User's Manual

CubeSuite+ V1.00.00

Integrated Development Environment
User's Manual: V850 Build

Target Device
V850 Microcontroller

Renesas Electronics
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How to Use This Manual

This manual describes the role of the CubeSuite+ integrated development environment for developing application systems for V850 microcontrollers, and provides an outline of its features.

CubeSuite+ is an integrated development environment (IDE) for V850 microcontrollers, integrating the necessary tools for the development phase of software (e.g. design, implementation, and debugging) into a single platform.

By providing an integrated environment, it is possible to perform all development using just this product, without the need to use many different tools separately.

Readers

This manual is intended for users who wish to understand the functions of the CubeSuite+ and design software and hardware application systems.

Purpose

This manual is intended to give users an understanding of the functions of the CubeSuite+ to use for reference in developing the hardware or software of systems using these devices.

Organization

This manual can be broadly divided into the following units.

CHAPTER 1 GENERAL
CHAPTER 2 FUNCTIONS
CHAPTER 3 BUILD OUTPUT LISTS
APPENDIX A WINDOW REFERENCE
APPENDIX B COMMAND REFERENCE
APPENDIX C INDEX

How to Read This Manual

It is assumed that the readers of this manual have general knowledge of electricity, logic circuits, and microcontrollers.

Conventions

Data significance:	Higher digits on the left and lower digits on the right
Active low representation:	$\overline{XXX}$ (overscore over pin or signal name)
Note:	Footnote for item marked with Note in the text
Caution:	Information requiring particular attention
Remark:	Supplementary information
Numeric representation:	Decimal … XXXX
	Hexadecimal … 0xXXXX

Related Documents The related documents indicated in this publication may include preliminary versions. However, preliminary versions are not marked as such.

Document Name		Document No.
CubeSuite+ Integrated Development Environment User's Manual	Start	R20UT0545E
	78K0 Design	R20UT0546E
	78K0R Design	R20UT0547E
	RL78 Design	R20UT0548E
	V850 Design	R20UT0549E
	R8C Design	R20UT0550E
	78K0 Coding	R20UT0551E
	RL78,78K0R Coding	R20UT0552E
	V850 Coding	R20UT0553E
	Coding for CX Compiler	R20UT0554E
	R8C Coding	R20UT0576E
	78K0 Build	R20UT0555E
	RL78,78K0R Build	R20UT0556E
	V850 Build	This manual
	Build for CX Compiler	R20UT0558E
	R8C Build	R20UT0575E
	78K0 Debug	R20UT0559E
	78K0R Debug	R20UT0560E
	RL78 Debug	R20UT0561E
	V850 Debug	R20UT0562E
	R8C Debug	R20UT0574E
	Analysis	R20UT0563E
	Message	R20UT0407E

Caution The related documents listed above are subject to change without notice. Be sure to use the latest edition of each document when designing.

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CHAPTER 1 GENERAL

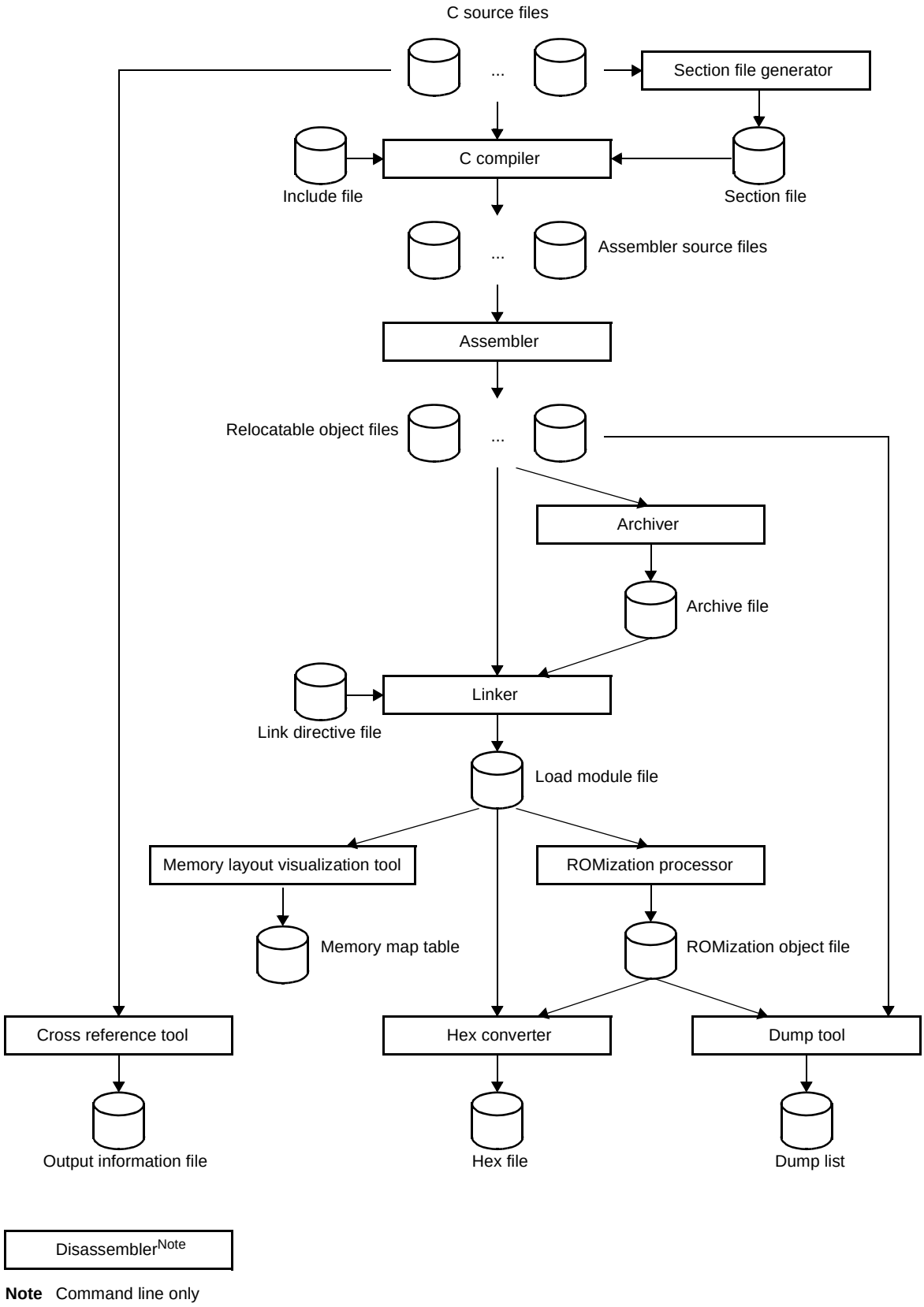
This chapter explains the product overview of the build tool.

1.1 Overview

The build tool is comprised of components provided by this product. It enables various types of information to be configured via a GUI tool, enabling you to generate ROMization object file, load module file, hex file, or archive file from your source files, according to your objectives.

The build tool process flow is shown below.

Figure 1-1. Build Tool Process Flow



Note Command line only

1.2 Features

The features of the build tools are shown below.

- Optimization function
  You can generate efficient object module files by performing optimizations such as prioritizing code size or execution speed when compiling.
  It is possible to select from six optimization levels and set a different optimization level for each source.

- Functions optimized for embedded systems
  It is possible to write interrupt processing and real-time OS tasks in C language.
  Access to the peripheral hardware of the microcomputer can be handled in the same way as normal access to variables.
  Overhead associated with saving to and restoring from registers during interrupt processing is reduced by restricting the number of general registers that are used by the C compiler (register mode).
  It is possible to fill the holes between members of structures and unions formed by alignment and handle the structures and unions predetermined by alignment (structure/union packing function).

CHAPTER 2 FUNCTIONS

This chapter describes the build procedure using CubeSuite+ and about the main build functions.

2.1 Overview

This section describes how to create a load module and user library.

2.1.1 Create a load module

The procedure for creating a load module is shown below.

(1) Create or load a project

Create a new project, or load an existing one.

Remark See "CubeSuite+ Start" for details about creating a new project or loading an existing one.

(2) Set a build target project

Set a build target project (see "2.17 Make Settings for Build Operations").
If there is no subproject, the project is always active.

Remarks 1. If there is no subproject in the project, the project is always active.
2. When setting a build mode, add the build mode (see "2.17.5 Add a build mode").

(3) Set build target files

Add or remove build target files and update the dependencies (see "2.3 Set Build Target Files").

Remarks 1. See "2.7.1 Add a user library" for the method of adding a user library to the project.
2. Also, you can set the link order of object module files and library files (see "2.17.1 Set the link order of files").

(4) Specify the output of a load module

Select the type of the load module to be generated (see "2.4 Set the Type of the Output File").

(5) Set build options

Set the options for the compiler, assembler, linker, and the like (see "2.5 Set Compile Options", "2.6 Set Assemble Options", "2.7 Set Link Options").

(6) Run a build

Run a build (see "2.18 Run a Build").
The following types of builds are available.

- Build (see "2.18.1 Run a build of updated files")
- Rebuild (see "2.18.2 Run a build of all files")
- Rapid build (see "2.18.3 Run a build in parallel with other operations")
- Batch build (see "2.18.4 Run builds in batch with build modes")

Remark If there are any commands you wish to run before or after the build process, on the Property panel, from the [Common Options] tab, in the [Others] category, set the [Commands executed before build processing] and [Commands executed after build processing] properties.
If there are any commands you wish to run before or after the build process at the file level, you can set

them from the [Individual Compile Options] tab (for a C source file) and [Individual Assemble Options] tab (for an assembler source file).

(7) Save the project

Save the setting contents of the project to the project file.

Remark See "CubeSuite+ Start" for details about saving the project.

2.1.2 Create a user library

The procedure for creating a user library is shown below.

(1) Create or load a project

Create a new project, or load an existing one.
When you create a new project, set a library project.

Remark See "CubeSuite+ Start" for details about creating a new project or loading an existing one.

(2) Set a build target project

Set a build target project (see "2.17 Make Settings for Build Operations").
If there is no subproject, the project is always active.

Remarks 1. If there is no subproject in the project, the project is always active.
2. When setting a build mode, add the build mode (see "2.17.5 Add a build mode").

(3) Set build target files

Add or remove build target files and update the dependencies (see "2.3 Set Build Target Files").

(4) Set build options

Set the options for the compiler, assembler, archiver, and the like (see "2.5 Set Compile Options", "2.6 Set Assemble Options", "2.10 Set Archive Options").

Remark To create a library common to various devices, set the [Output common object file for various devices] property in the [Output File Type and Path] category from the [Common Options] tab on the Property panel.

(5) Run a build

Run a build (see "2.18 Run a Build").
The following types of builds are available.

- Build (see "2.18.1 Run a build of updated files")
- Rebuild (see "2.18.2 Run a build of all files")
- Rapid build (see "2.18.3 Run a build in parallel with other operations")
- Batch build (see "2.18.4 Run builds in batch with build modes")

Remark If there are any commands you wish to run before or after the build process, on the Property panel, from the [Common Options] tab, in the [Others] category, set the [Commands executed before build processing] and [Commands executed after build processing] properties.
If there are any commands you wish to run before or after the build process at the file level, you can set them from the [Individual Compile Options] tab (for a C source file) and [Individual Assemble Options] tab (for an assembler source file).

(6) Save the project

Save the setting contents of the project to the project file.

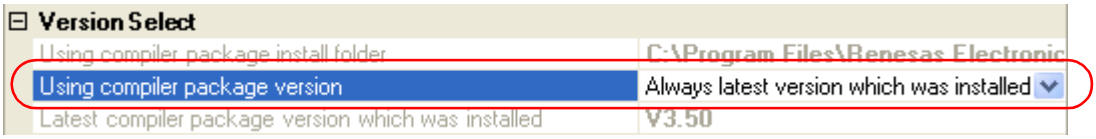
Remark See "CubeSuite+ Start" for details about saving the project.

2.2 Change the Build Tool Version

You can change the version of the build tool (compiler package) used in the project (main project or subproject).

Select the build tool node on the project tree and select the [Common Options] tab on the Property panel. Select [Always latest version which was installed] or the version on the [Using compiler package version] property in the [Version Select] category.

Figure 2-1. [Version Select] Category



Remarks 1. When the build tool used in the main project and subprojects is the same, you can collectively change the build tool version by selecting all of the Build tool nodes and setting the property.

2. If you have selected a compiler package that has not been installed (e.g. if you open a project created in another execution environment), then that version is also displayed.

3. If the options change depending on the compiler package, then the display of the build tool's properties will change according to the selected version.

Properties that are hidden when the version is changed are saved in the project file's settings, and the values will be reproduced when the properties are displayed again.

Options are changed in accordance with the following rules. Information about changes is displayed in the Output panel.

- If you change from an older version to a newer version, the option settings will be inherited and converted (only if necessary).
- If you change from a newer version to an older version, only identical option settings will be inherited.

  Options that only exist in the older version will be set to the default values.

2.3 Set Build Target Files

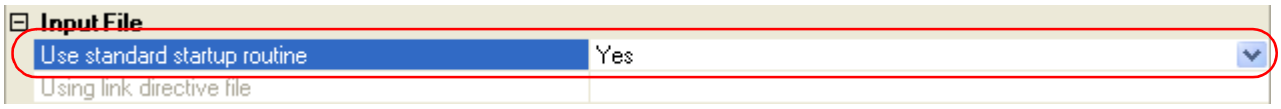
Before running a build, you must add the build target files (such as C source file, assembler source file) to the project. This section explains operations on setting files in the project.

2.3.1 Set a startup routine

(1) Using the standard startup routine

Select the build tool node on the project tree and select the [Compile Options] tab on the Property panel.
To use the standard startup routine, select [Yes] on the [Use standard startup routine] property in the [Input File] category.

Figure 2-2. [Use standard startup routine] Property



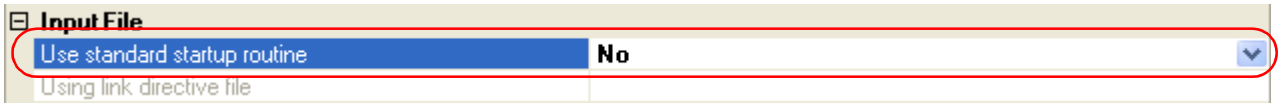
The following file is used as the standard startup routine, depending on the value of the [Select register mode] property in the [Register Mode] category from the [Common Options] tab.

Value of [Select register mode] Property	Standard Startup Routine
32-register mode(None)	*Using compiler package install folder*\lib850\r32\crtE.o
26-register mode(-reg26)	*Using compiler package install folder*\lib850\r26\crtE.o
22-register mode(-reg22)	*Using compiler package install folder*\lib850\r22\crtE.o

(2) Using other than the standard startup routine

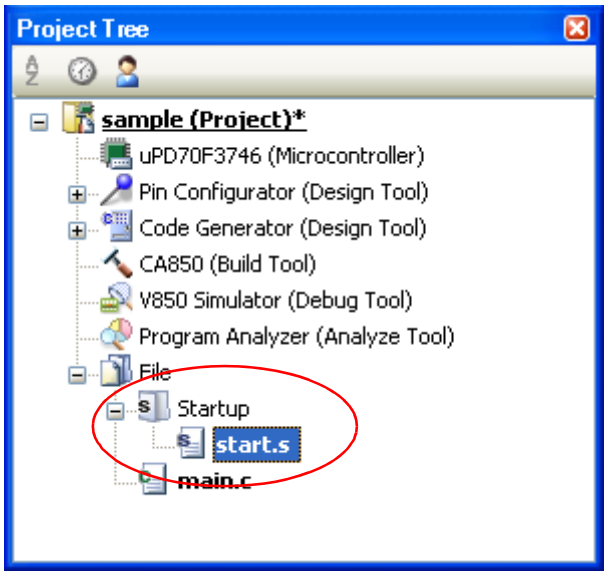
Select the build tool node on the project tree and select the [Compile Options] tab on the Property panel.
To use other than the standard startup routine, select [No] on the [Use standard startup routine] property in the [Input File] category ([Yes] is selected by default).

Figure 2-3. [Use standard startup routine] Property



Next, add a startup file (a file that the startup routine is described) to the Startup node on the project tree. See "2.3.3 Add a file to a project" for the method of adding the file to the project tree.

Figure 2-4. Project Tree Panel (After Adding Startup File)



Caution **A build target file added directly below the Startup node on the project tree is treated as the startup file. It is not treated as a startup file if it is added to the category below the Startup node. When adding a startup file to the Startup node, if a startup file has already been added then only the latest startup file to be added is targeted by a build; any such files added prior to this one will not be targeted.**
When setting a startup file that is not targeted by a build as a build target, if other startup files have also been added then the file will be targeted by the build, and the others will not be targeted.

Remark To create a new startup routine, copy the following sample and add it to the project. And then edit it.

Register Mode	Sample of Startup Routine
32-register mode	*Using compiler package install folder*\lib850\r32\crtE.s
26-register mode	*Using compiler package install folder*\lib850\r26\crtE.s
22-register mode	*Using compiler package install folder*\lib850\r22\crtE.s

A startup routine must be described in assembly language.
See “CubeSuite+ V850 Coding” for details about a startup routine.

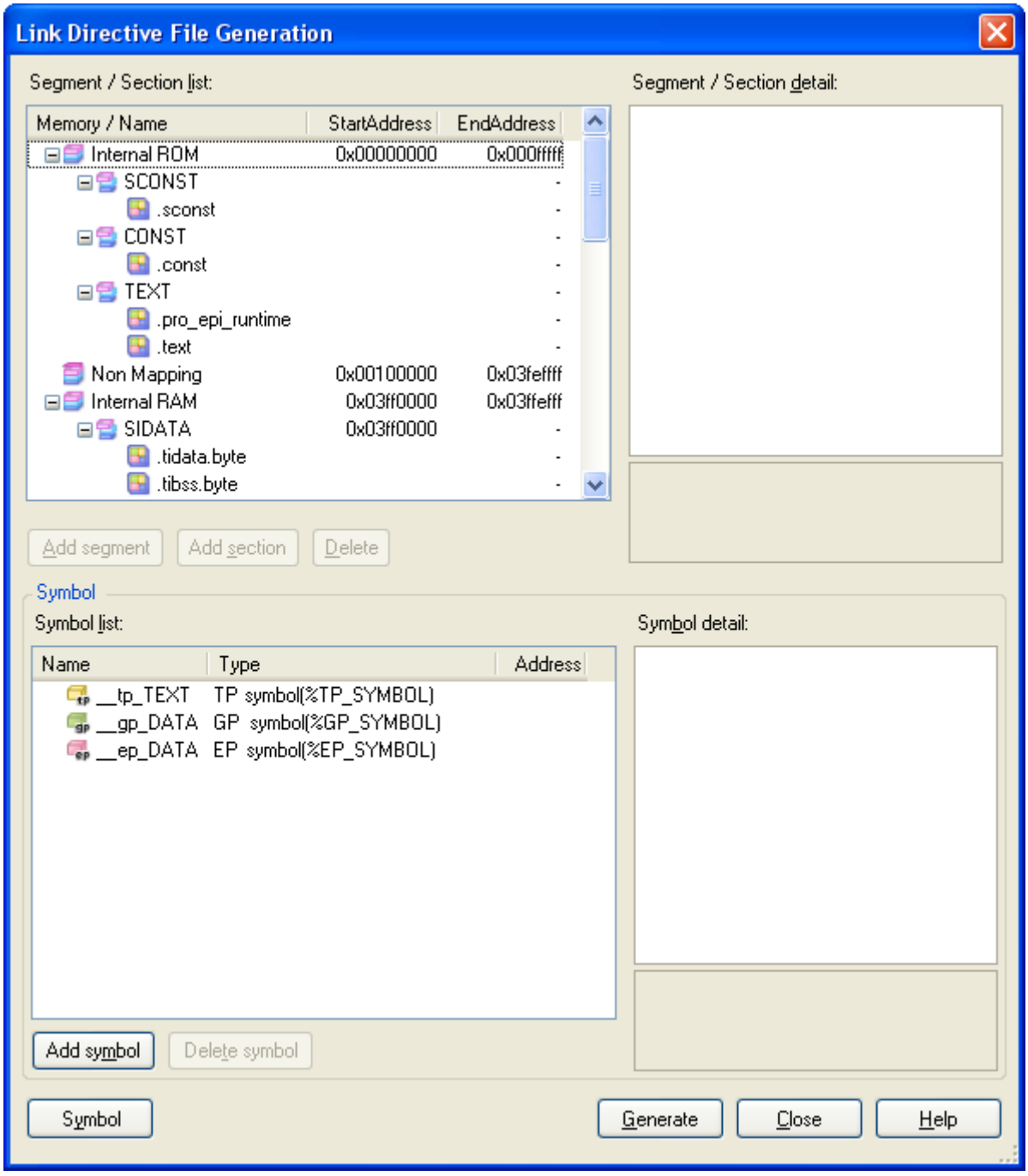
2.3.2 Automatically generate link directives

Although users can create a link directive file and add it to a project, it is also possible to generate it automatically in CubeSuite+.

Remark See “CubeSuite+ V850 Coding” for details about link directives and creating a link directive file.

On the project tree, select the Build tool node, and then select [Create Link Directive File...] from the context menu. The Link Directive File Generation dialog box opens.

Figure 2-5. Link Directive File Generation Dialog Box



Edit the segments/sections and symbols in the dialog box.

(1) Edit segments/sections

The [Segment / Section list] area displays the device memory allocation information, and a list of the currently configured segments and sections.

When a segment/section is selected from the list, detailed information on that segment/section is displayed in the [Segment/Section detail] area. Edit the items in the [Segment / Section detail] area.

Remark Some items in reserved sections cannot be edited (items for which values are set automatically). See "APPENDIX A WINDOW REFERENCE", "Link Directive File Generation dialog box" for details about each item and how reserved sections are handled.

Figure 2-6. Segment Detail (When SCONST Is Selected)

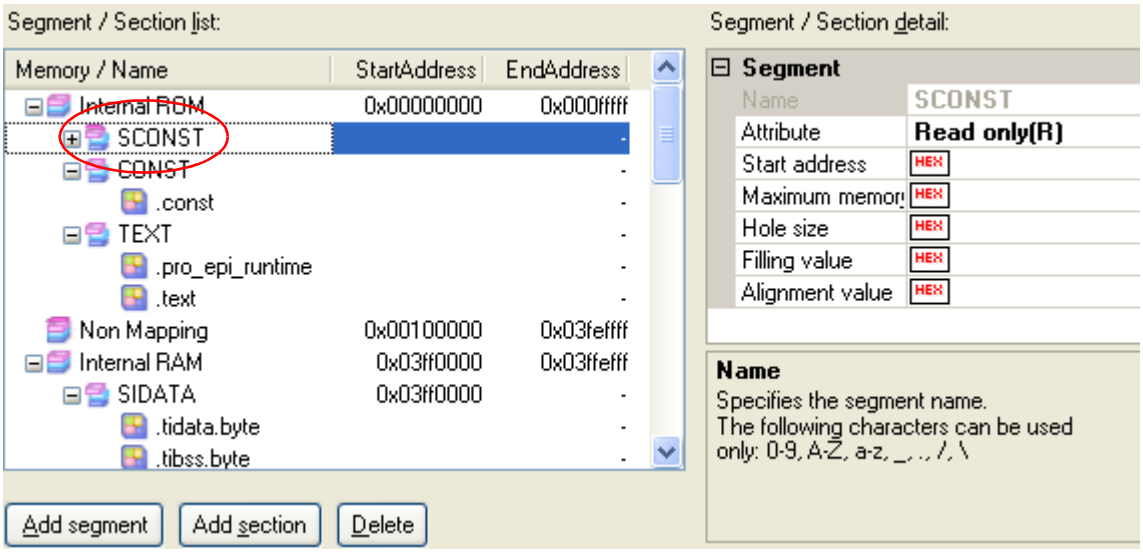
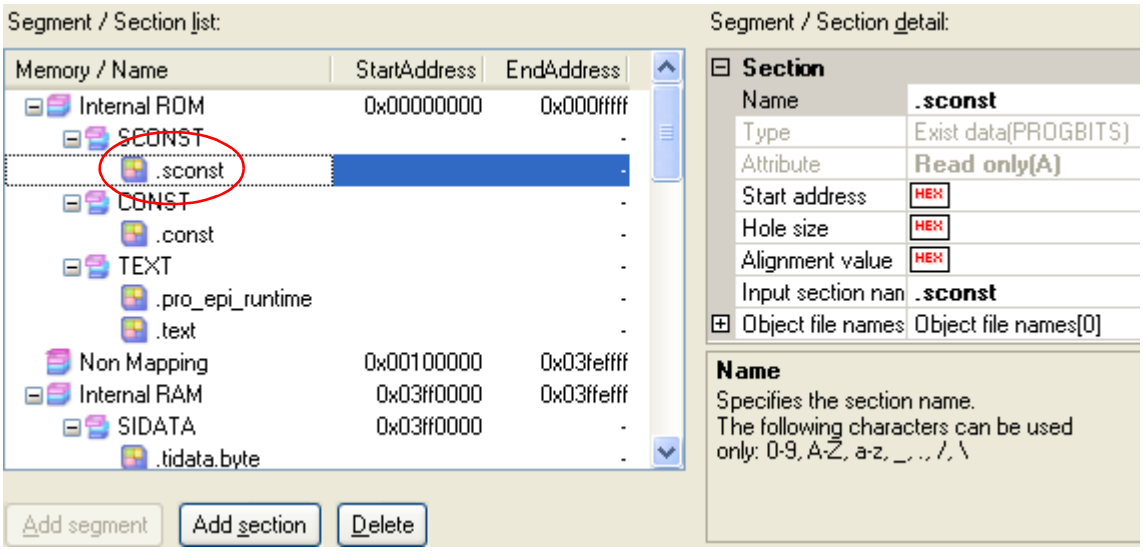


Figure 2-7. Section Detail (When .sconst Is Selected)



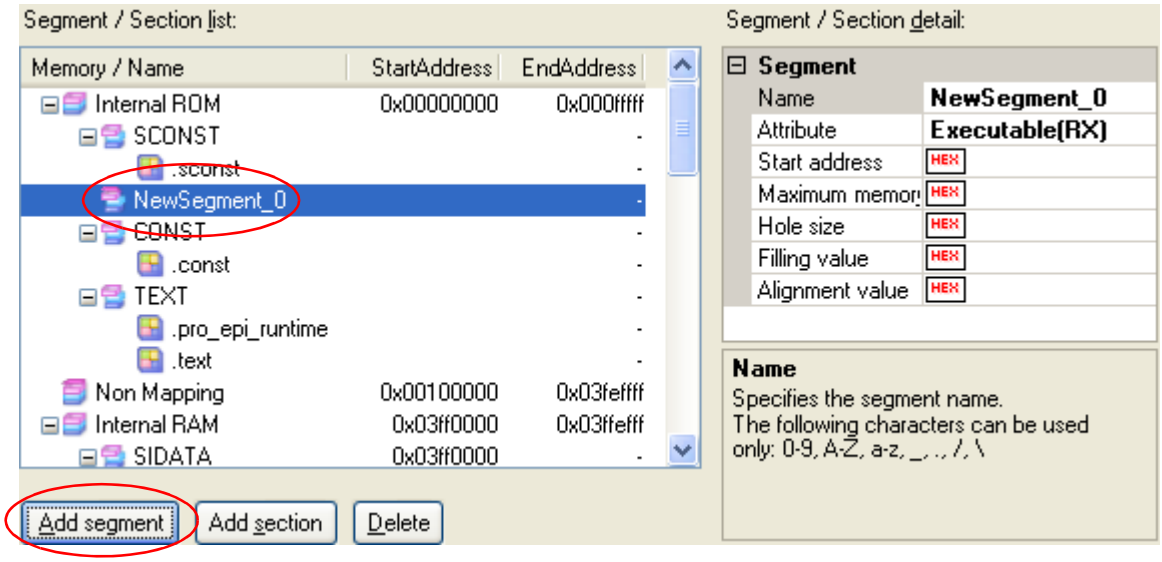
Segments and sections can also be added.

Click [Add Segment] to add a new segment "NewSegment_*XXX*" directly below the row selected in the list (*XXX*: 0 to 255 in decimal numbers). Edit the items in the [Segment / Section detail] area. By default, [Attribute] is set to

[Executable(RX)] (if added to the internal ROM area or non mapping area) or to [Read/Write(RW)] (if added to the internal RAM area).

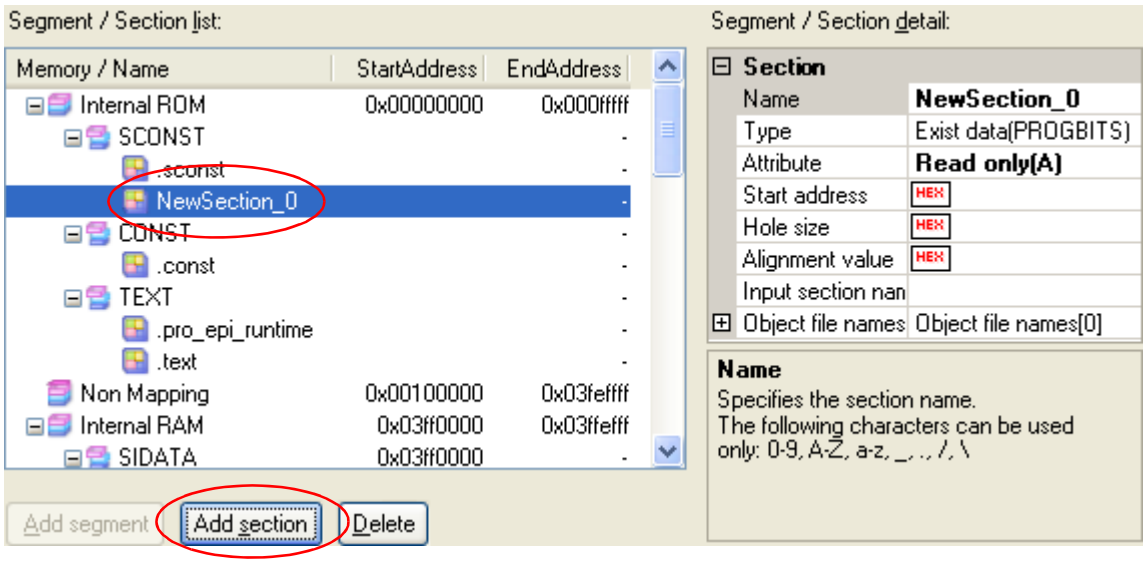
Caution When a section row is selected in the list, the [Add segment] button is invalid.

Figure 2-8. Add Segment



Click [Add Section] to add a new section "NewSection_*XXX*" directly below the row selected in the list (*XXX*: 0 to 255 in decimal numbers). Edit the items in the [Segment / Section detail] area. By default, [Type] is set to [Exist data (PROGBITS)], and [Attribute] inherits the value of the parent segment.

Figure 2-9. Add Section

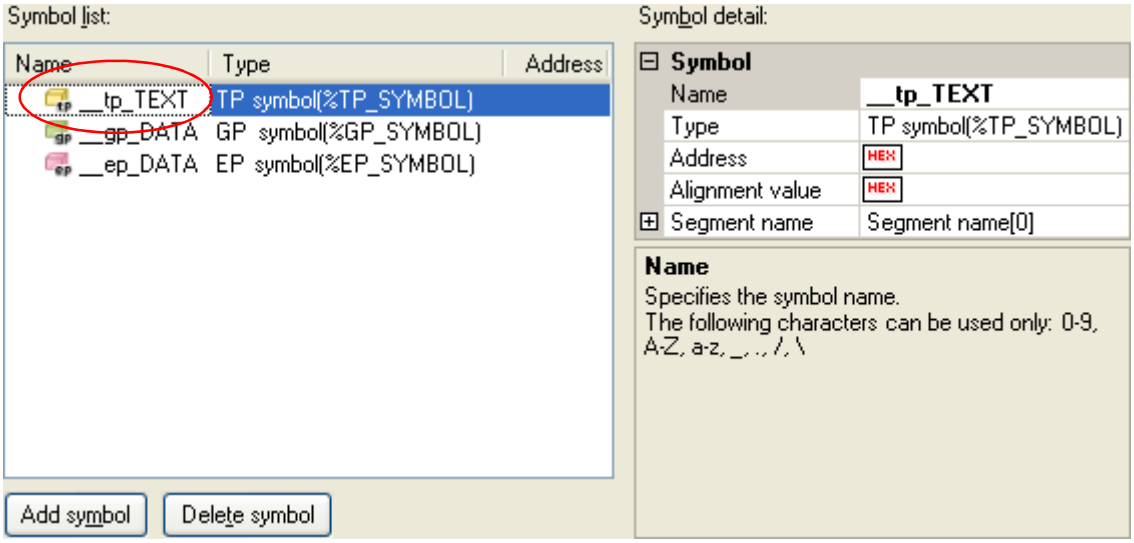


(2) Edit symbols

The [Symbol list] area displays the list of currently configured symbols.

When a symbol is selected from the list, detailed information on that symbol is displayed in the [Symbol detail] area. Edit the items in the [Symbol detail] area.

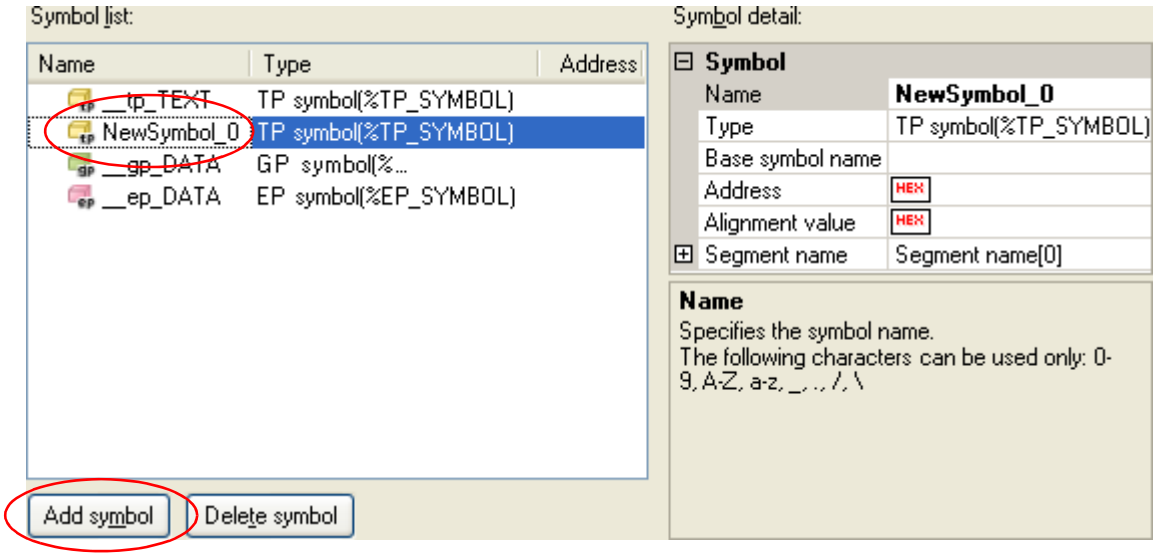
Figure 2-10. Segment Detail (When _tp_TEXT Is Selected)



Symbols can also be added.

Click [Add symbol] to add a new symbol "NewSymbol_*XXX*" directly below the row selected in the list (*XXX*: 0 to 255 in decimal numbers). Edit the items in the [Symbol detail] area. By default, [Type] is set to [TP symbol(%TP_SYMBOL)].

Figure 2-11. Add Symbol

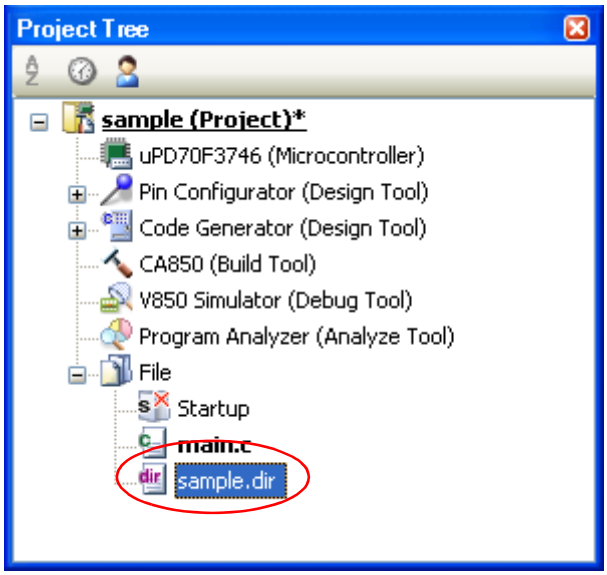


After editing the segments/sections and symbols, click the [Generate] button.

A link directive file (named *project-name*.dir) is generated based on the specified memory, segments, sections, and symbol allocation information, and then added to the project.

The link directive file is generated in the project folder. The link directive file that has been generated is also shown on the project tree, under the File node.

Figure 2-12. Project Tree Panel (After Generating Link Directive File)



Caution The generated link directive file will be a build target. If a link directive file has already been registered to the project, then the file will be removed from the build target.

2.3.3 Add a file to a project

Files can be added to a project by the following methods.

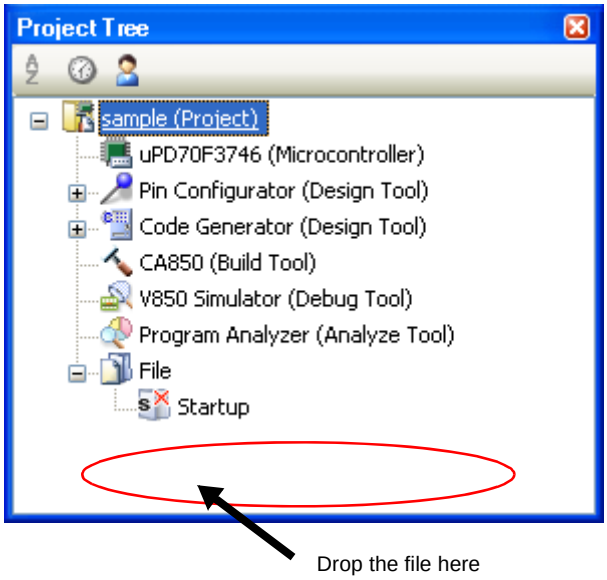
- Adding an existing file
- Creating and adding an empty file

(1) Adding an existing file

(a) Add individual files

Drag a folder from Explorer or the like, and drop it onto the empty space below the project tree.
The file is added below the File node.

Figure 2-13. Project Tree Panel (File Drop Location)



Caution To add other than a startup routine, drop a file onto the Startup node. See "2.3.1 Set a startup routine" for details about using other than a startup routine.

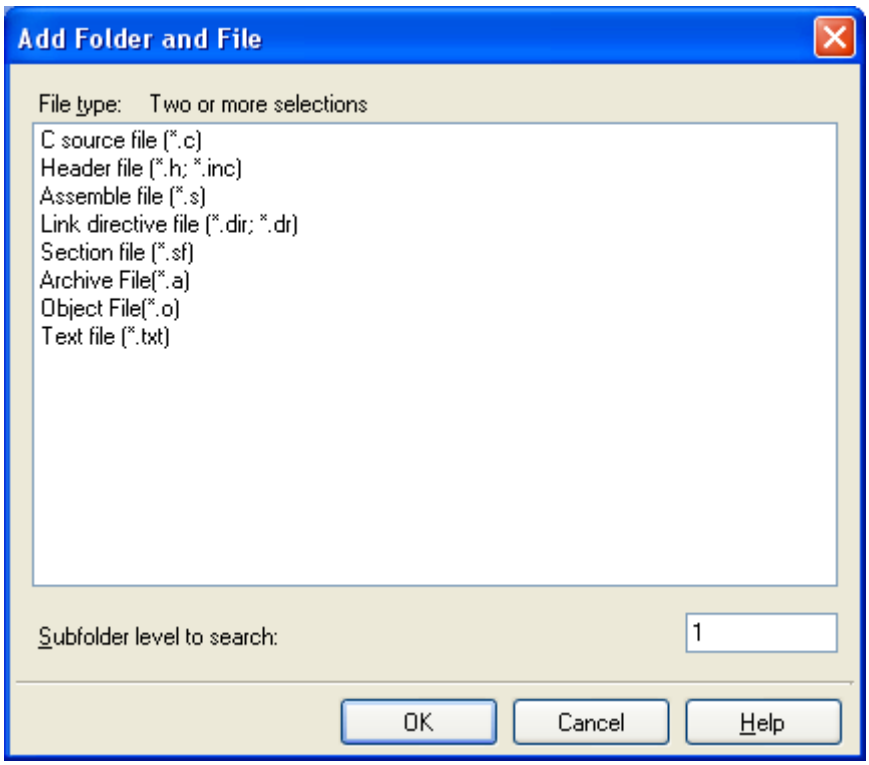
(b) Add a folder

Drag a folder from Explorer or the like, and drop it onto the empty space below the project tree. The Add Folder and File dialog box opens.

Remark You can also add multiple folders to the project at the same time by dragging multiple folders at same time and dropping them onto the project tree.

Caution When a folder with the name that is more than 200 characters is dropped, the folder is added to the project tree as a category with the name that 201st character and after are deleted.

Figure 2-14. Add Folder and File Dialog Box



In the dialog, select the file types to add to the project, specify the number of subfolder levels to add, and then click the [OK] button.

Remark You can select multiple file types by left clicking while holding down the [Ctrl] or [Shift] key. If nothing is selected, it is assumed that all types are selected.

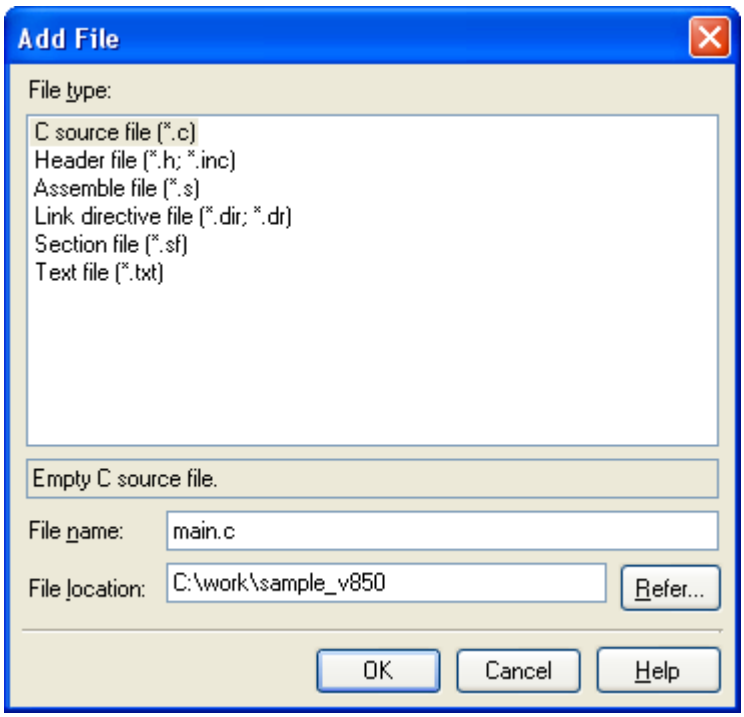
The folder is added below the File node.
Note that on the project tree, the folder is the category.

Remark When the category node created by the user exists, you can add a file below the node by dropping the file onto the node (see "2.3.6 Classify a file into a category" for a category node).

(2) Creating and adding an empty file

On the project tree, select either one of the Project node, Subproject node, or File node, and then select [Add] >> [Add New File...] from the context menu. The Add File dialog box opens.

Figure 2-15. Add File Dialog Box



In the dialog box, specify the file to be created and then click the [OK] button.
The file is added below the File node.

The project tree after adding the file will look like the one below.

Figure 2-16. Project Tree Panel (After Adding File "main.c")

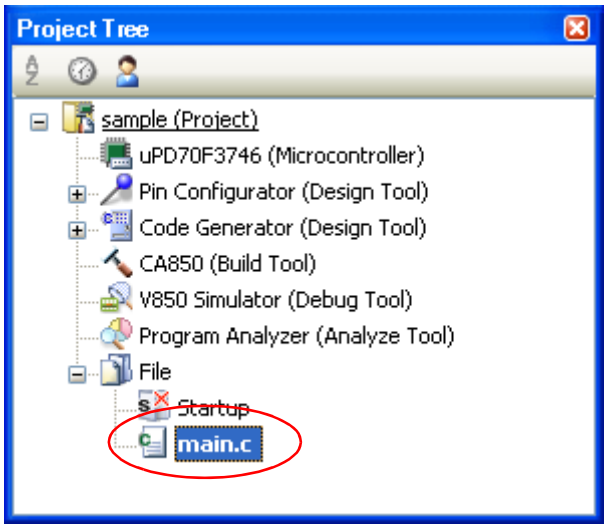
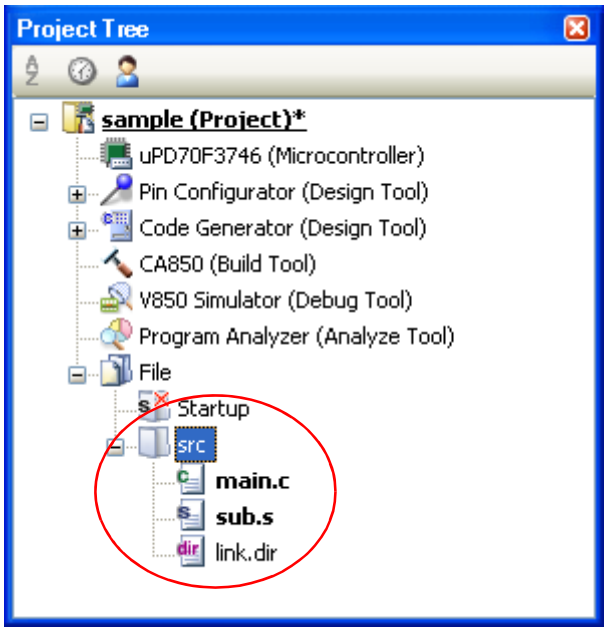


Figure 2-17. Project Tree Panel (After Adding Folder "src")



Remark The location of the file added below the File node depends on the current file display order setting. See "2.3.7 Change the file display order" for the method of changing the file display order.

Cautions 1. If the paths differ, you can add source files with the same name. Note, however, that if the setting of the output file name is left as the default, the output files will have the same name, which will prevent the build from running correctly (for example, when adding D:\sample1\func.c and D:\sample2\func.c, the default output file name for these files is both func.o).
To avoid this problems, set the output file name for each of those files to a different name with the individual build options for the source files.
Changing the name of the C source file is made with the [Object file name] property in the [Output File] category from the [Individual Compile Options] tab. Changing the name of the assembler source file is made with the [Object file name] property in the [Output File] category from the [Individual Assemble Options] tab. See "2.15.2 Set build options at the file level" for how to set the individual build options.

2. If source files with the same name are added, the target file cannot opened during debugging.

3. If a file with an extension of "dr" or "dir" is added to the project, it is treated as a link directive file. It is also treated as a link directive file if it is added below the Startup node.
When adding a link directive file to the project, if a link directive file has already been added then only the latest link directive file to be added is targeted by a build; any such files added prior to this one will not be targeted.
When setting a link directive file that is not targeted by a build as a build target, if other link directive files have also been added then the file will be targeted by the build, and the others will not be targeted.

4. Up to 5000 files can be added to the main project or subproject.

When a new file is added, an empty file is created in the location specified in the Add File dialog box.
By double clicking the file name on the project tree, you can open the Editor panel and edit the file.
The files that can be opened with the Editor panel are shown below.

- C source file (.c)

- Assembler source file (.s)
- Header file (.h, .inc)
- Link directive file (.dr, .dir)
- Section file (.sf)
- Map file (.map)
- Hex file (.hex)
- Text file (.txt)

Remarks 1. You can use one of the methods below to open files other than those listed above in the Editor panel.
- Drag a file and drop it onto the Editor panel.
- Select a file and then select [Open with Internal Editor...] from the context menu.

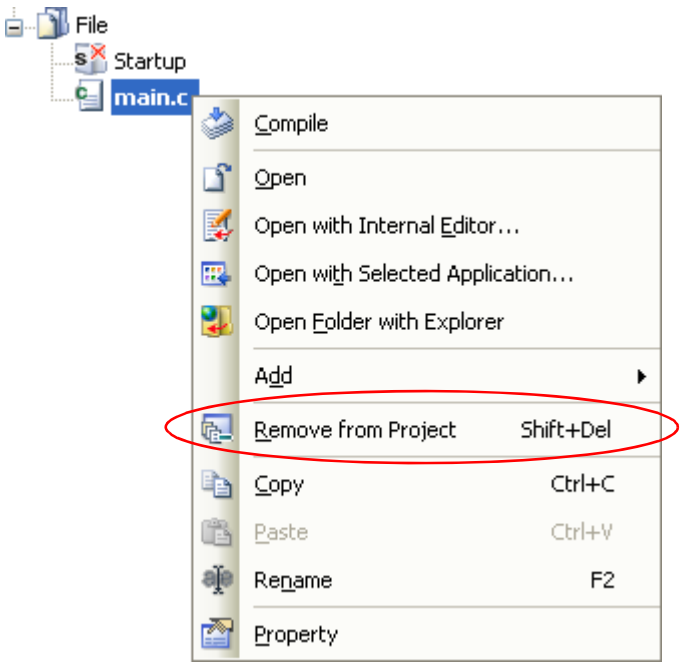
2. When the environment is set to use an external editor on the Option dialog box, the file is opened with the external editor that has been set. Other files are opened with the applications associated by the host OS.

2.3.4 Remove a file from a project

To remove a file added to a project, select the file to be removed from the project on the project tree and then select [Remove from Project] from the context menu.

In addition, the file itself is not deleted from the file system.

Figure 2-18. [Remove from Project] Item

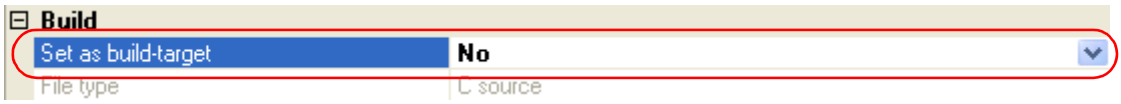


2.3.5 Remove a file from the build target

You can remove a specific file from the build target out of all the files added to the project.

Select the file to be removed from the build target on the project tree and select the [Build Settings] tab on the Property panel. Select [No] on the [Set as build-target] property in the [Build] category.

Figure 2-19. [Set as build-target] Property



Remark The files that can be applied this function are C source files, assembler source files, link directive files, section file, object files, and archive file.

2.3.6 Classify a file into a category

You can create a category under the File node and classify files by the category. This makes it easier to view files added to the project on the project tree, and makes it easier to manage files according to function.

To create a category node, select either one of the Project node, Subproject node, or File node on the project tree, and then select [Add] >> [Add New Category] from the context menu.

Figure 2-20. [Add New Category] Item (For File Node)

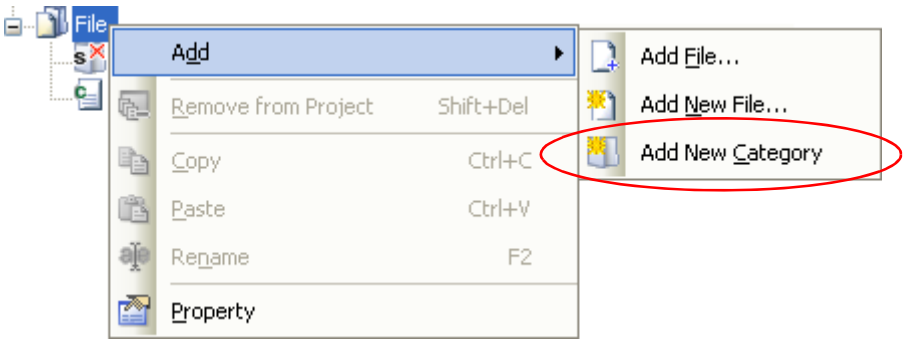
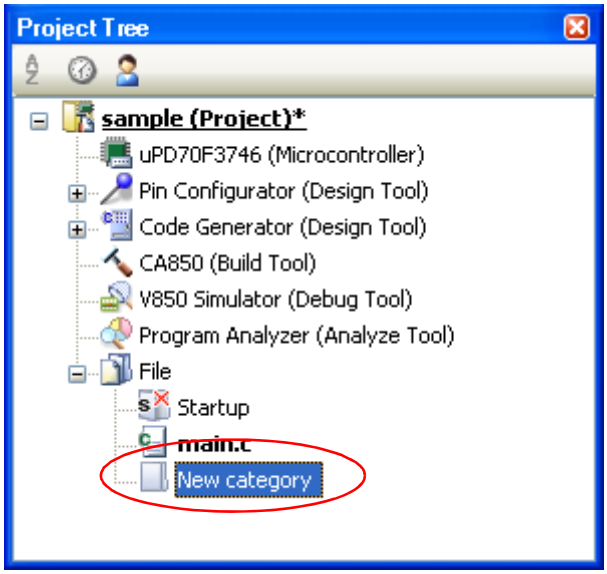


Figure 2-21. Project Tree Panel (After Adding Category Node)



Remarks 1. The default category name is "New category".
To change the category name, you can use [Rename] from the context menu of the category node.

2. You can also add a category node with the same name as an existing category node.

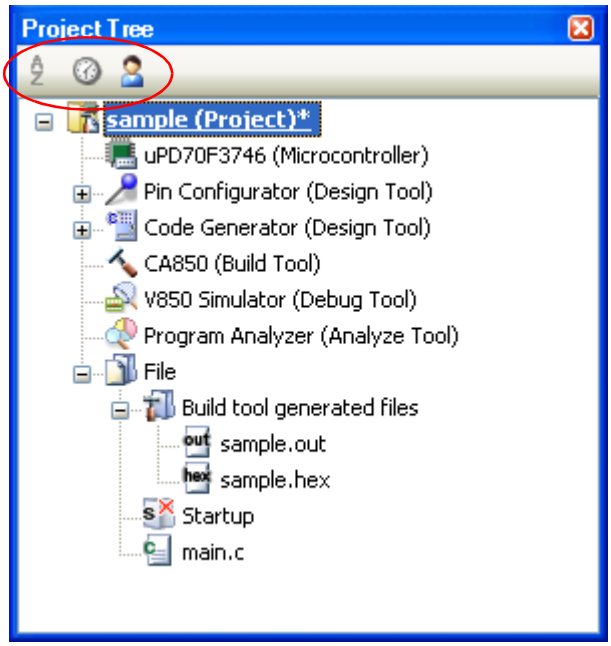
3. Categories can be nested up to 20 levels.

You can classify files into the created category node by dragging and dropping the file.

2.3.7 Change the file display order

You can change the display order of the files and category nodes using the buttons on the project tree.

Figure 2-22. Toolbar (Project Tree Panel)



Select any of the buttons below on the toolbar of the Project Tree panel.

Button	Description
	Sorts category nodes and files by name.  : Ascending order  : Descending order  : Ascending order
	Sorts category nodes and files by timestamp.  : Descending order  : Ascending order  : Descending order
	Displays category nodes and files in the specified order by the user (default). You can change the display order of the category nodes and files arbitrarily by dragging and dropping them.

2.3.8 Update file dependencies

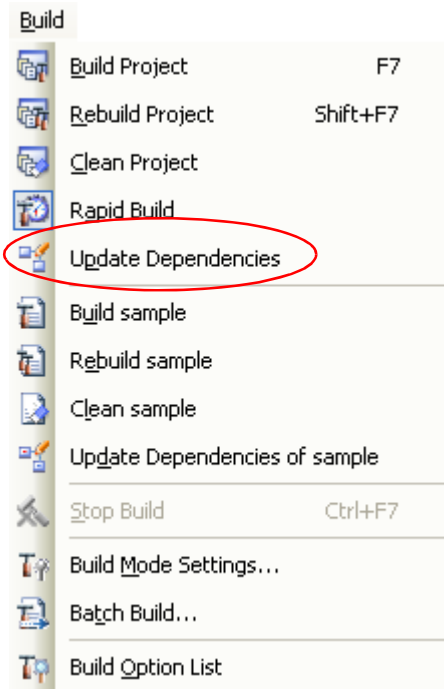
When you perform a change (changing include file paths, adding an include statement of the header file to the C source file and assembler source file, etc.) that effects the file dependencies in the compile option settings or assemble option settings, you must update the dependencies of the relevant files.

Updating file dependencies is performed for the entire project (main project and subprojects) or active project.

(1) For the entire project

From the [Build] menu, select [Update Dependencies].

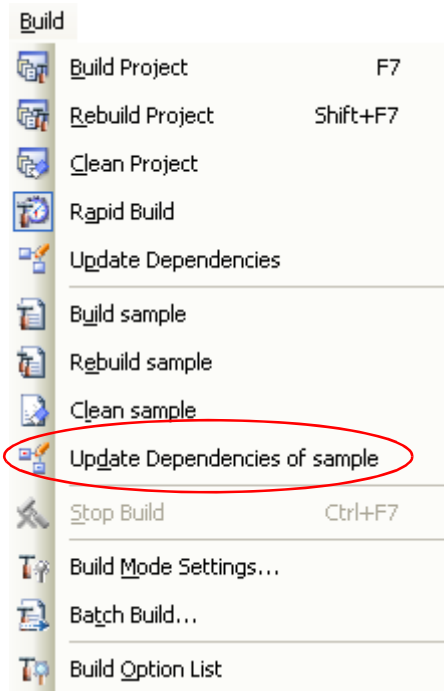
Figure 2-23. [Update Dependencies] Item



(2) For the active project

From the [Build] menu, select [Update Dependencies of *active project*].

Figure 2-24. [Update Dependencies of *active project*] Item



Remark If there are files being edited with the Editor panel when updating file dependencies, then all these files are saved.

Cautions 1. During checking of dependence relationships of include files with CubeSuite+, condition statements such as #if and comments are ignored. Therefore, include files not required for build are mistaken as required files (In the example below, header1.h and header5.h are judged as required for build).

```
#if         0
#include    "header1.h"     /* Dependence relationship judged to exist */
#else                       /* ! zero */
#include    "header2.h"     /* Dependence relationship to exist */
#endif

#define     AAA
#ifdef      AAA
#include    "header3.h"     /* Dependence relationship to exist */
#else
#include    "header4.h"     /* Dependence relationship to exist */
#endif

/*
#include    "header5.h"     /* Dependence relationship judged to exist */
*/
```

2. During checking of dependence relationships of include files with CubeSuite+, include statements described after comments are ignored. Therefore, include files required for build

are mistaken as no-required files (In the example below, header6.h and header7.h are judged as no-required for build).

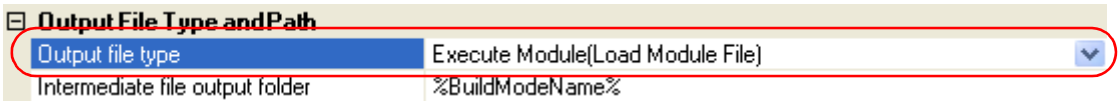
```
/* Dependence relationship judged not to exist */
/* comment */   #include        "header6.h"

/* Dependence relationship judged not to exist */
/*
comment
*/  #include    "header7.h"
```

2.4 Set the Type of the Output File

Set the type of the file to be output as the product of the build.

Select the build tool node on the project tree and select the [Common Options] tab on the Property panel. Select the file type on the [Output file type] property in the [Output File Type and Path] category.

Figure 2-25. [Output file type] Property



(1) When [Execute Module(ROMization Module)] is selected

A ROMization module file is created.

The file set in the [Output File] category on the [ROMization Process Options] tab is the debug target.

(2) When [Execute Module(Load Module File)] is selected (default)

A load module file is created.

The file set in the [Output File] category on the [Link Options] tab is the debug target.

(3) When [Execute Module(Hex File)] is selected

A hex file is also created.

The file set in the [Output File] category on the [Hex Convert Options] tab is the debug target.

Caution For library projects, this property is always [Library] and cannot be changed.

2.4.1 Change the output file name

The names of the ROMization module file, load module file, hex file, archive file output by the build tool are set to the following names by default.

"%ProjectName%" is an embedded macro. It is replaced to the project name.

ROMization module file name: romp.out

Load module file name: %ProjectName%.out

Hex file name: %ProjectName%.hex

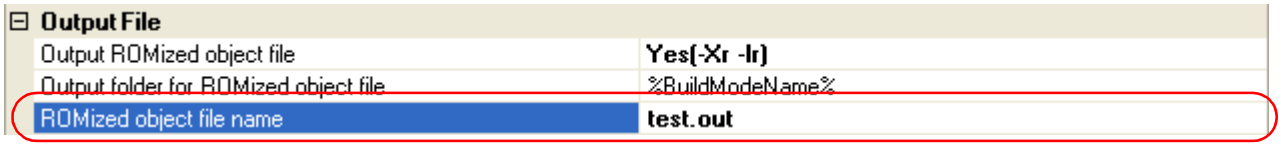
Archive file name: lib%ProjectName%.a

The method to change these file names is shown below.

(1) When changing the ROMization module file name

Select the build tool node on the project tree and select the [ROMization Process Options] tab on the Property panel. Enter the file name to be changed to on the [ROMized object file name] property in the [Output File] category.

Figure 2-26. [ROMized object file name] Property (For ROMized Module File)

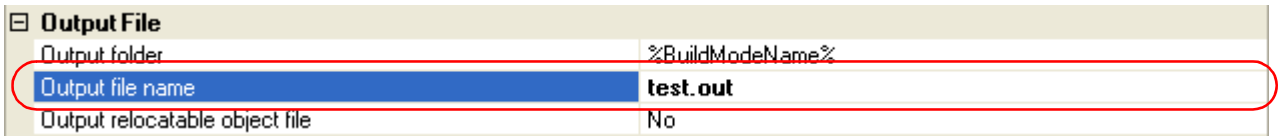


Remark You can also change the option in the same way with the [ROMized object file name] property in the [Frequently Used Options(for ROMization)] category on the [Common Options] tab.

(2) When changing the load module file name

Select the build tool node on the project tree and select the [Link Options] tab on the Property panel. Enter the file name to be changed to on the [Output file name] property in the [Output File] category.

Figure 2-27. [Output file name] Property (For Load Module File)

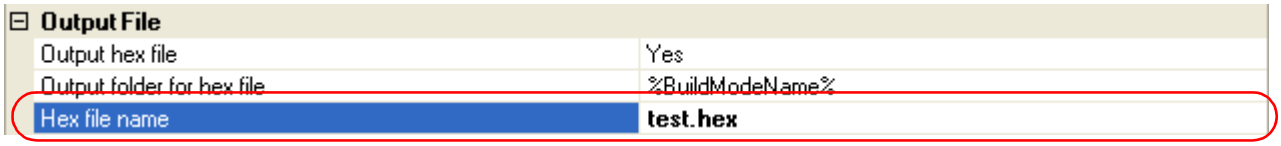


Remark You can also change the option in the same way with the [Output file name] property in the [Frequently Used Options(for Link)] category on the [Common Options] tab.

(3) When changing the hex file name

Select the build tool node on the project tree and select the [Hex Convert Options] tab on the Property panel. Enter the file name to be changed to on the [Hex file name] property in the [Output File] category.

Figure 2-28. [Hex file name] Property



Remark You can also change the option in the same way with the [Hex file name] property in the [Frequently Used Options(for Hex Convert)] category on the [Common Options] tab.

(4) When changing the archive file name

Select the build tool node on the project tree and select the [Archive Options] tab on the Property panel. Enter the file name to be changed to on the [Output file name] property in the [Output File] category.

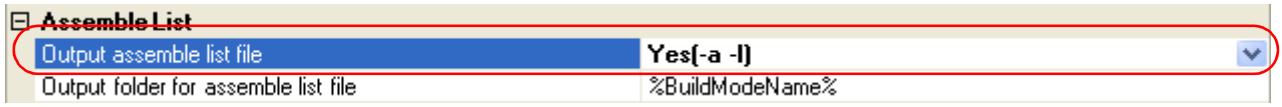
Figure 2-29. [Output file name] Property (For Archive File)

2.4.2 Output an assemble list

The results of the assembly are output to the assembler list file.

Select the build tool node on the project tree and select the [Assemble Options] tab on the Property panel. To output the assemble list, select [Yes(-a -l)] on the [Output assemble list file] property in the [Assemble List] category.

Figure 2-30. [Output assemble list file] Property



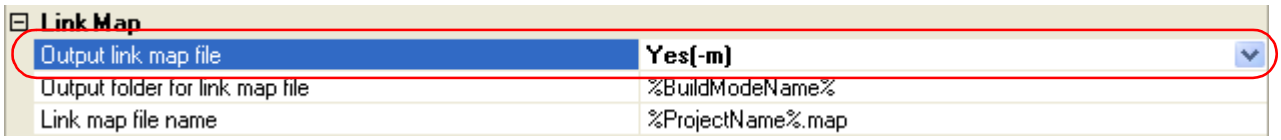
Remark See "3.1 Assembler" for the assemble list.

2.4.3 Output map information

Map information (information on the location of section) is output to the link map file.

Select the build tool node on the project tree and select the [Link Options] tab on the Property panel. To output the link map file, select [Yes(-m)] on the [Output link map file] property in the [Link Map] category.

Figure 2-31. [Output link map file] Property (For Map Information)



When outputting a link map file, you can set the output folder and output file name.

(1) Set the output folder

Setting the output folder is made with the [Output folder for link map file] property by directly entering to the text box or by the [...] button. Up to 247 characters can be specified in the text box. "%BuildModeName%" is set by default. "%BuildModeName%" is an embedded macro. It is replaced to the build mode name.

(2) Set the output file name

Setting the output file is made with the [Link map file name] property by directly entering to the text box. Up to 259 characters can be specified in the text box. "%ProjectName%.map" is set by default. "%ProjectName%" is an embedded macro. It is replaced to the project name.

Remark See "3.2 Linker" for map information.

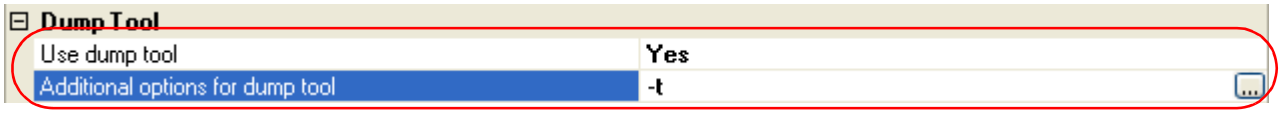
2.4.4 Output symbol information

To output symbol information defined in the input module, use the -t option of the dump tool.

Select the build tool node on the project tree and select the [Dump Options] tab on the Property panel.

Set the -t option in the [Dump Tool] category. If you select [Yes] on the [Use dump tool] property, the [Additional options for dump tool] property is displayed.

Figure 2-32. [Use dump tool] and [Additional options for dump tool] Property



Specify "-t" on the [Additional options for dump tool] property.

Remarks 1. See "(8) Symbol table" for symbol information to be output.

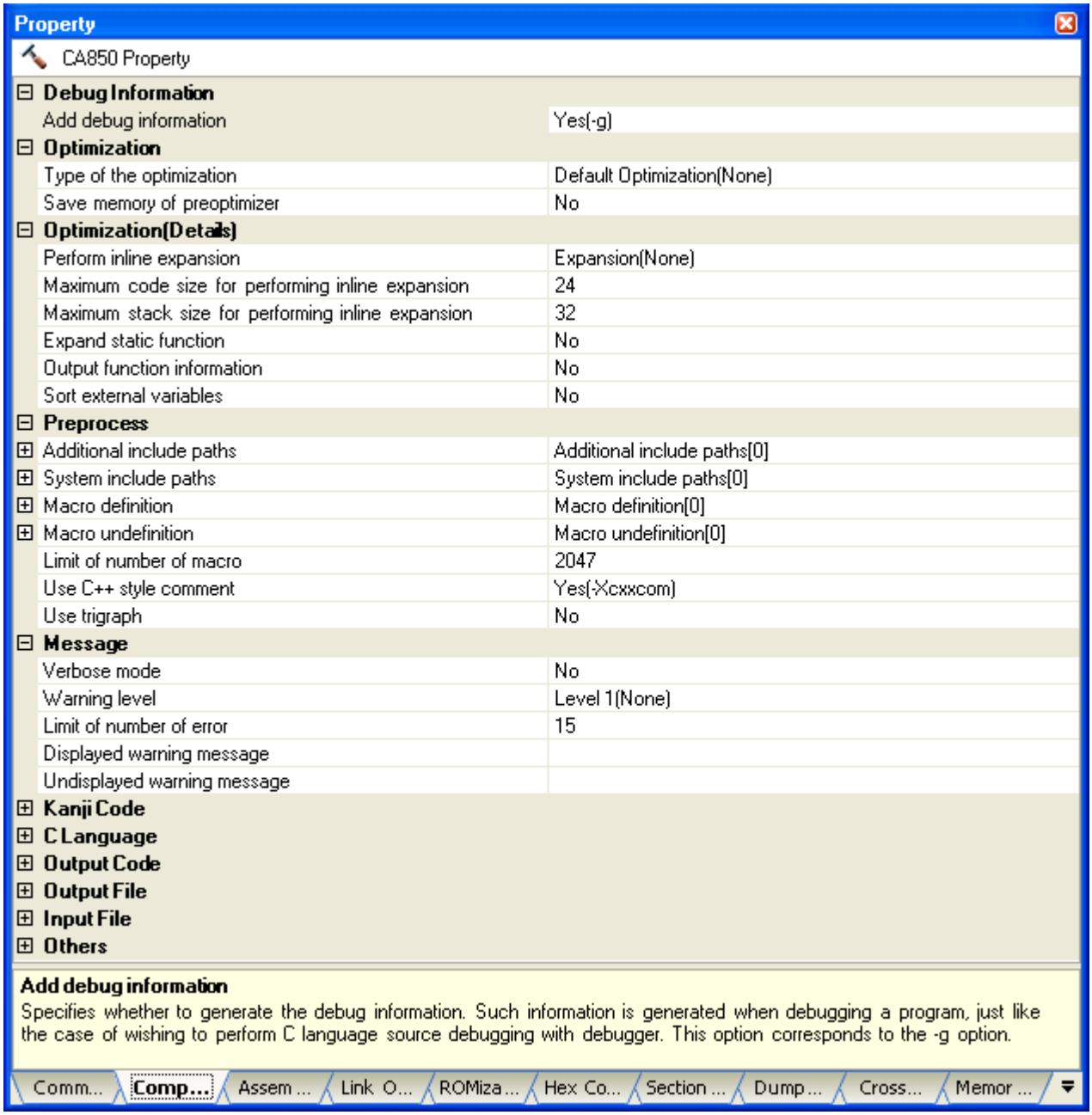
2. If "-t *num*" on the [Additional options for dump tool] property, the *num*th and greater symbol table entries will be displayed. If "-v" is also specified, a value such as a section attribute can be displayed as a string instead of a number.
See "B.8.2 Option" for details about the options.

2.5 Set Compile Options

To set options for the compiler, select the Build tool node on the project tree and select the [Compile Options] tab on the Property panel.

You can set the various compile options by setting the necessary properties in this tab.

Figure 2-33. Property Panel: [Compile Options] Tab



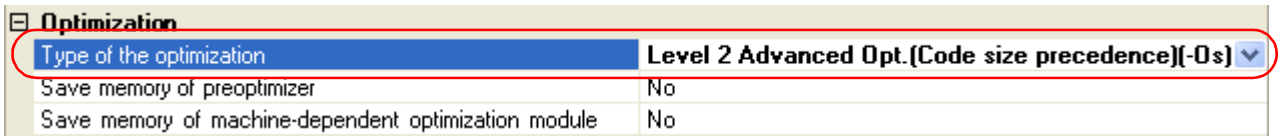
Remark Often used options have been gathered under the [Frequently Used Options(for Compile)] category on the [Common Options] tab.

2.5.1 Perform optimization with the code size precedence

Select the build tool node on the project tree and select the [Compile Options] tab on the Property panel.

To perform optimization with the code size precedence, select [Level 2 Advanced Opt.(Code size precedence)(-Os)] on the [Type of the optimization] property in the [Optimization] category ([Default Optimization(None)] is selected by default).

Figure 2-34. [Type of the optimization] Property (Code Size Precedence)



Remarks 1. You can also set the option in the same way with the [Type of the optimization] property in the [Frequently Used Options(for Compile)] category on the [Common Options] tab.

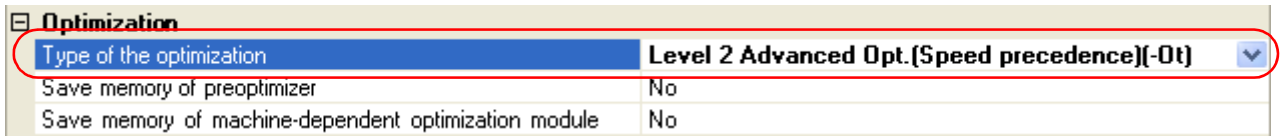
2. See "(3) Efficient use of optimization" for details about optimization.

2.5.2 Perform optimization with the execution speed precedence

Select the build tool node on the project tree and select the [Compile Options] tab on the Property panel.

To perform optimization with the execution speed precedence, select [Level 2 Advanced Opt.(Speed precedence)(-Ot)] on the [Type of the optimization] property in the [Optimization] category ([Default Optimization(None)] is selected by default).

Figure 2-35. [Type of the optimization] Property (Execution Speed Precedence)



Remarks 1. You can also set the option in the same way with the [Type of the optimization] property in the [Frequently Used Options(for Compile)] category on the [Common Options] tab.

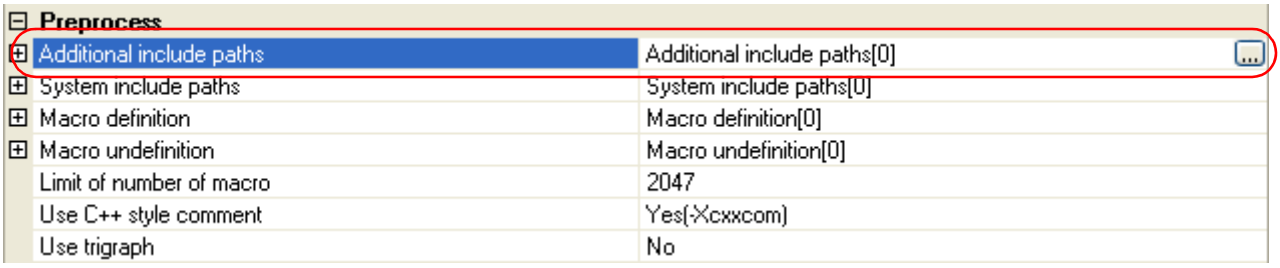
2. See "(3) Efficient use of optimization" for details about optimization.

2.5.3 Add an include path

Select the build tool node on the project tree and select the [Compile Options] tab on the Property panel.

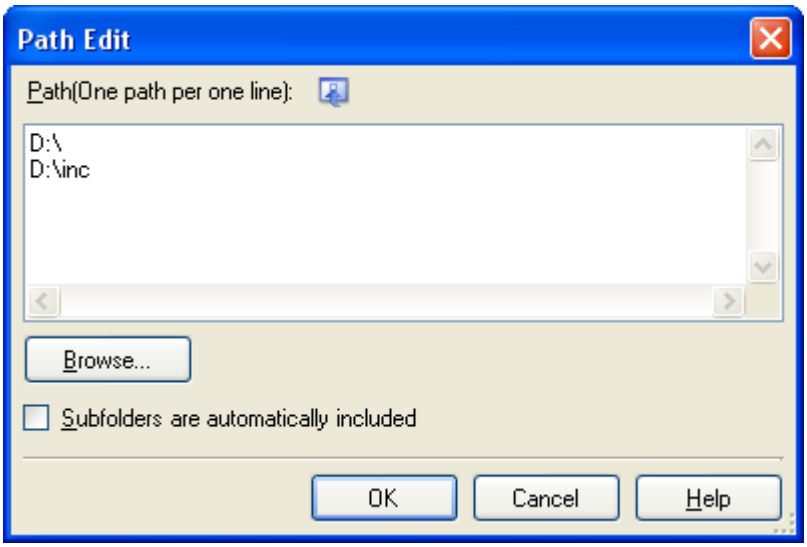
The include path setting is made with the [Additional include paths] property in the [Preprocess] category.

Figure 2-36. [Additional include paths] Property



If you click the [...] button, the Path Edit dialog box will open.

Figure 2-37. Path Edit Dialog Box

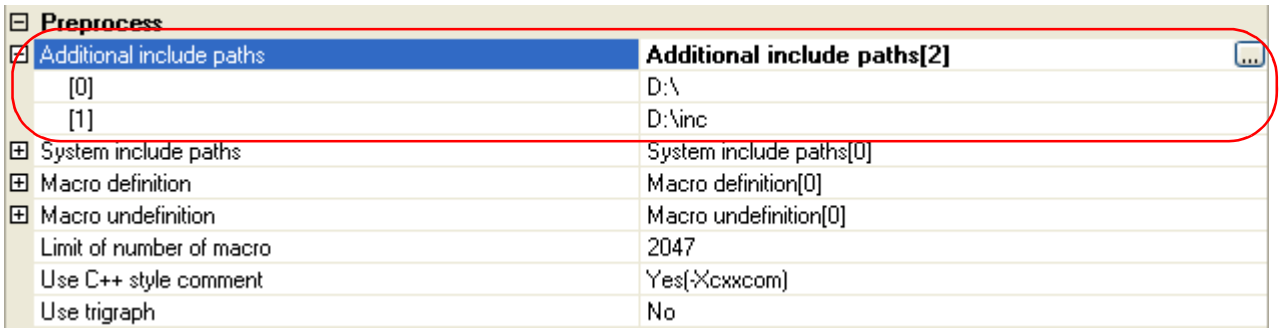


Enter an include path per line in [Path(One path per one line)]. You can specify up to 259 characters per line, up to 64 line.

Remark You can also specify the include path by dragging and dropping from Explorer or the like, or by the [Browse...] button. Select the [Subfolders are automatically included] check box before clicking the [Browse...] button to add all paths under the specified one (down to 5 levels) to [Path(One path per one line)].

If you click the [OK] button, the entered include paths are displayed as subproperties.

Figure 2-38. [Additional include paths] Property (After Adding Include Paths)



To change the include paths, you can use the [...] button or enter the path directly in the text box of the subproperty. When the include path is added to the project tree, the path is added to the top of the subproperties automatically.

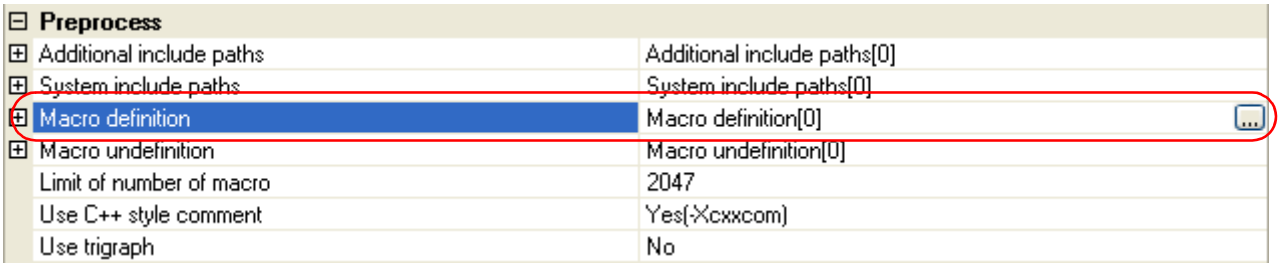
Remark You can also set the option in the same way with the [Additional include paths] property in the [Frequently Used Options(for Compile)] category on the [Common Options] tab.

2.5.4 Set a macro definition

Select the build tool node on the project tree and select the [Compile Options] tab on the Property panel.

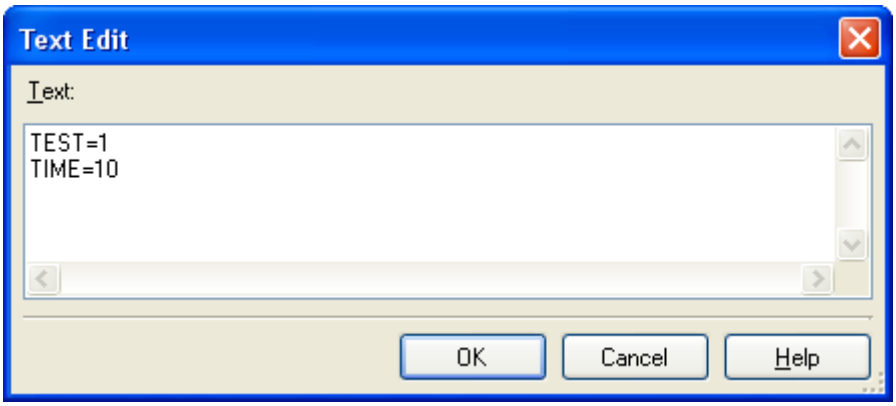
The macro definition setting is made with the [Macro definition] property in the [Preprocess] category.

Figure 2-39. [Macro definition] Property



If you click the [...] button, the Text Edit dialog box will open.

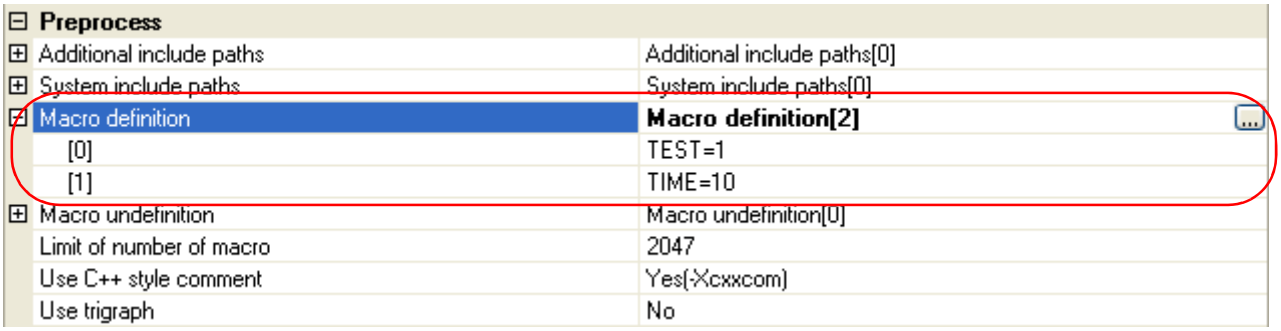
Figure 2-40. Text Edit Dialog Box



Enter the macro definition in the format of "*macro name=defined value*", with one macro name per line. You can specify up to 256 characters per line, up to 30 line. The "=*defined value*" part can be omitted, and in this case, "1" is used as the defined value.

If you click the [OK] button, the entered macro definitions are displayed as subproperties.

Figure 2-41. [Macro definition] Property (After Setting Macros)



To change the macro definitions, you can use the [...] button or enter the path directly in the text box of the subproperty.

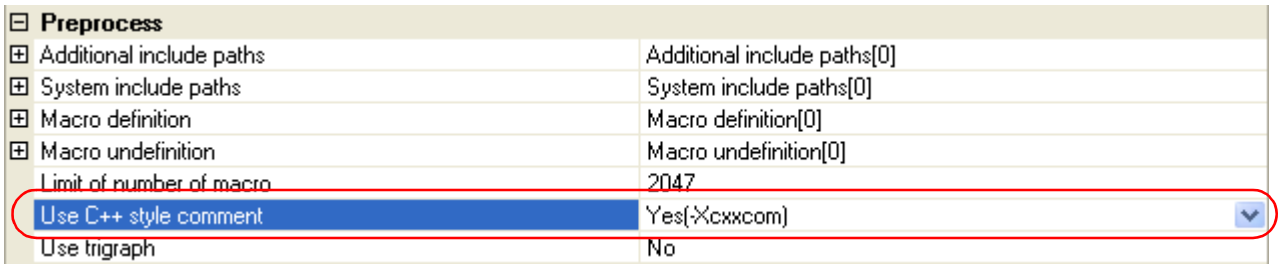
Remark You can also set the option in the same way with the [Macro definition] property in the [Frequently Used Options(for Compile)] category on the [Common Options] tab.

2.5.5 Enable C++ comments

Select the build tool node on the project tree and select the [Compile Options] tab on the Property panel.

To enable C++ comments, select [Yes(-Xcxxcom)] on the [Use C++ style comment] property in the [Preprocess] category (default).

Figure 2-42. [Use C++ style comment] Property



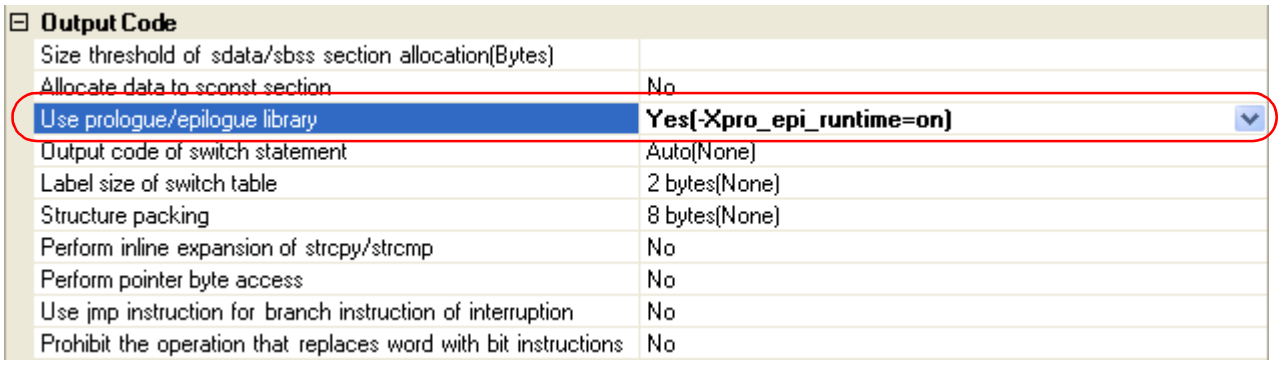
2.5.6 Reduce the code size (perform prologue/epilogue runtime calls)

It is possible to reduce the code size by performing a part of prologue/epilogue processing of the function based on runtime library function calls. However, the execution time overhead will increase because the callt instruction performs a runtime call.

Select the build tool node on the project tree and select the [Compile Options] tab on the Property panel.

To perform prologue/epilogue processing of the function based on runtime library function calls, select [Yes(-Xpro_epi_runtime=on)] on the [Use prologue/epilogue library] property in the [Output Code] category.

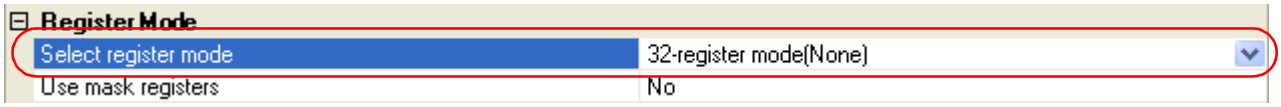
Figure 2-43. [Use prologue/epilogue library] Property



2.5.7 Change the register mode

Select the build tool node on the project tree and select the [Common Options] tab on the Property panel.
Select the register mode to on the [Select register mode] property in the [Register Mode] category.

Figure 2-44. [Select register mode] Property



You can select from the following register modes.

Register Mode	Working Registers	Registers for Register Variables
32-register mode(None) (default)	r10 to r19	r20 to r29
26-register mode(-reg26)	r10 to r16	r23 to r29
22-register mode(-reg22)	r10 to r14	r25 to r29

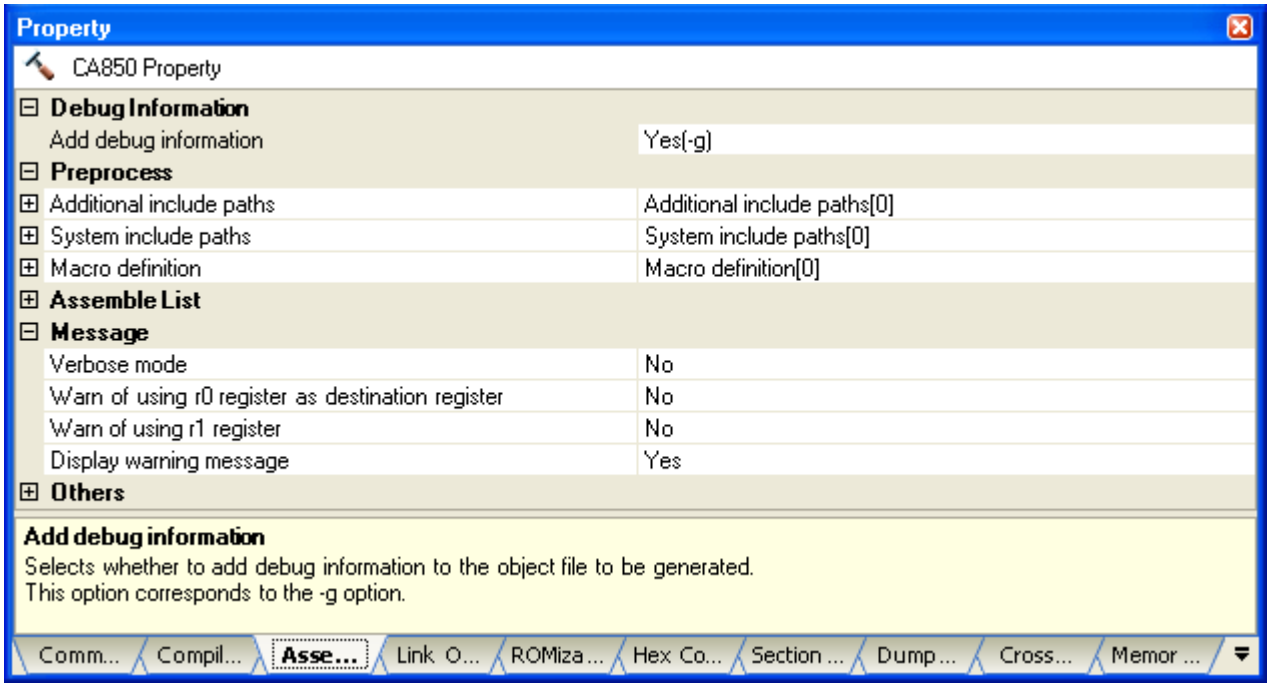
Remark See “CubeSuite+ V850 Coding” for details about the register mode.

2.6 Set Assemble Options

To set options for the assembler, select the Build tool node on the project tree and select the [Assemble Options] tab on the Property panel.

You can set the various assemble options by setting the necessary properties in this tab.

Figure 2-45. Property Panel: [Assemble Options] Tab



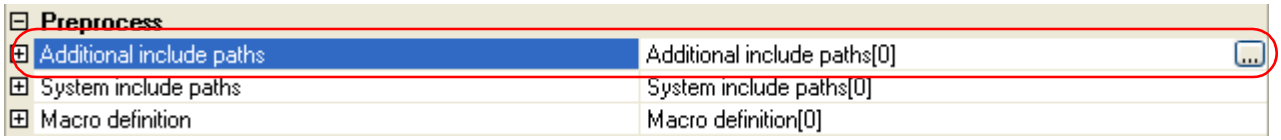
Remark Often used options have been gathered under the [Frequently Used Options(for Assemble)] category on the [Common Options] tab.

2.6.1 Add an include path

Select the build tool node on the project tree and select the [Assemble Options] tab on the Property panel.

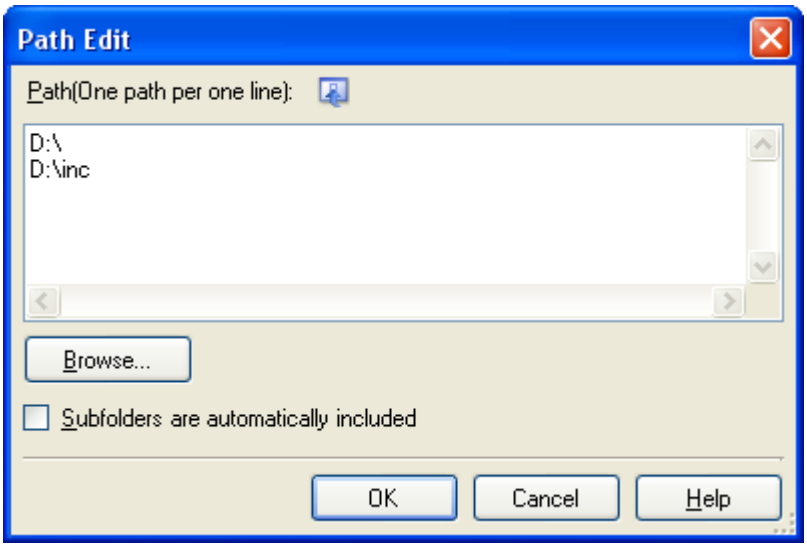
The include path setting is made with the [Additional include paths] property in the [Preprocess] category.

Figure 2-46. [Additional include paths] Property



If you click the [...] button, the Path Edit dialog box will open.

Figure 2-47. Path Edit Dialog Box

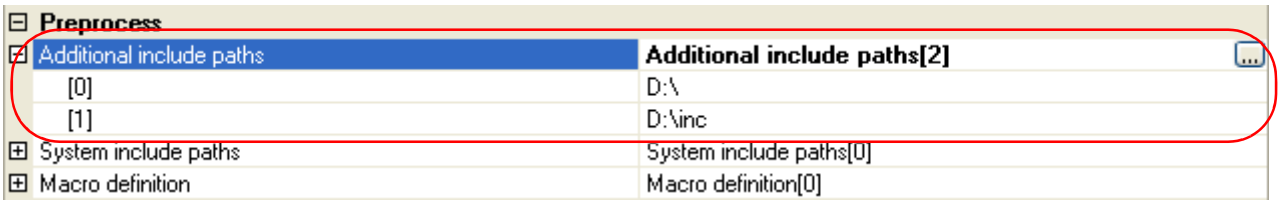


Enter an include path per line in [Path(One path per one line)]. You can specify up to 259 characters per line, up to 64 line.

Remark You can also specify the include path via the [Browse...] button. Select the [Subfolders are automatically included] check box before clicking the [Browse...] button to add all paths under the specified one (down to 5 levels) to [Path(One path per one line)].

If you click the [OK] button, the entered include paths are displayed as subproperties.

Figure 2-48. [Additional include paths] Property (After Adding Include Paths)



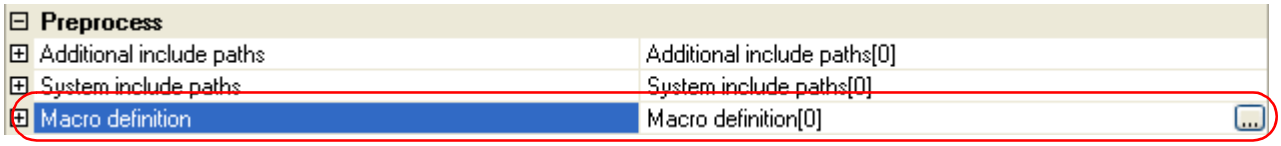
To change the include paths, you can use the [...] button or enter the path directly in the text box of the subproperty. When the include path is added to the project tree, the path is added to the top of the subproperties automatically.

Remark You can also set the option in the same way with the [Additional include paths] property in the [Frequently Used Options(for Assemble)] category on the [Common Options] tab.

2.6.2 Set a macro definition

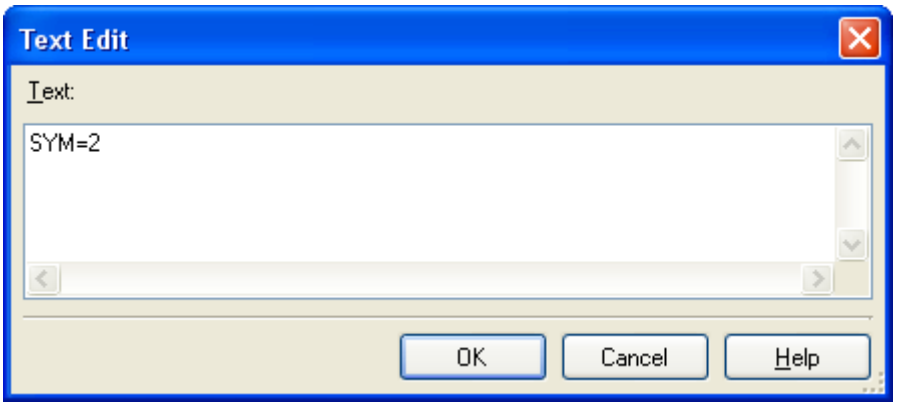
Select the build tool node on the project tree and select the [Assemble Options] tab on the Property panel.
The macro definition setting is made with the [Macro definition] property in the [Preprocess] category.

Figure 2-49. [Macro definition] Property



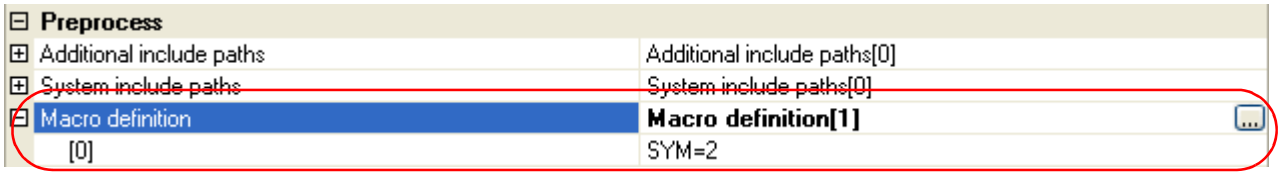
If you click the [...] button, the Text Edit dialog box will open.

Figure 2-50. Text Edit Dialog Box



Enter the macro definition in the format of "*macro name=defined value*", with one macro name per line. You can specify up to 31 characters per line, up to 30 line. The "*=defined value*" part can be omitted, and in this case, "1" is used as the defined value.
If you click the [OK] button, the entered macro definitions are displayed as subproperties.

Figure 2-51. [Macro definition] Property (After Setting Macros)



To change the macro definitions, you can use the [...] button or enter the path directly in the text box of the subproperty.

Remark You can also set the option in the same way with the [Macro definition] property in the [Frequently Used Options(for Assemble)] category on the [Common Options] tab.

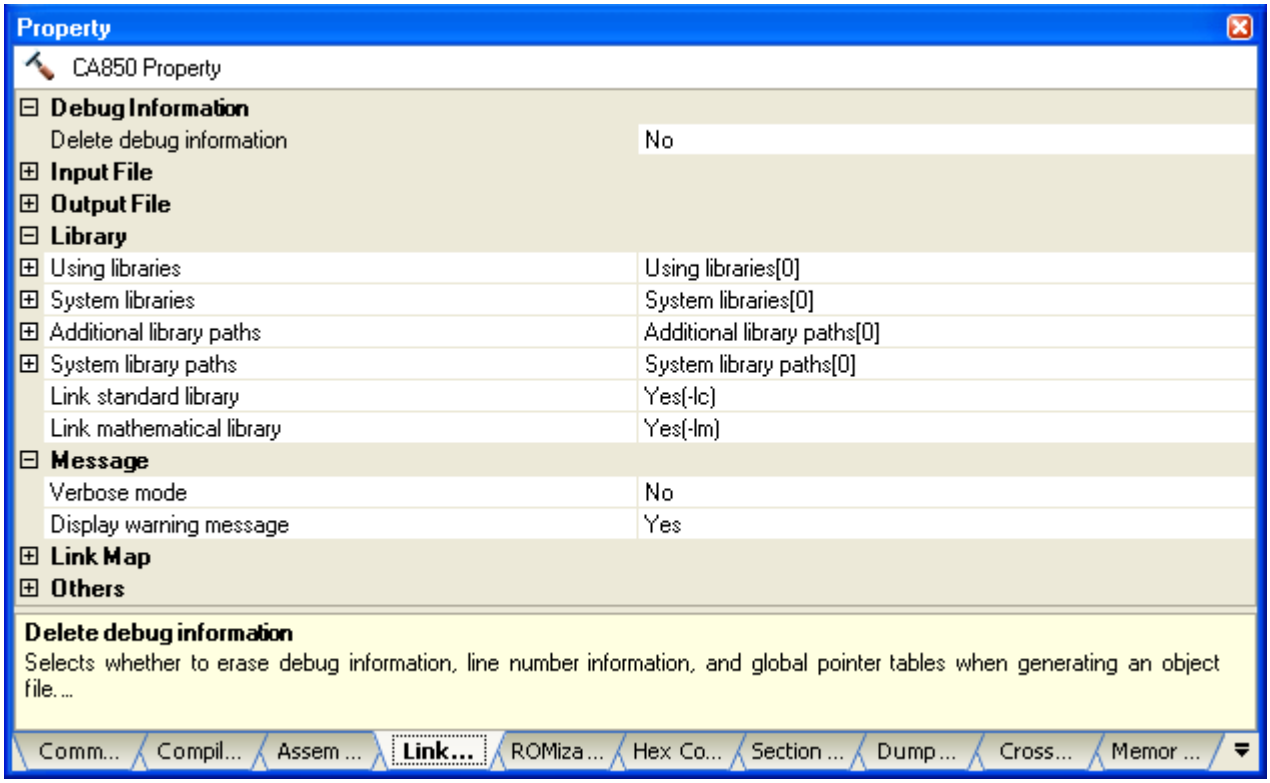
2.7 Set Link Options

To set options for the linker, select the Build tool node on the project tree and select the [Link Options] tab on the Property panel.

You can set the various link options by setting the necessary properties in this tab.

Caution This tab is not displayed for library projects.

Figure 2-52. Property Panel: [Link Options] Tab

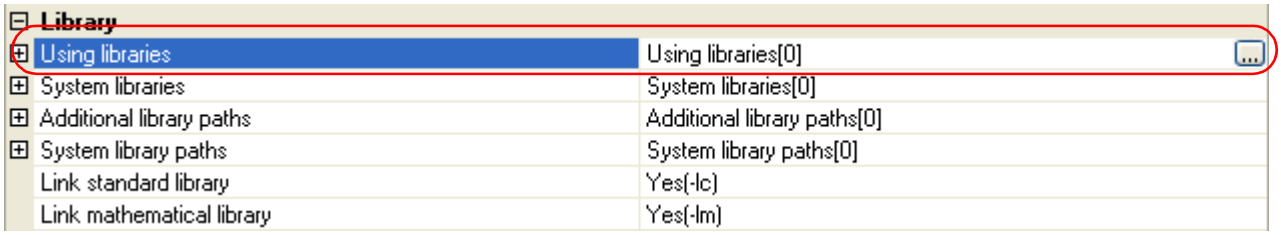


Remark Often used options have been gathered under the [Frequently Used Options(for Link)] category on the [Common Options] tab.

2.7.1 Add a user library

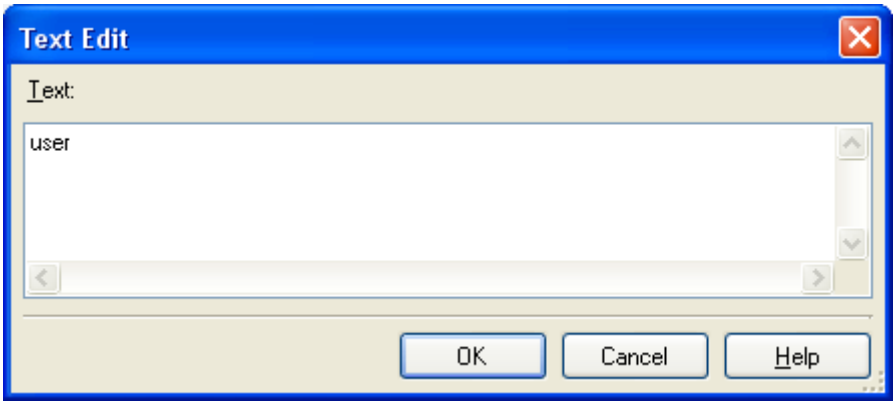
Select the build tool node on the project tree and select the [Link Options] tab on the Property panel.
Adding a user library is made with the [Using libraries] property in the [Library] category.

Figure 2-53. [Using libraries] Property



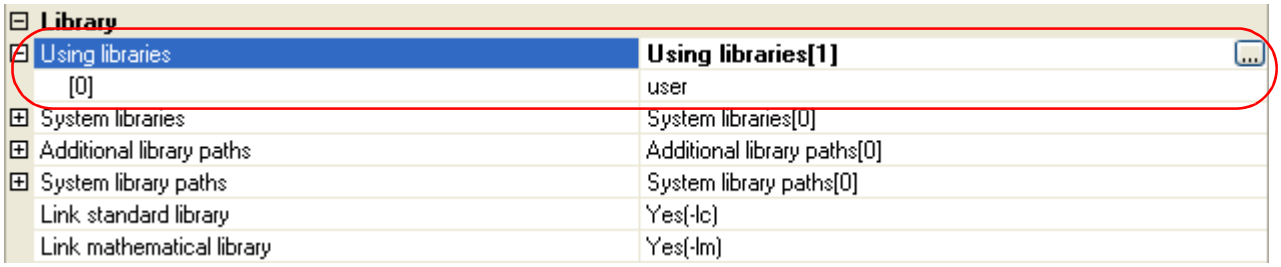
If you click the [...] button, the Text Edit dialog box will open.

Figure 2-54. Text Edit Dialog Box



In the [Text], specify only the "*string*" part of the library file name "lib*string*.a" (example: if you specify "user", "libuser.a" is assumed to be specified). Add one item in one line. You can specify up to 63 characters per line, up to 256 line.
If you click the [OK] button, the entered library files are displayed as subproperties.

Figure 2-55. [Using libraries] Property (After Setting Library Files)



To change the library files, you can use the [...] button or enter the path directly in the text box of the subproperty.

Remark You can also set the option in the same way with the [Using libraries] property in the [Frequently Used Options(for Link)] category on the [Common Options] tab.

The library files are searched from the library path. To add a library path, set the [Additional library paths] property.

Caution Library files can also be linked by adding them directly to the project. In this case, the library files are not searched from the library paths because they are linked directly via their absolute paths.

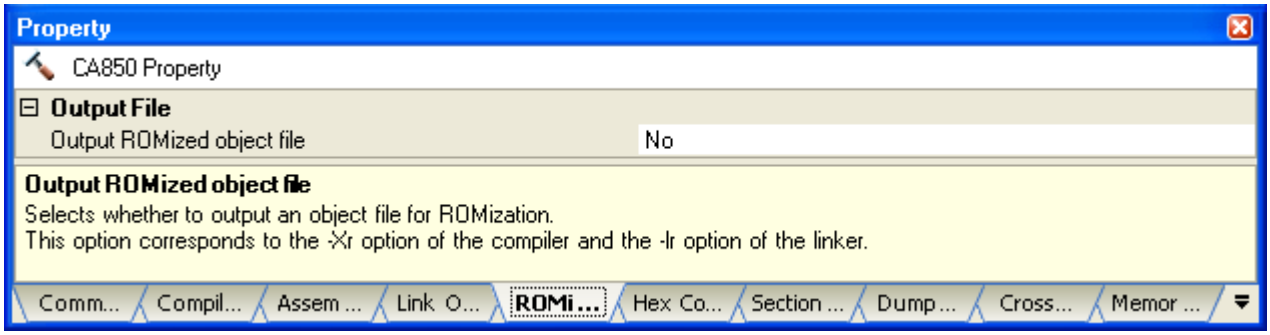
2.8 Set ROMization Process Options

To set options for the ROMization processor, select the Build tool node on the project tree and select the [ROMization Process Options] tab on the Property panel.

You can set the various ROMization processor options by setting the necessary properties in this tab.

Caution This tab is not displayed for library projects.

Figure 2-56. Property Panel: [ROMization Process Options] Tab



Remark Often used options have been gathered under the [Frequently Used Options(for ROMization)] category on the [Common Options] tab.

2.8.1 Create an object for ROMization

The following procedure shows how to create an object for ROMization using the ROMization area reservation code (rompcrt.o) that is provided as the default object.

The ROMization processor is a tool that takes default value information for variables in data-attribute sections as well as programs allocated to RAM and packs them into a single section. By default, this section becomes the "rompsec section". By allocating the rompsec section to ROM and calling the copy function, it is possible to deploy default value information and programs into RAM.

Remark See “B.4.3 Creating object for ROMization” for details about the method of creating the ROMization object.

(1) Call a copy function within the application

In the program, specify the section you want to copy from ROM to RAM using the copy function (_rcopy, _rcopy1, _rcopy2 and _rcopy4).

Specify the label "__S_romp" (label defined in rompcrt.o) which indicates the start address of the rompsec section as the first argument of the copy function.

Remark Call the copy function as early as possible in the program, such as within the startup routine or at the start of the main function.

(2) Create a link directive

During ROMization, a rompsec section is added immediately after the .text section. By allocating the .text section to the end of ROM in the link directive, the rompsec section up to the end of ROM can be allocated.

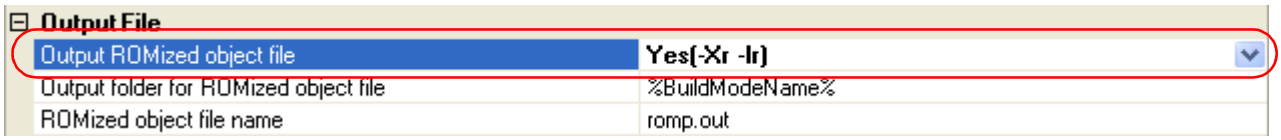
(3) Set ROMization process options

Select the build tool node on the project tree and select the [ROMization Process Options] tab on the Property panel.

(a) Configure the object for ROMization output

To create the object for ROMization, select [Yes(-Xr -lr)] on the [Output ROMized object file] property in the [Output File] category.

Figure 2-57. [Output ROMized object file] Property



When outputting a ROMized object file, you can set the output folder and output file name.

<1> Set the output folder

Setting the output folder is made with the [Output folder for ROMized object file] property by directly entering to the text box or by the [...] button. Up to 247 characters can be specified in the text box. "%BuildModeName%" is set by default. "%BuildModeName%" is an embedded macro. It is replaced to the build mode name.

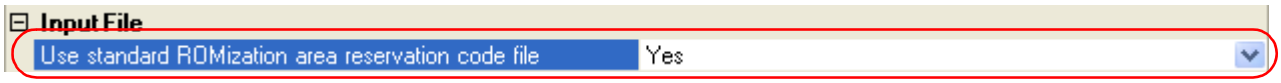
<2> Set the output file name

Setting the output file is made with the [ROMized object file name] property by directly entering to the text box. Up to 259 characters can be specified in the text box. "romp.out" is set by default.

(b) Configure using the standard ROMization area reservation code file

To use the standard ROMization area reservation code file, set the [Use standard ROMization area reservation code file] property to [Yes] (default).

Figure 2-58. [Use standard ROMization area reservation code file] Property

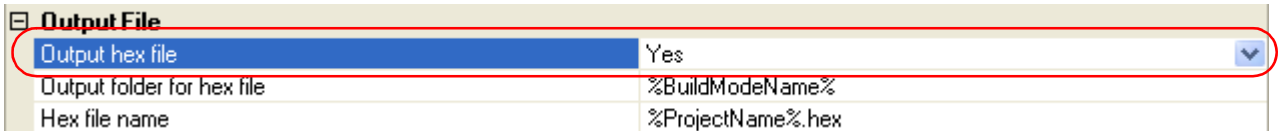


(4) Run a build

By running a build, the code that specifies "__S_romp" as the label indicating the start address of the rompsec section is generated, and the ROMization area reservation code (rompcrt.o) and ROMization library that stores the _rcopy function (libr.a) are linked. Finally, the ROMization object file will be generated from the generated load module file.

If [Yes] on the [Output hex file] property in the [Output File] category from the [Hex Convert Options] tab on the Property panel is selected, a hex file is also generated.

Figure 2-59. [Output hex file] Property



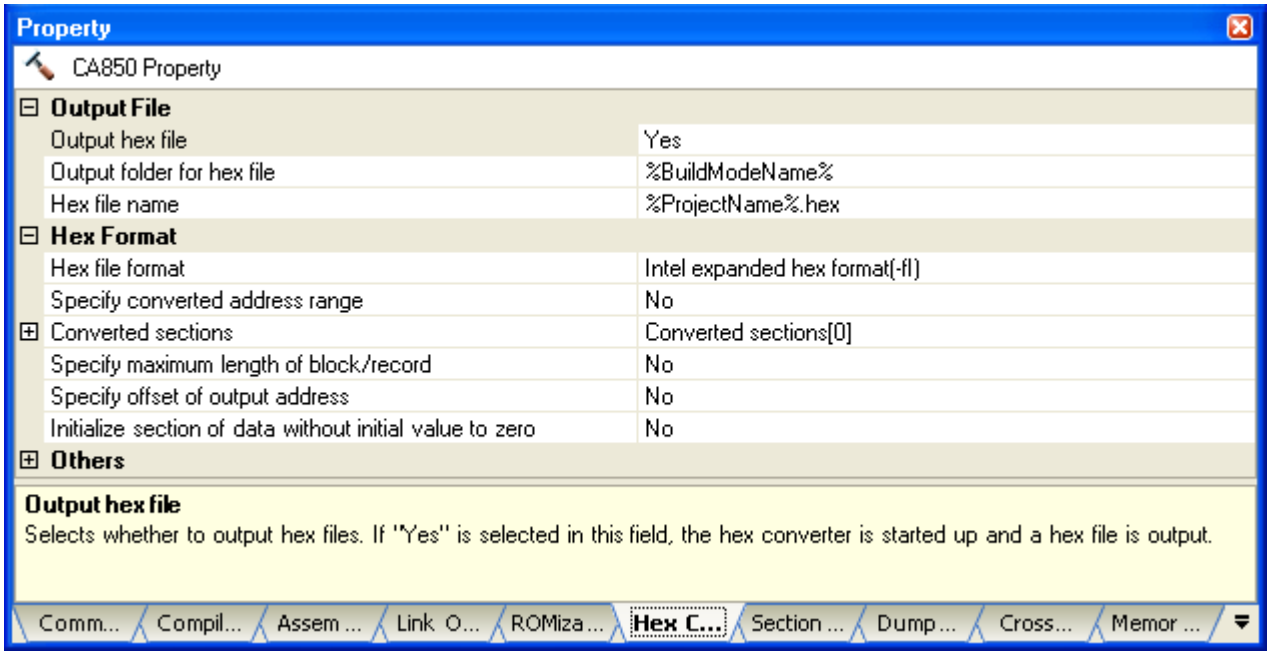
2.9 Set Hex Convert Options

To set options for the hex converter, select the Build tool node on the project tree and select the [Hex Convert Options] tab on the Property panel.

You can set the various hex converter options by setting the necessary properties in this tab.

Caution This tab is not displayed for library projects.

Figure 2-60. Property Panel: [Hex Convert Options] Tab



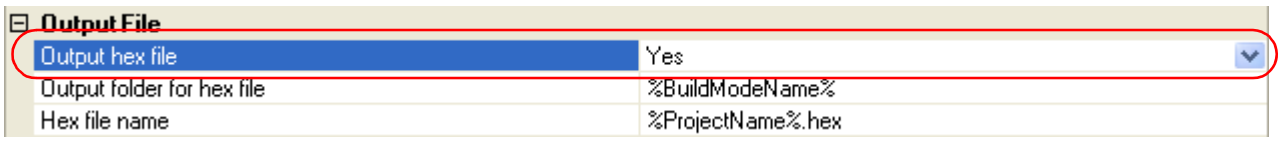
Remark Often used options have been gathered under the [Frequently Used Options(for Hex Convert)] category on the [Common Options] tab.

2.9.1 Set the output of a hex file

Select the build tool node on the project tree and select the [Hex Convert Options] tab on the Property panel.

The setting to output a hex file is made with the [Output hex file] property in the [Output File] category. To output a hex file, select [Yes] (default), to not output a hex file, select [No].

Figure 2-61. [Output hex file] Property



When outputting a hex file, you can set the output folder and output file name.

(1) Set the output folder

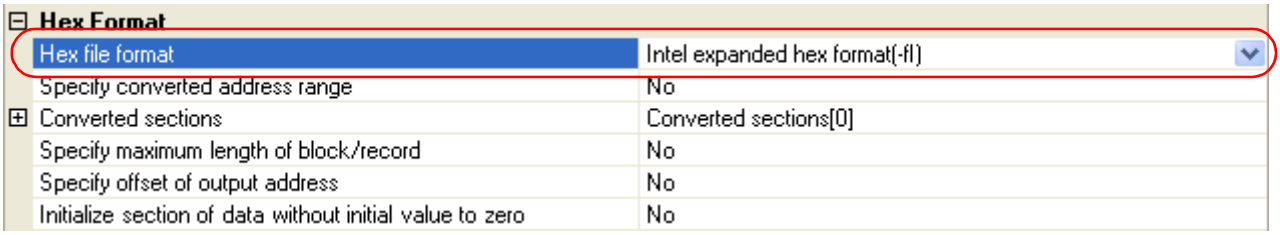
Setting the output folder is made with the [Output folder for hex file] property by directly entering to the text box or by the [...] button. Up to 247 characters can be specified in the text box. "%BuildModeName%" is set by default. "%BuildModeName%" is an embedded macro. It is replaced to the build mode name.

(2) Set the output file name

Setting the output file is made with the [Hex file name] property by directly entering to the text box. Up to 259 characters can be specified in the text box. "%ProjectName%.hex" is set by default. "%ProjectName%" is an embedded macro. It is replaced to the project name.

You can also set the format of the hex file.
Select the format on the [Hex file format] property in the [Hex Format] category.

Figure 2-62. [Hex file format] Property



You can select any of the formats below.

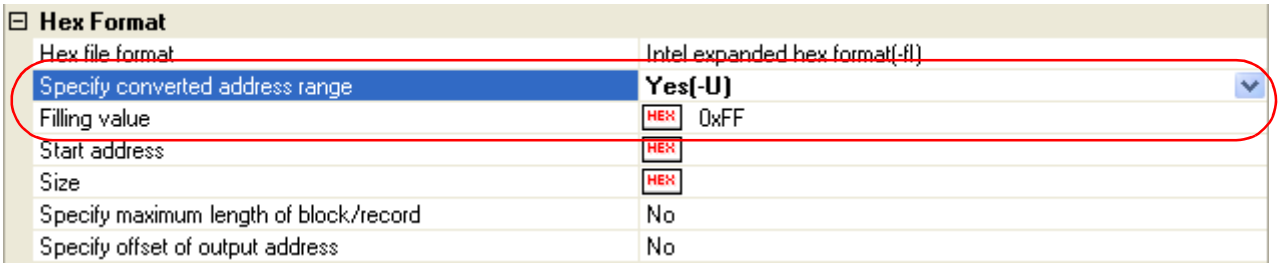
Format	Configuration
Intel expanded hex format(-fI) (default)	Start address record, expanded address record, data record, and end record
Motorola S type format(standard address)(-fS)	S0 record as a header record, S2 record as data record, and S8 record as end record
Motorola S type format(32-bit address)(-fs)	S0 record as a header record, S3 record as data record, and S7 record as end record
Expanded Tektronix hex format(-fT)	Data block, symbol block, and termination block

Remark See "3.3 Hex Converter" for details about the hex file format.

2.9.2 Fill the vacant area

Select the build tool node on the project tree and select the [Hex Convert Options] tab on the Property panel.
The setting to fill the vacant area is made with the [HEX Format] category. If you select [Yes(-U)] on the [Specify converted address range] property, the [Filling value] property is displayed.

Figure 2-63. [Specify converted address range] and [Filling value] Property



Enter the fill value for the vacant area directly to the text box. The range that can be specified for the value is 0x00 to 0xFF (hexadecimal). "0xFFFF" is set by default.

Set the address range of the area to be converted to a hex file. The range that can be specified for the value is 0x0 to *the maximum value of the address that can be handled by the device* (hexadecimal) for the [Start address] property, 0x1 to *the maximum value of the address that can be handled by the device* (hexadecimal) for the [Size] property. By default, the start address and size of the internal ROM area defined in the device file are set.

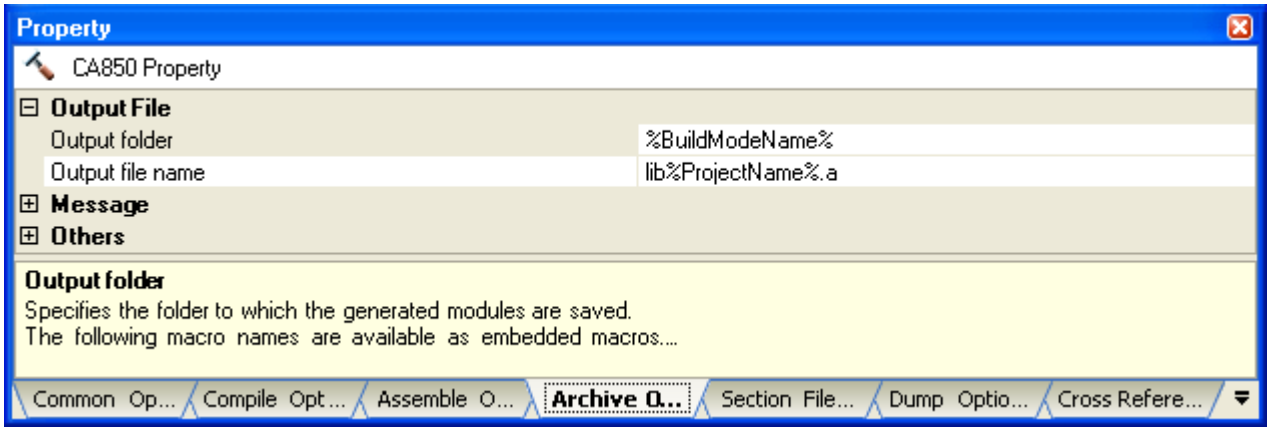
2.10 Set Archive Options

To set options for the archiver, select the Build tool node on the project tree and select the [Archive Options] tab on the Property panel.

You can set the various archive options by setting the necessary properties in this tab.

Caution This tab is displayed only for library projects.

Figure 2-64. Property Panel: [Archive Options] Tab

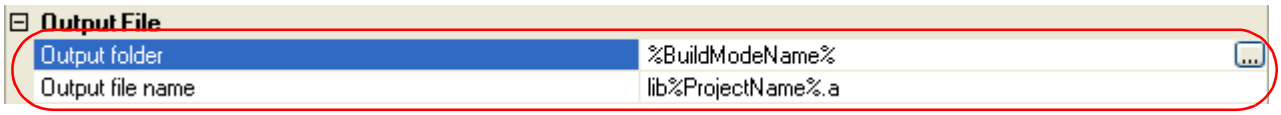


2.10.1 Set the output of an archive file

Select the build tool node on the project tree and select the [Archive Options] tab on the Property panel.

The setting to output an archive file is made with the [Output File] category.

Figure 2-65. [Output File] Category



(1) Set the output folder

Setting the output folder is made with the [Output folder] property by directly entering to the text box or by the [...] button. Up to 247 characters can be specified in the text box. "%BuildModeName%" is set by default. "%BuildModeName%" is an embedded macro. It is replaced to the build mode name.

(2) Set the output file name

Setting the output file is made with the [Output file name] property by directly entering to the text box. Up to 259 characters can be specified in the text box. "%ProjectName%.a" is set by default. "%ProjectName%" is an embedded macro. It is replaced to the project name.

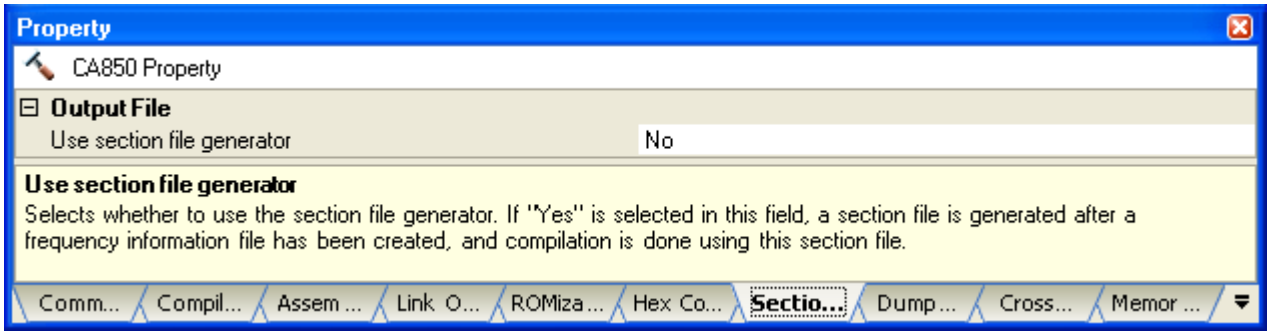
Add "lib" to the head of the output file name, naming the file "lib%ProjectName%.a" so that it can be specified in the link options.

2.11 Set Section File Generate Options

To set options for the section file generator, select the Build tool node on the project tree and select the [Section File Generate Options] tab on the Property panel.

You can set the various section file generate options by setting the necessary properties in this tab.

Figure 2-66. Property Panel: [Section File Generate Options] Tab



2.11.1 Automatically allocate variables through static analysis

To allocate variables automatically through static analysis, use the section file generator. This tool generates a section file (a file defining the sections to which external variables are allocated). Variables will be allocated to the specified sections by performing compilation using that file.

Select the build tool node on the project tree and select the [Section File Generate Options] tab on the Property panel.

In the [Output File] category, set the [Use section file generator] property to [Yes] to generate an empty section file, and add it to the project (it will also appear in the File node of the project tree). The output destination is the file set in the [Output folder for section file] property and the [Section file name] property.

Remark If a section file with the same name already exists, the build will be configured to use it.

Figure 2-67. [Use section file generator] Property

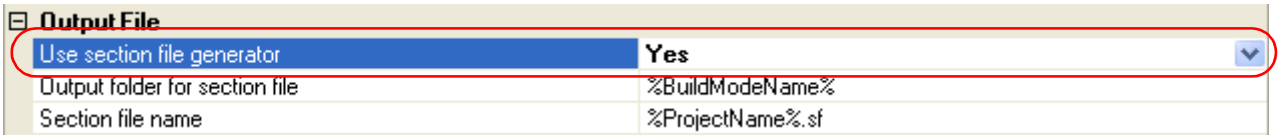
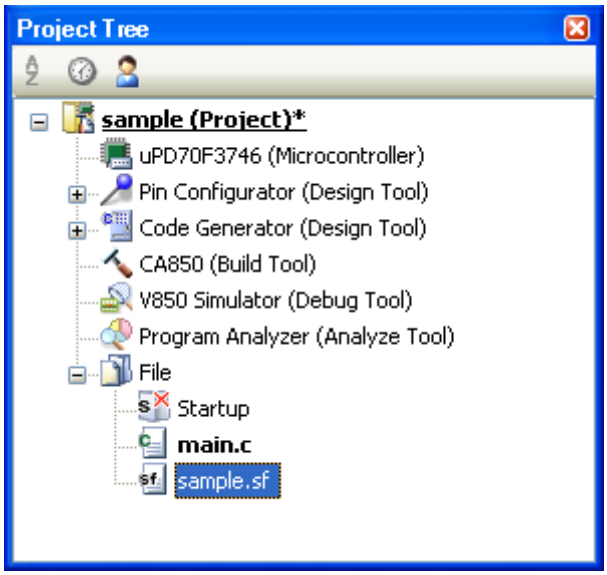


Figure 2-68. Project Tree Panel (After Generating Section File)



Remark See "3.4 Section File Generator" for details about the format of the section file to be generated.

The settings of the output folder and file of the section file are can be changed.

(1) Set the output folder

Setting the output folder is made with the [Output folder for section file] property by directly entering to the text box or by the [...] button. Up to 247 characters can be specified in the text box. "%BuildModeName%" is set by default. "%BuildModeName%" is an embedded macro. It is replaced to the build mode name.

(2) Set the output file name

Setting the output file is made with the [Section file name] property by directly entering to the text box. Up to 259 characters can be specified in the text box. "%ProjectName%.sf" is set by default. "%ProjectName%" is an embedded macro. It is replaced to the project name.

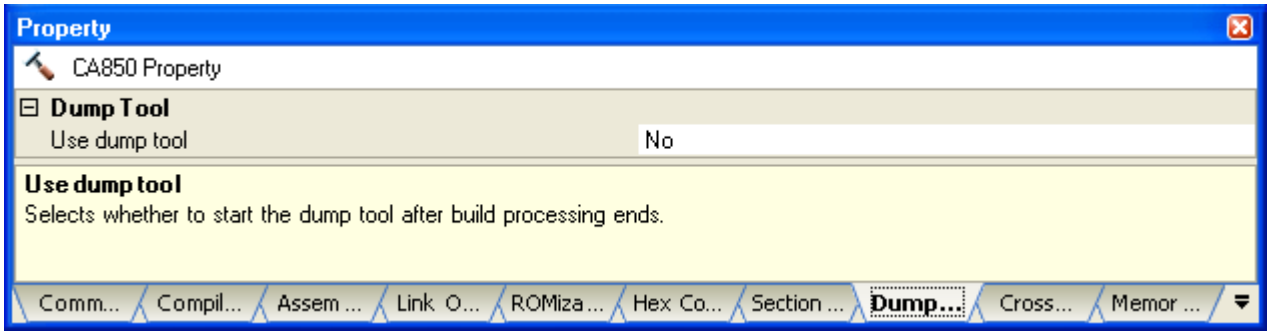
If this property is changed, an empty section file is generated and added to the project (it will also appear in the File node of the project tree).

2.12 Set Dump Options

To set options for the dump tool, select the Build tool node on the project tree and select the [Dump Options] tab on the Property panel.

You can set the various dump options by setting the necessary properties in this tab.

Figure 2-69. Property Panel: [Dump Options] Tab



2.12.1 Use the dump tool

Using the dump tool, you can output information such as the address, attribute, and symbol name of a section/segment in the object file and archive file.

Select the build tool node on the project tree and select the [Dump Options] tab on the Property panel.

To use the dump tool, select [Yes] on the [Use dump tool] property in the [Dump Tool] category ([No] is selected by default).

Figure 2-70. [Use dump tool] Property

Remark See "3.5 Dump Tool " for details about the information output by the dump tool.

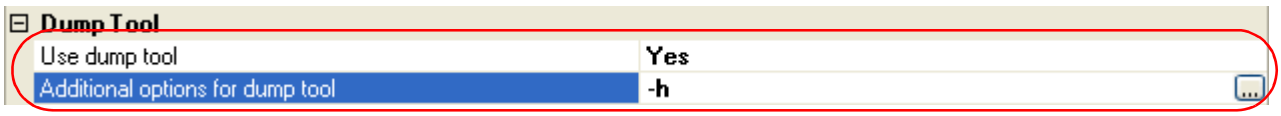
2.12.2 Reference the section information

To output section information defined in the input module, use the -h option of the dump tool.

Select the build tool node on the project tree and select the [Dump Options] tab on the Property panel.

Set the -h option in the [Dump Tool] category. If you select [Yes] on the [Use dump tool] property, the [Additional options for dump tool] property is displayed.

Figure 2-71. [Use dump tool] and [Additional options for dump tool] Property



Specify "-h" on the [Additional options for dump tool] property.

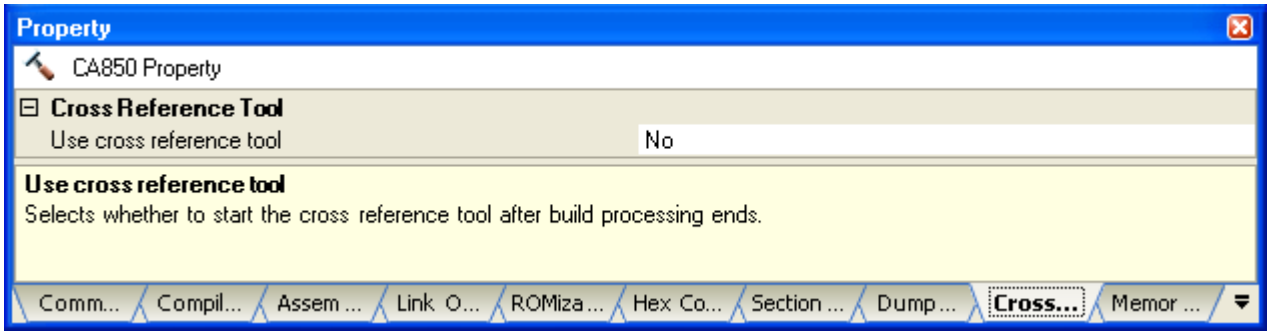
Remark See "3.5 Dump Tool" for section information to be output.

2.13 Set Cross Reference Options

To set options for the cross reference tool, select the Build tool node on the project tree and select the [Cross Reference Options] tab on the Property panel.

You can set the various cross reference options by setting the necessary properties in this tab.

Figure 2-72. Property Panel: [Cross Reference Options] Tab



2.13.1 Use the cross reference tool

Using the cross reference tool, you can take all the C source files registered to the project as an input and output all information (cross reference information, tag jump information, call tree, function metrics and call database) to the files in text format and CSV format.

Select the build tool node on the project tree and select the [Cross Reference Options] tab on the Property panel.

To use the cross reference tool, select [Yes] on the [Use cross reference tool] property in the [Cross Reference Tool] category ([No] is selected by default).

Figure 2-73. [Use cross reference tool] Property

Remark See "3.7 Cross Reference Tool " for details about the information output by the cross reference tool.

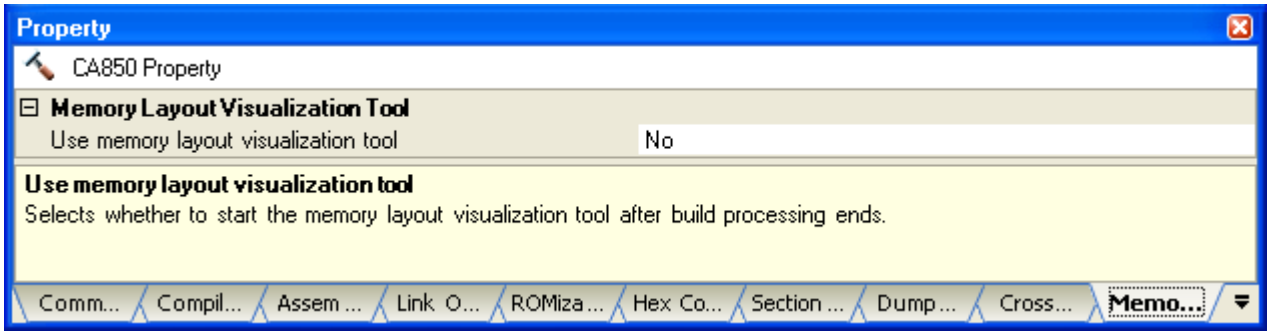
2.14 Set Memory Layout Visualization Options

To set options for the memory layout visualization tool, select the Build tool node on the project tree and select the [Memory Layout Visualization Options] tab on the Property panel.

You can set the various memory layout visualization options by setting the necessary properties in this tab.

Caution This tab is not displayed for library projects.

Figure 2-74. Property Panel: [Memory Layout Visualization Options] Tab



2.14.1 Use the memory layout visualization tool

Using the memory layout visualization, you can take an object file (*.out) as an input and output a memory map table (memory map information of variables) to the files in text format and CSV format.

Select the build tool node on the project tree and select the [Memory Layout Visualization Options] tab on the Property panel.

To use the memory layout visualization tool, select [Yes] on the [Use memory layout visualization tool] property in the [Memory Layout Visualization Tool] category ([No] is selected by default).

Figure 2-75. [Use memory layout visualization tool] Property

Remark See "3.8 Memory Layout Visualization Tool" for details about the memory map table.

2.15 Set Build Options Separately

Build options are set at the project or file level.

- Project level: See "2.15.1 Set build options at the project level"
- Project level: See "2.15.2 Set build options at the file level"

2.15.1 Set build options at the project level

To set options for build options for a project (main project or subproject), select the Build tool node on the project tree to display the Property panel.

Select the component tabs, and set build options by setting the necessary properties.

Compiler: [Compile Options] tab
Assembler: [Assemble Options] tab
Linker: [Link Options] tab
ROMization processor: [ROMization Process Options] tab
Hex converter: [Hex Convert Options] tab
Archiver: [Archive Options] tab
Section file generator: [Section File Generate Options] tab
Dump tool: [Dump Options] tab
Cross reference tool: [Cross Reference Options] tab
Memory layout visualization tool: [Memory Layout Visualization Options] tab

2.15.2 Set build options at the file level

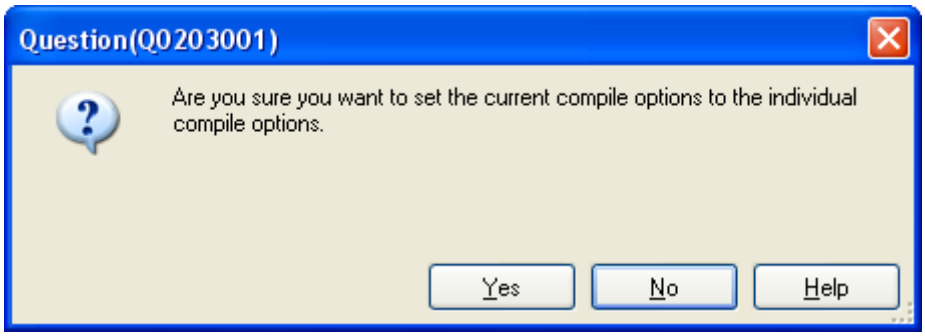
You can individually set compile and assemble options for each source file added to the project.

(1) When setting compile options for a C source file

Select a C source file on the project tree and select the [Build Settings] tab on the Property panel. In the [Build] category, if you select [Yes] on the [Set individual compile option] property, the message dialog box ("Figure 2-77. Message Dialog Box") is displayed.

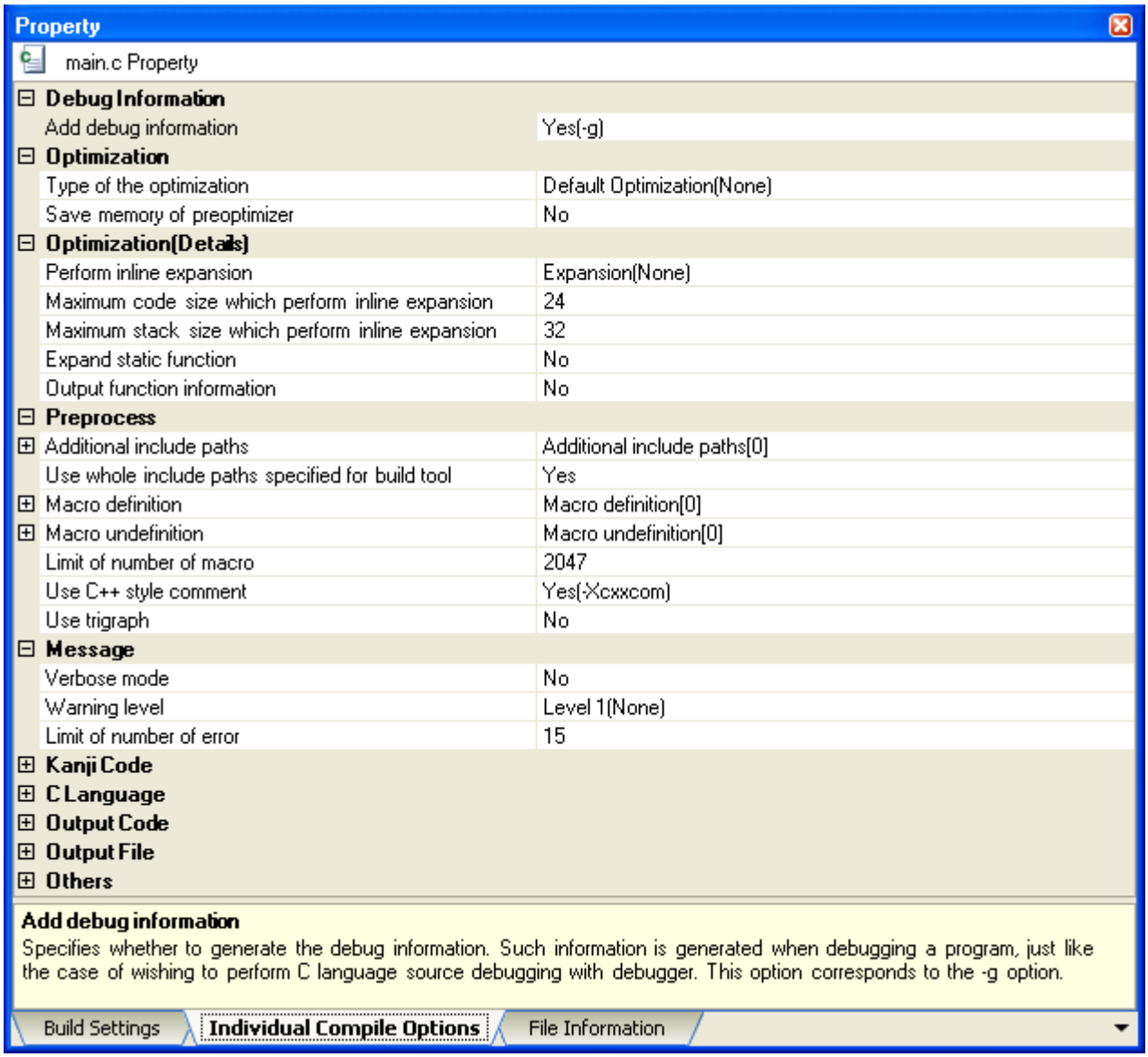
Figure 2-76. [Set individual compile option] Property

Figure 2-77. Message Dialog Box



If you click the [Yes] button in the dialog box, the [Individual Compile Options] tab will be displayed.

Figure 2-78. Property Panel: [Individual Compile Options] Tab



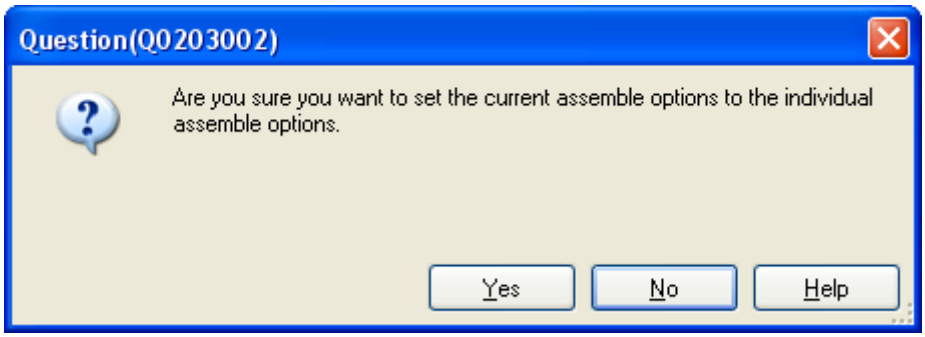
You can set compile options for the C source file by setting the necessary properties in this tab. Note that this tab takes over the settings of the [Compile Options] tab by default.

(2) When setting assemble options for an assembler source file

Select an assembler source file on the project tree and select the [Build Settings] tab on the Property panel. In the [Build] category, if you select [Yes] on the [Set individual assemble option] property, the message dialog box ("Figure 2-80. Message Dialog Box") is displayed.

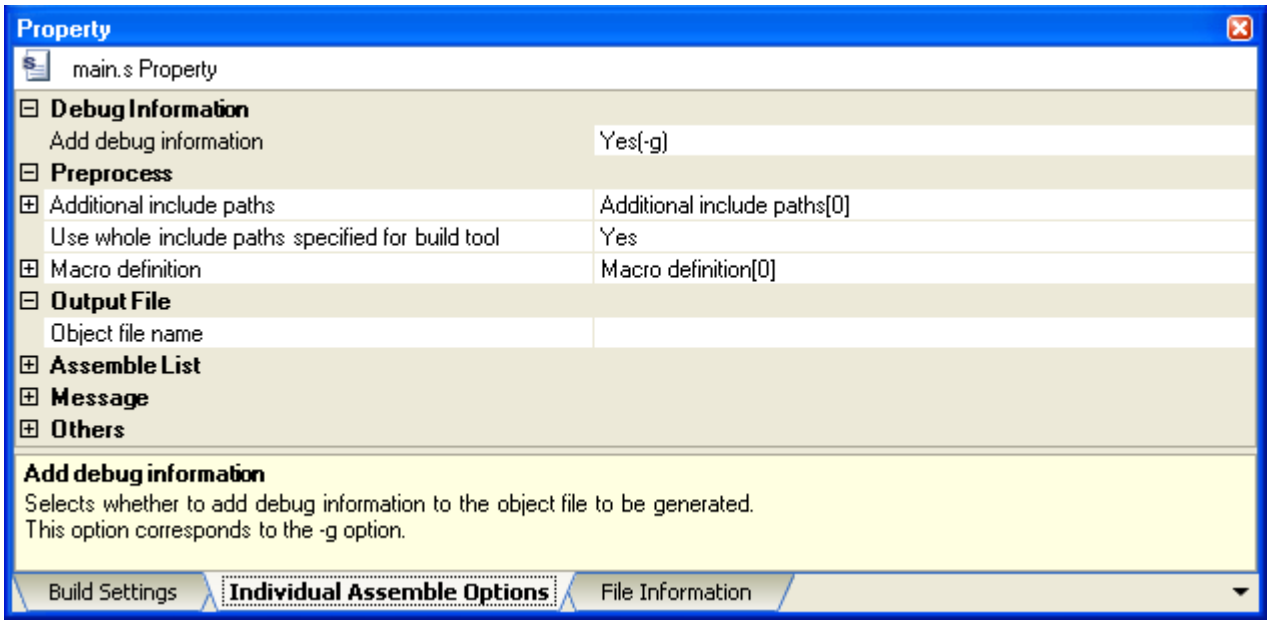
Figure 2-79. [Set individual assemble option] Property

Figure 2-80. Message Dialog Box



If you click the [Yes] button in the dialog box, the [Individual Assemble Options] tab will be displayed.

Figure 2-81. Property Panel: [Individual Assemble Options] Tab



You can set assemble options for the assembler source file by setting the necessary properties in this tab. Note that this tab takes over the settings of the [Assemble Options] tab by default.

Remark You can also set assemble options for assembler source files created from C source files. Select a C source file on the project tree and select the [Individual Compile Options] tab on the Property panel. If you select [Yes(-Fs)] on the [Output assemble file] property in the [Output File] category, the [Individual Assemble Options] tab is displayed.

2.16 Prepare for Implementing Boot-flash Relink Function

Depending on the system, in addition to the area which cannot be rewritten/replaced (boot area), there are occasions when you can use the area which can be rewritten/replaced (flash area), such as the flash or external ROM.

In these kinds of systems, when you wish to change the program in the flash area, a function called the "relink function" correctly performs function calls between the boot area and flash area without rebuilding the program in the boot area.

By creating load module files for the boot area and flash area, you can implement the relink function. The method to implement the relink function is shown below.

Remark See "B.3.3 Boot-flash relink function" for details about the relink function and how to implement it.

2.16.1 Prepare the build target files

(1) Prepare the link directive files

Prepare link directive files for the projects for both the boot area and flash area.

Remark You can use the same link directive file with the boot area and flash area, but since the description will become complicated, it is recommend to use a separate link directive file for each area.

(2) Describe the .ext_func quasi directive

Describe the .ext_func quasi directive in the assembler source file.

With the .ext_func directive, specify the ID value for the target function (the actual function exists in the flash area and is called from the boot area).

Remark In order to prevent description mistakes and inconsistencies between source files, it is recommend that you organize the .ext_func directive description in a single file, and regardless of the boot area or flash area, include that file in all the assembler source files using the .include directive.

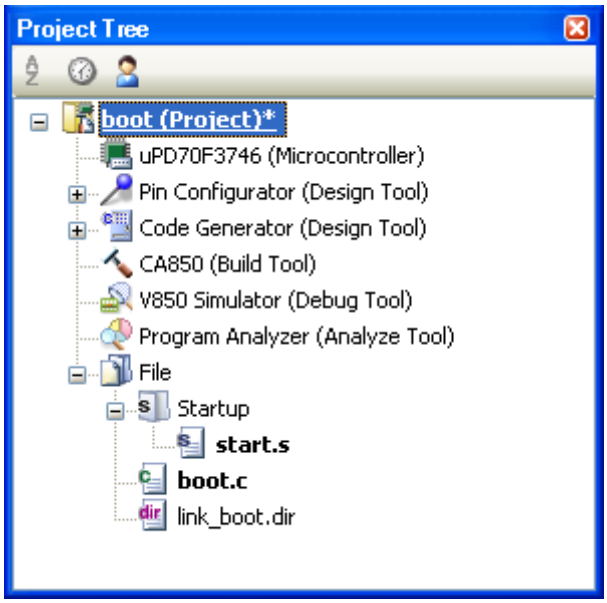
2.16.2 Set the boot area project

(1) Create the boot area project

Create a project for the boot area and add the build target files to the project.

Add the startup routine to the Startup node.

Figure 2-82. Boot Area Project

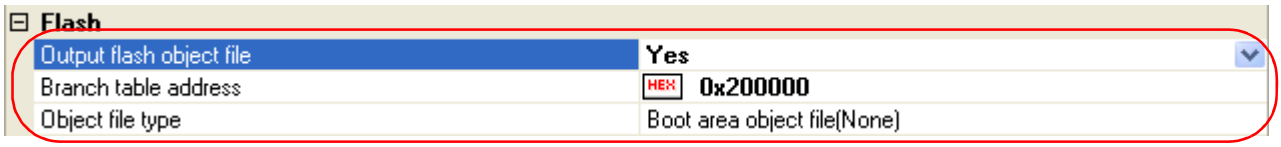


(2) Set the build options for the boot area project

Select the build tool node on the project tree and select the [Common Options] tab on the Property panel. Set the build options in the [Flash] category.

If you select [Yes] on the [Output flash object file] property, the [Branch table address] property and [Object file type] property are displayed.

Figure 2-83. [Output flash object file], [Branch table address], and [Object file type] property in Boot Area



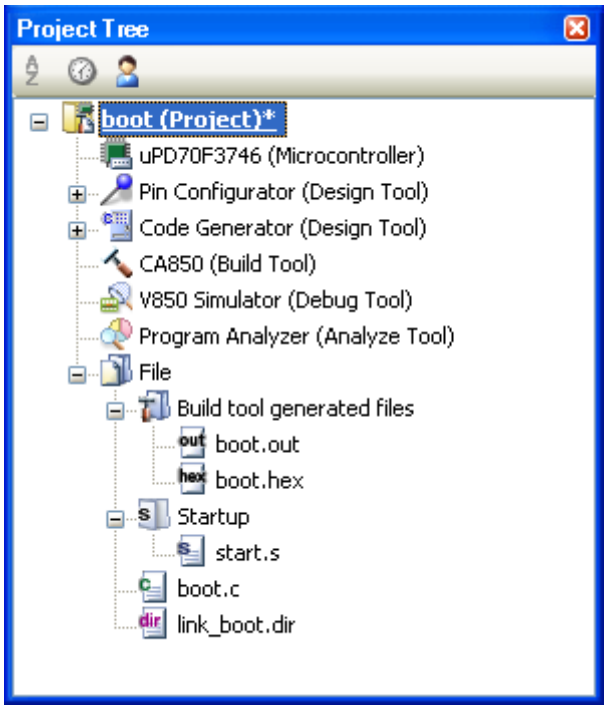
Specify the start address of the branch table (address in the flash area) in the [Branch table address] property. The range that can be specified for the value is 0x0 to 0xffffffff (hexadecimal). "0x0" is set by default.

Also, select [Boot area object file(None)] on the [Object file type] property.

(3) Run a build of the boot area project

When you run a build of the boot area project, a load module file is created.

Figure 2-84. ""Created Files for Boot Area

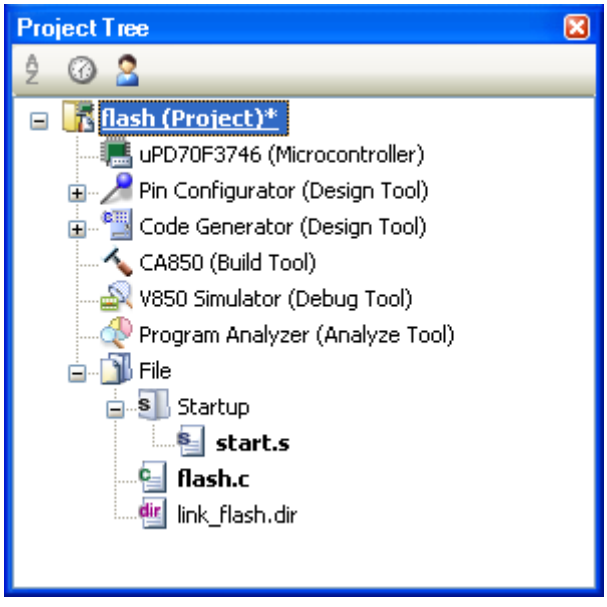


2.16.3 Set the flash area project

(1) Create the flash area project

Create a project for the boot area and add the build target files to the project.
Add the startup routine to the Startup node.

Figure 2-85. Flash Area Project

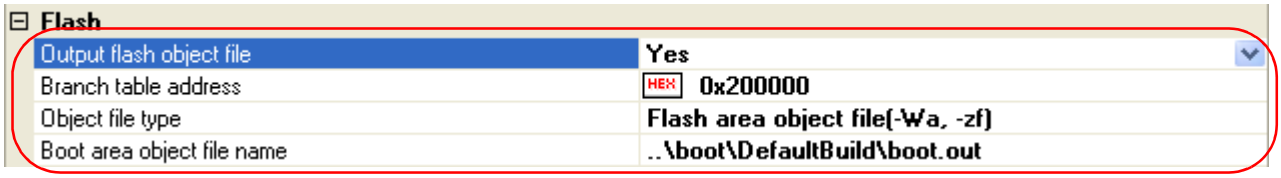


(2) Set the build options for the flash area project

Select the build tool node on the project tree and select the [Common Options] tab on the Property panel. Set the build options in the [Flash] category.

If you select [Yes] on the [Output flash object file] property, the [Branch table address] property and [Object file type] property are displayed.

Figure 2-86. [Output flash object file], [Branch table address], [Object file type], and [Boot area object file name] Property



Specify the start address of the branch table (same as the address specified in the boot area project) in the [Branch table address] property.

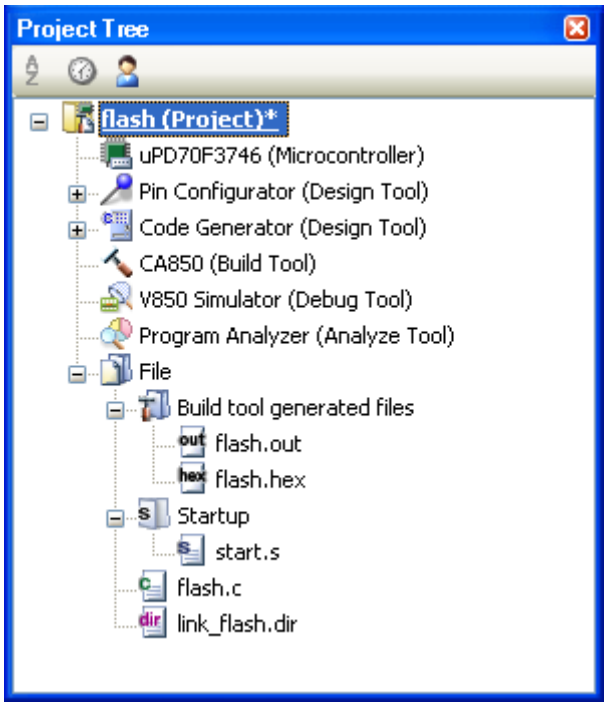
If you select [Flash area object file(-Wa, -zf)] on the [Object file type] property, the [Boot area object file name] property are displayed. Specify the boot area object file.

Caution Specify an object output by the linker. An error occurs if an object output by the ROMization processor is specified.

(3) Run a build of the flash area project

When you run a build of the flash area project, a load module file which implements the relink function is created.

Figure 2-87. Created Files for Flash Area



2.17 Make Settings for Build Operations

This section explains operations on a build.

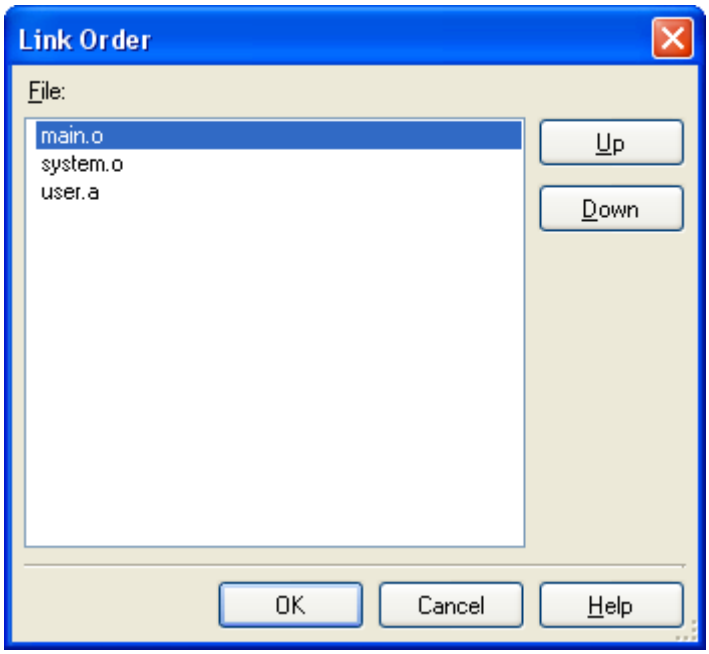
- Set the link order of files
- Change the file build order of subprojects
- Display a list of build options
- Change the file build target project
- Add a build mode
- Change the build mode
- Delete a build mode
- Set the current build options as the standard for the project

2.17.1 Set the link order of files

The link order of object module files and library files is decided automatically, but you can also set the order.

On the project tree, select the Build tool node, and then select [Set Link Order...] from the context menu. The Link Order dialog box opens.

Figure 2-88. Link Order Dialog Box



The names of the following files are listed in [File] in the order that the files are input to the linker.

- Object module files generated from the source files added to the selected main project or subproject
- Object module files added directly to the project tree of the selected main project or subproject
- Library files added directly to the project tree of the selected main project or subproject

Remark The default order is the order the files are added to the project.
Object module files created from newly added source files and newly added object module files are added after the last object module file in the list. Newly added library files are added to the end of the list.

By changing the display order of the files, you can set the input order of the files to the linker.

To change the display order, use the [Up] and [Down] buttons, or drag and drop the file names. After changing the display order, click the [OK] button.

2.17.2 Change the file build order of subprojects

Builds are run in the order of subproject, main project, but when there are multiple subprojects added, the build order of subprojects is their display order on the project tree.

To change the display order of the subprojects on the project tree, drag the subproject to be moved and drop it on the desired location.

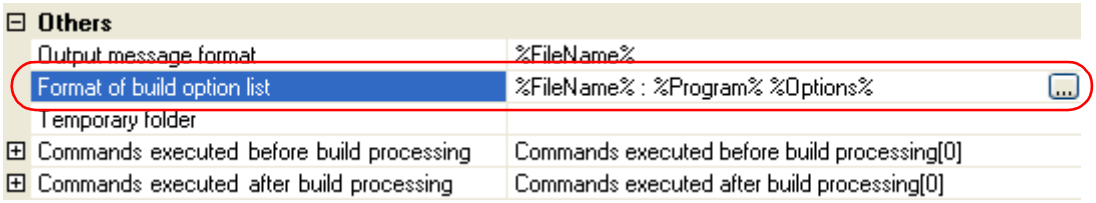
2.17.3 Display a list of build options

You can display the list of build options set currently on the Property panel for the project (main project and subproject).

If you select [Build Options List] from the [Build] menu, the current settings of the options for the project are displayed on the [Build Tool] tab from the Output panel in the build order.

Remark You can change the display format of the build option list.
Select the build tool node on the project tree and select the [Common Options] tab on the Property panel.
Set the [Format of build option list] property in the [Others] category.

Figure 2-89. [Format of build option list] Property



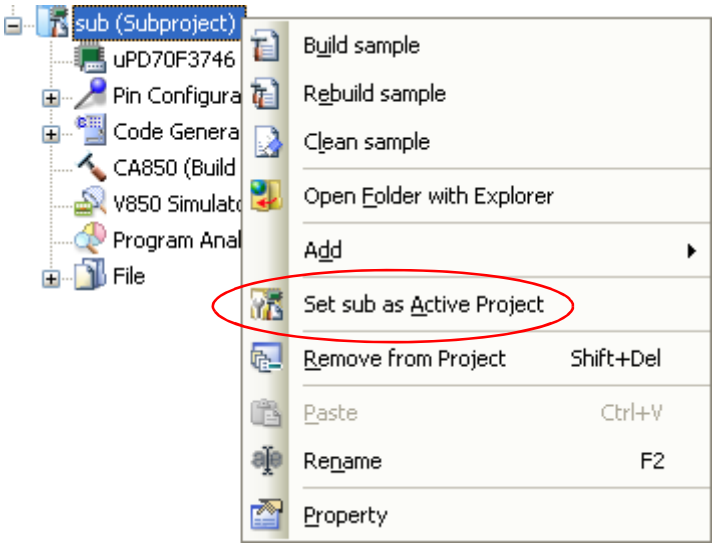
"%FileName% : "%FileName% : %Program% %Options%" is set by default.
"%FileName%", "%Program%", and "%Options%" are embedded macros. They are replaced to the file name being built, program name under execution, and command line option under build execution.

2.17.4 Change the file build target project

When running a build that targets a specific project (main project or subproject), you must set that project as the "active project".

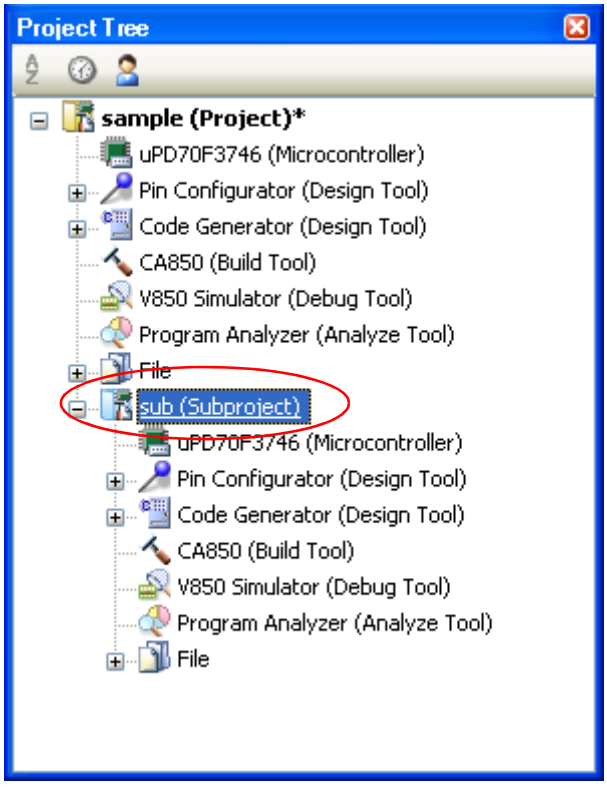
To set the active project, select the main project or subproject to be set as the active project on the project tree and select [Set *selected subproject* as Active Project] from the context menu.

Figure 2-90. [Set *selected project* as Active Project] Item



When a project is set as the active project, that project is underlined.

Figure 2-91. Active Project



Remarks 1. Immediately after creating a project, the main project is the active project.

2. When you remove a subproject that set as the active project from a project, the main project will be the active project.

2.17.5 Add a build mode

When you wish to change the build options and macro definitions according to the purpose of the build, you can collectively change those settings. Build options and macro definition settings are organized into what is called "build mode", and by changing the build mode, you eliminate the necessity of changing the build options and macro definition settings every time.

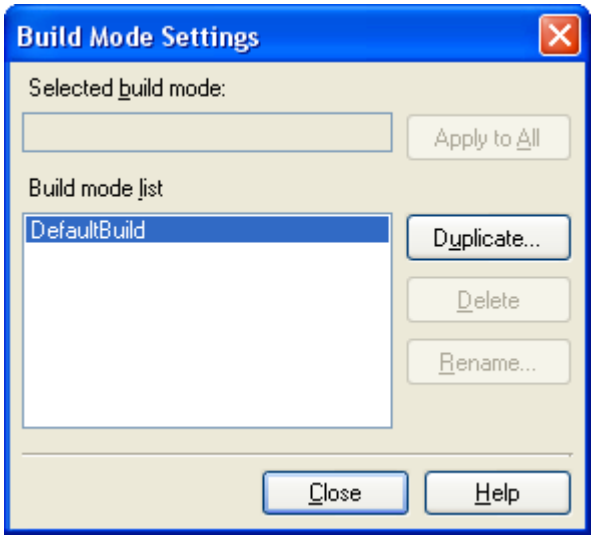
The build mode prepared by default is only "DefaultBuild". Add a build mode according to the purpose of the build. The method to add a build mode is shown below.

(1) Create a new build mode

Creating a new build mode is performed with duplicating an existing build mode.

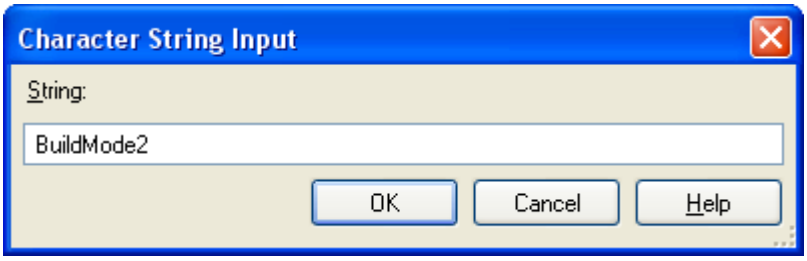
Select [Build Mode Settings...] from the [Build] menu. The Build Mode Settings dialog box opens.

Figure 2-92. Build Mode Settings Dialog Box



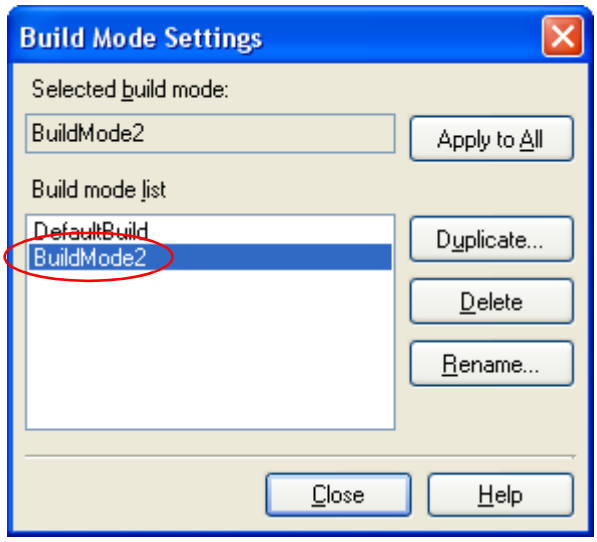
Select the build mode to be duplicated from the build mode list and click the [Duplicate...] button. The Character String Input dialog box opens.

Figure 2-93. Character String Input Dialog Box



In the dialog box, enter the name of the build mode to be created and then click the [OK] button. The build mode with that name will be duplicated. The created build mode is added to the build modes of the main project and all the subprojects which belong to the project.

Figure 2-94. Build Mode Settings Dialog Box (After Adding Build Mode)



(2) Change the build mode

Change the build mode to the newly created build mode (see "2.17.6 Change the build mode").

(3) Change the setting of the build mode

Select the build tool node on the project tree and change the build options and macro definition settings on the Property panel.

Remark Creating a build mode is regarded a project change. When closing the project, you will be asked to confirm whether or not to save the build mode.

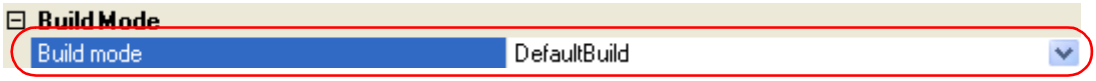
2.17.6 Change the build mode

When you wish to change the build options and macro definitions according to the purpose of the build, you can collectively change those settings. Build options and macro definition settings are organized into what is called "build mode", and by changing the build mode, you eliminate the necessity of changing the build options and macro definition settings every time.

(1) When changing the build mode for the main project or subprojects

Select the Build tool node of the target project on the project tree and select the [Common Options] tab on the Property panel. Select the build mode to be changed to on the [Build mode] property in the [Build Mode] category.

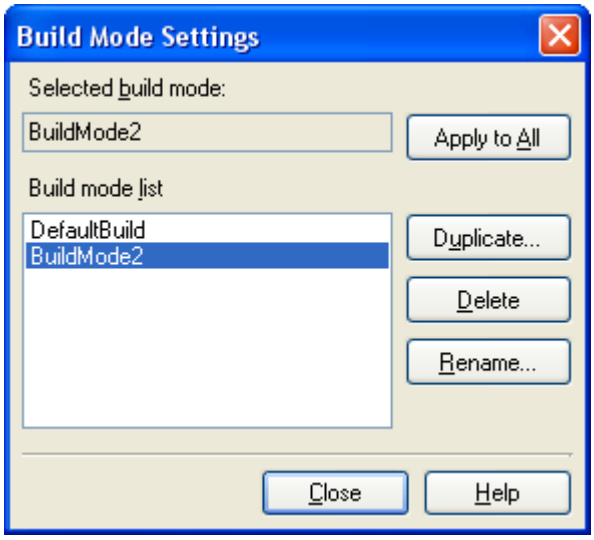
Figure 2-95. [Build Mode] Property



(2) When changing the build mode for the entire project

Select [Build Mode Settings...] from the [Build] menu. The Build Mode Settings dialog box opens.

Figure 2-96. Build Mode Settings Dialog Box



If you select the build mode to be changed from the build mode list, the selected build mode is displayed in [Selected build mode]. If you click the [Apply to All] button, the build mode for the main project and all the subprojects which belong to the project will be changed to the build mode selected in the dialog box.

Caution For projects that the selected build mode does not exist, the build mode is duplicated from "DefaultBuild" with the selected build mode name, and the build mode is changed to the duplicated build mode.

Remarks 1. The build mode prepared by default is only "DefaultBuild". See "2.17.5 Add a build mode" for the method of adding a build mode.

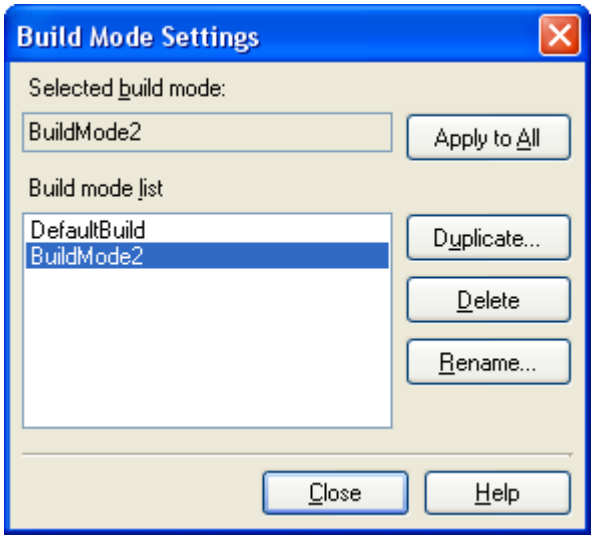
2. You can change the name of the build mode by selecting the build mode from the build mode list and clicking the [Rename...] button. However, you cannot change the name of "DefaultBuild".

2.17.7 Delete a build mode

Deleting a build mode is performed with the Build Mode Settings dialog box.

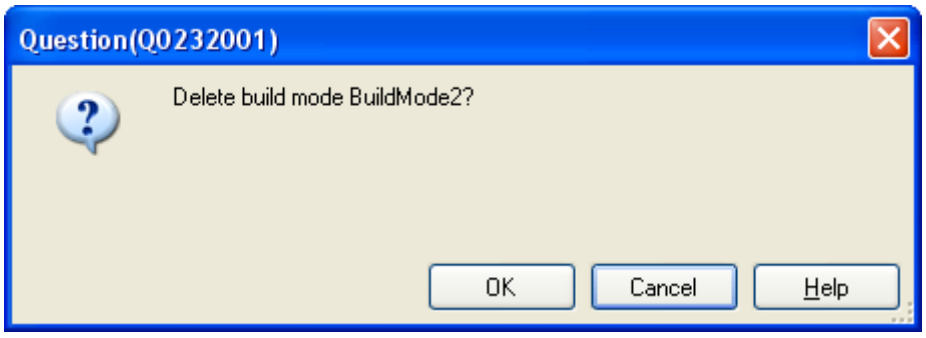
Select [Build Mode Settings...] from the [Build] menu. The dialog box opens.

Figure 2-97. Build Mode Settings Dialog Box



Select the build mode to be deleted from the build mode list and click the [Delete] button. The Message dialog box below opens.

Figure 2-98. Message Dialog Box



To continue with the operation, click the [OK] button in the dialog box.

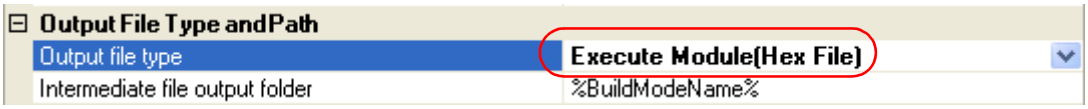
The selected build mode is deleted from the project.

Caution You cannot delete "DefaultBuild".

2.17.8 Set the current build options as the standard for the project

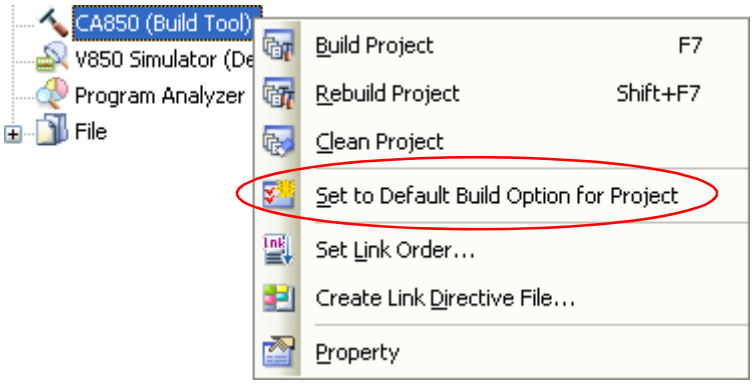
On the Property panel, if you add a change to the settings for the standard build options, the value of the property will be displayed in boldface.

Figure 2-99. Property Panel (After Changing Standard Build Option)



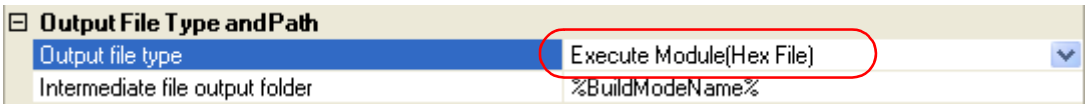
To make the build options for the currently selected project (main project or subproject) the standard build options (remove the boldface), select the Build tool node on the project tree and select [Set to Default Build Option for Project] from the context menu.

Figure 2-100. [Set to Default Build Option for Project] Item



The value of the properties after setting them as the standard build option are as shown below.

Figure 2-101. Property Panel (After Setting Standard Build Option)



Caution When the main project is selected, only the main project settings are made. Even if subprojects are added, their settings are not made.

2.18 Run a Build

This section explains operations related to running a build.

(1) Build types

The following types of builds are available.

Table 2-1. Build Types

Type	Description
Build	Out of build target files, runs a build of only updated files. See "2.18.1 Run a build of updated files".
Rebuild	Runs a build of all build target files. See "2.18.2 Run a build of all files".
Rapid build	Runs a build in parallel with other operations. See "2.18.3 Run a build in parallel with other operations".
Batch build	Runs builds in batch with the build modes that the project has. See "2.18.4 Run builds in batch with build modes".

Remarks 1. Builds are run in the order of subproject, main project.
Subprojects are built in the order that they are displayed on the project tree (see "2.17.2 Change the file build order of subprojects").

2. If there are files being edited with the Editor panel when running a build, rebuild, or batch build, then all these files are saved.

(2) Display execution results

The execution results of the build (output messages of the build tool) are displayed in each tab on the Output panel.

- Build, rebuild, or batch build: [All Messages] tab and [Build Tool] tab
- Rapid build: [Rapid Build] tab

Figure 2-102. Build Execution Results (Build, Rebuild, or Batch Build)

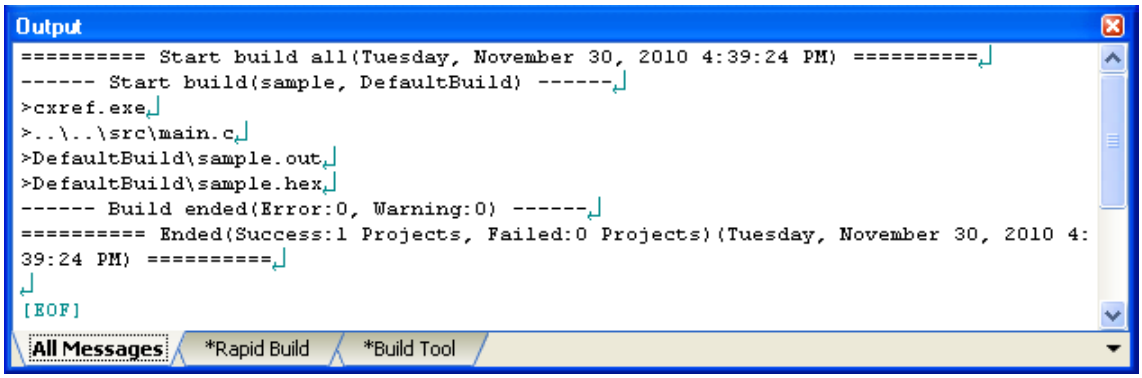


Figure 2-103. Build Execution Results (Rapid Build)

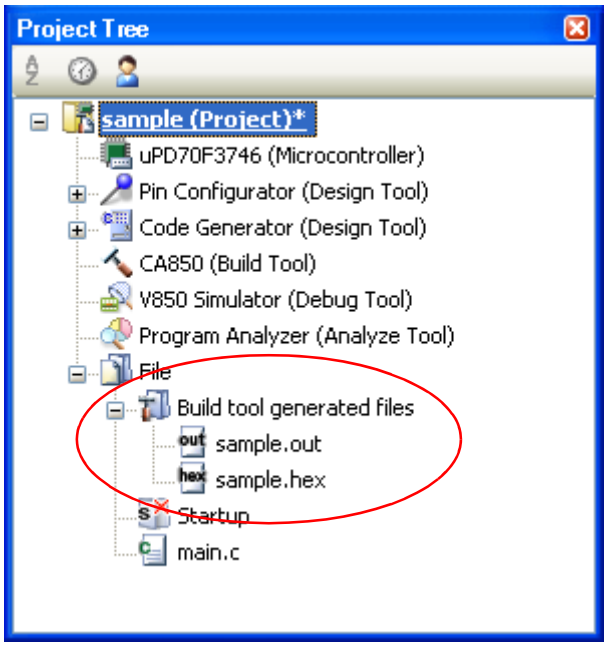
Remarks 1. The text in the [Rapid Build] tab becomes dimmed.

2. When a file name or line number can be obtained from the output messages, if you double click on the message, you can jump to the relevant line in the file.

3. If you press the [F1] key when the cursor is on a line displaying the warning or error message, you can display the help related to that line's message.

Files generated by the build tool appear on the Project Tree panel, under the Build tool generated files node.

Figure 2-104. Build Tool Generated Files



Remark Files displayed under the Build tool generated files node are as follows.

- For other than library projects

Load module file (*.out)
Link map file (*.map)
Hex file (*.hex)
Dump list (dump.txt)
Cross reference information (cxref)
Tag information (ctags)
Call tree information (ccalltre.csv, ccalltre.lst)
Function metrics information (cmeasure.csv, cmeasure.lst)
Call database information (cprofile.csv, cprofile.dat)
Memory map table (rammap.csv)

- For library projects
  Archive file (*.a)
  Dump list (dump.txt)
  Cross reference information (cxref)
  Tag information (ctags)
  Call tree information (ccalltre.csv, ccalltre.lst)
  Function metrics information (cmeasure.csv, cmeasure.lst)
  Call database information (cprofile.csv, cprofile.dat)

Caution The Build tool generated files node is created during build.
This node will no longer appear if you reload the project after building.

2.18.1 Run a build of updated files

Out of build target files, run a build of only updated files (hereafter referred to as "build").
Running a build is performed for the entire project (main project and subprojects) or active project (see "2.17.4 Change the file build target project").

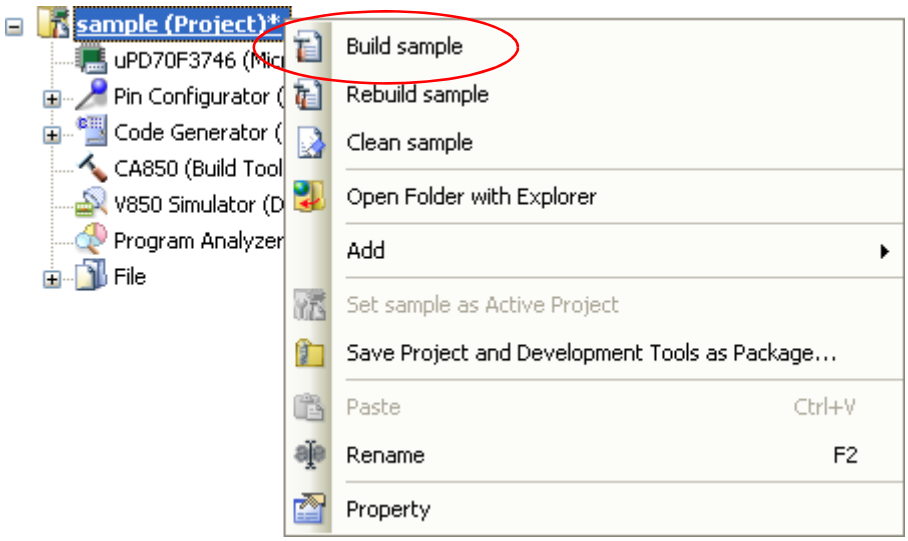
(1) When running a build of the entire project

Click  on the toolbar.

(2) When running a build of the active project

Select the project, and then select [Build *active project*] from the context menu.

Figure 2-105. [Build *active project*] Item



Remark If the included source files are not built after editing the header file and running the build, update the file dependencies (see "2.3.8 Update file dependencies").

2.18.2 Run a build of all files

Run a build of all build target files (hereafter referred to as "rebuild").

Running a rebuild is performed for the entire project (main project and subprojects) or active project (see "2.17.4 Change the file build target project").

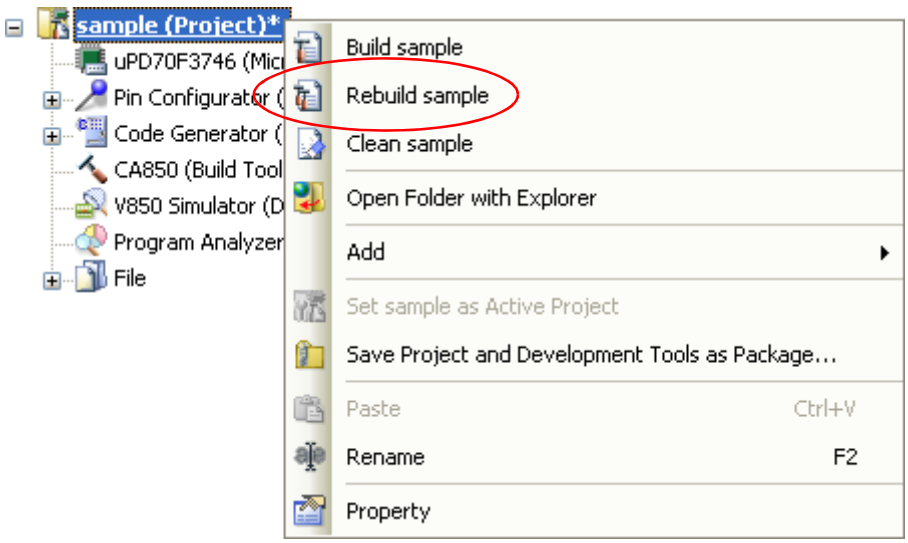
(1) When running a rebuild of the entire project

Click  on the toolbar.

(2) When running a rebuild of the active project

Select the project, and then select [Rebuild *active project*] from the context menu.

Figure 2-106. [Rebuild *active project*] Item



2.18.3 Run a build in parallel with other operations

CubeSuite+ has a function that a build is started automatically when one of the following events occurs (hereafter referred to as "rapid build").

- When C source files, assembler source files, header files, link directive file, section file, object module file, or library file that has been added to the project are updated
- When a build target file has been added to or removed from the project
- When the link order of object module files and library files has changed
- When the properties of the build tool or build target files are changed
  (except, however, when the properties of [Dump Options] tab, [Cross Reference Options] tab, and [Memory Layout Visualization Options] tab are changed)

If a rapid build is enabled, it is possible to perform a build in parallel with the above operations.

To enable/disable a rapid build, select [Rapid Build] from the [Build] menu. A rapid build is enabled by default.

Figure 2-107. [Rapid Build] Item (When Rapid Build Is Valid)

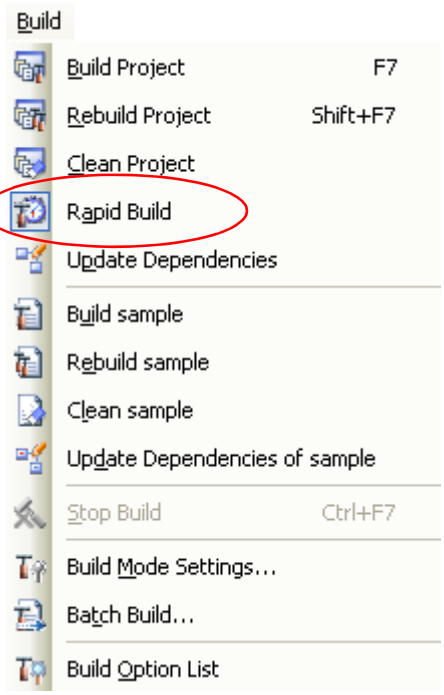
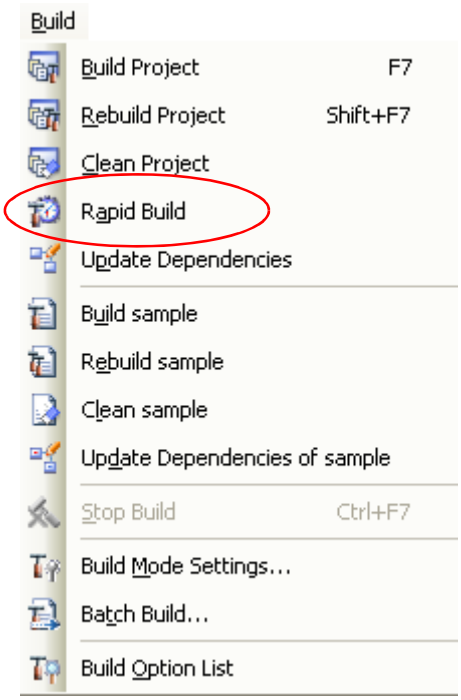


Figure 2-108. [Rapid Build] Item (When Rapid Build Is Invalid)



Remarks 1. After editing source files, it is recommend to save frequently by pressing the [Ctrl] + [S] key.

2. Enabling/disabling a rapid build is set for the entire project (main project and subprojects).

3. If you disable a rapid build while it is running, it will be stopped at that time.

Caution This function is valid only when editing source files with the Editor panel.

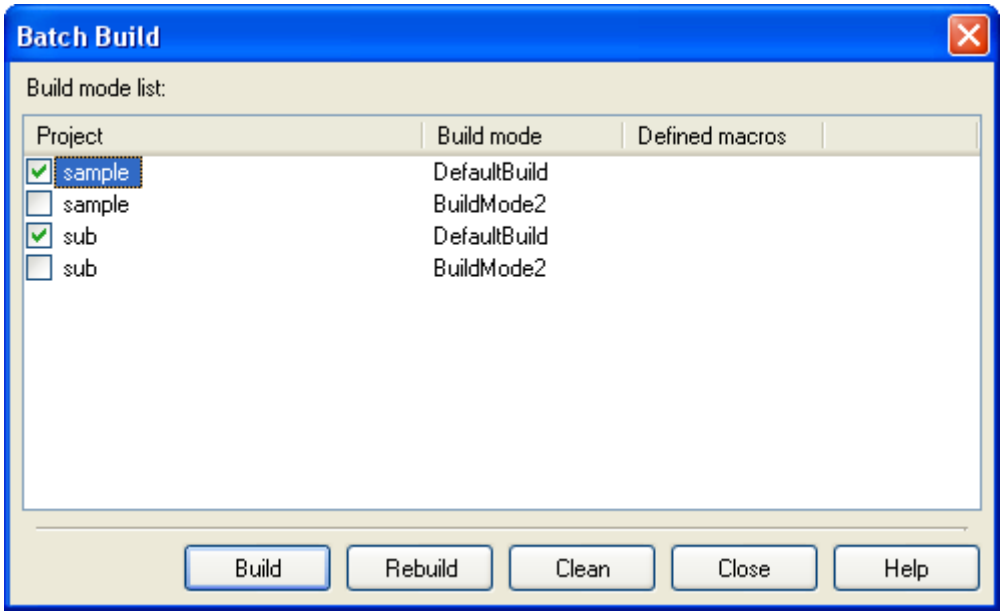
2.18.4 Run builds in batch with build modes

You can run builds, rebuilds and cleans in batch with the build modes that the project (main project and subproject) has (hereafter referred to as "batch build").

Remark See the sections below for a build, rebuild, and clean.
- Build: See "2.18.1 Run a build of updated files".
- Rebuild: See "2.18.2 Run a build of all files".
- Clean: See "2.18.8 Delete intermediate files and generated files".

Select [Batch Build] from the [Build] menu. The Batch Build dialog box opens.

Figure 2-109. Batch Build Dialog Box



In the dialog box, the list of the combinations of the names of the main project and subprojects in the currently opened project and their build modes and macro definitions is displayed.

Select the check boxes for the combinations of the main project and subprojects and build modes that you wish to run a batch build, and then click the [Build], [Rebuild], or [Clean] button.

Remark The batch build order follows the project build order, the order of the subprojects, main project.
When multiple build modes are selected for a single main project or subproject, after running builds of the subproject with all the selected build modes, the build of the next subproject or main project is run.

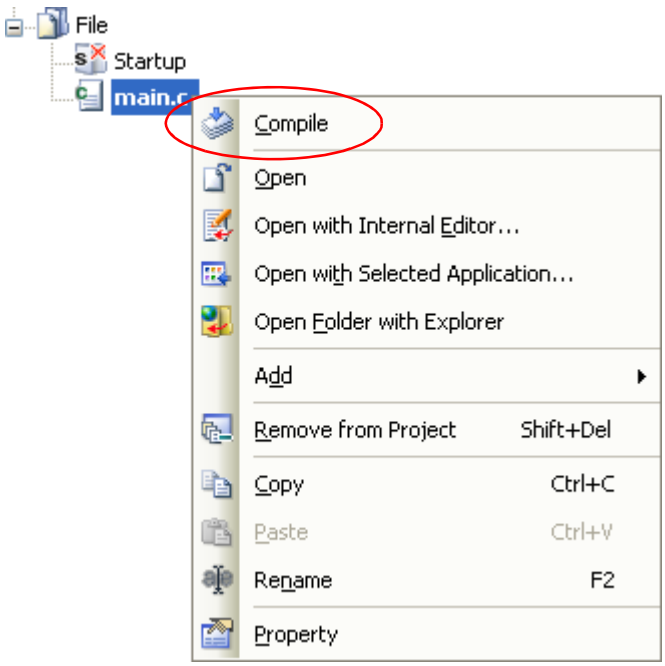
2.18.5 Compile/assemble individual files

You can just compile or assemble for each source file added to the project.

(1) When compiling a C source file

Select a C source file on the project tree and select the [Compile] from the context menu.

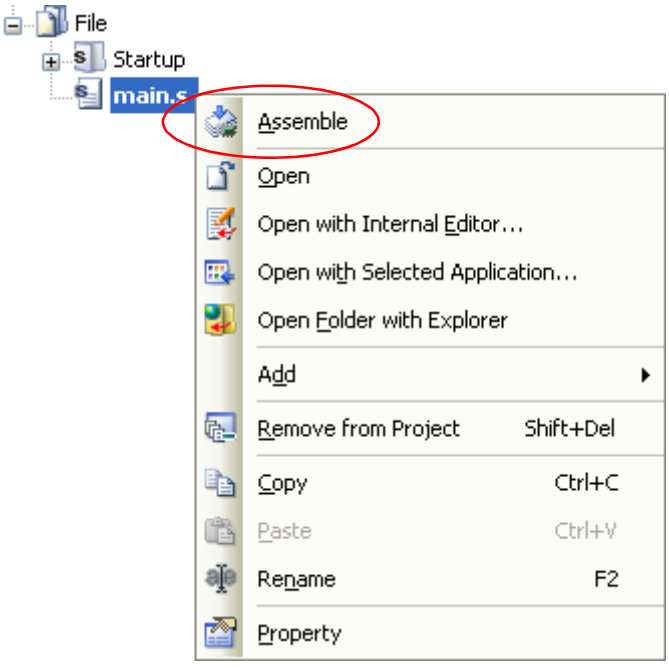
Figure 2-110. [Compile] Item



(2) When assembling an assembler source file

Select an assembler source file on the project tree and select the [Assemble] from the context menu.

Figure 2-111. [Assemble] Item



2.18.6 Stop running a build

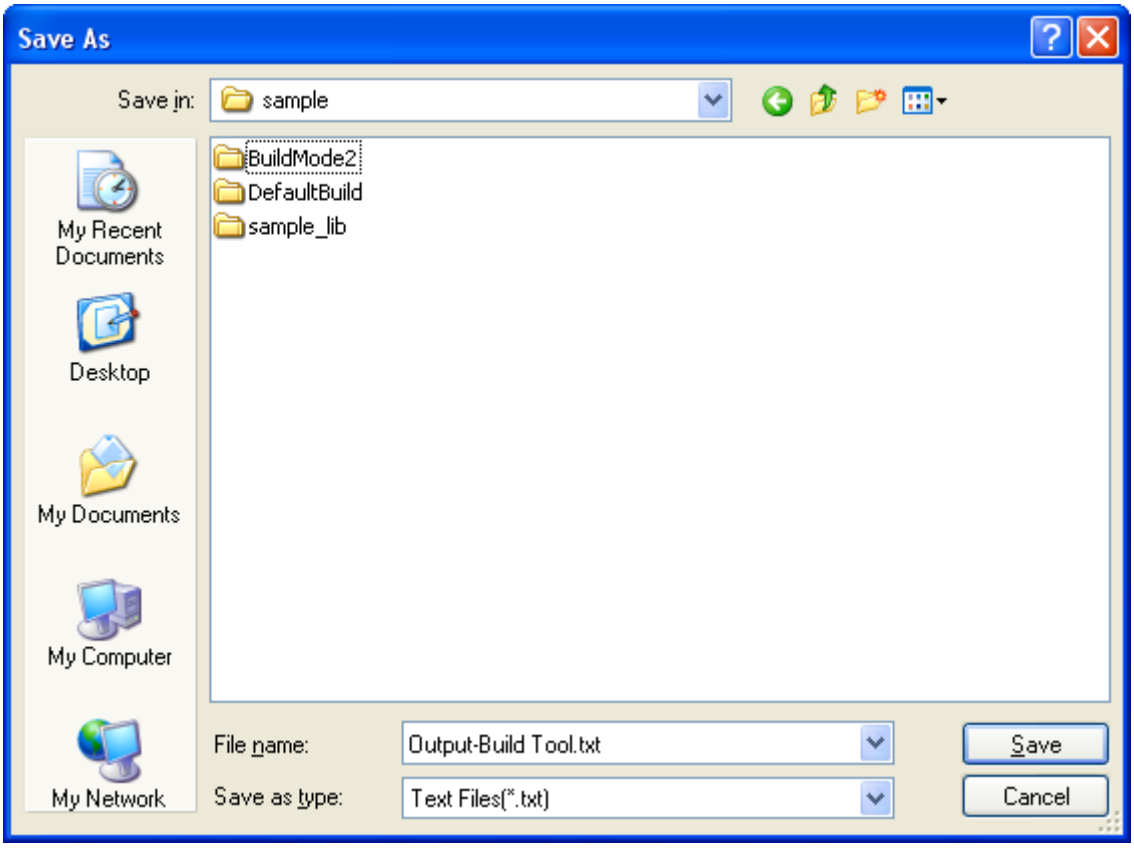
To stop running a build, rebuild, or batch build, click  on the toolbar.

2.18.7 Save the build results to a file

You can save the execution results of the build (output messages of the build tool) that displayed on the Output panel.

Select the [Build Tool] tab on the panel, and then select [Save Output - Build Tool As...] from the [File] menu. The Save As dialog box opens.

Figure 2-112. Save As Dialog Box



In the dialog box, specify the file to be saved and then click the [Save] button.

2.18.8 Delete intermediate files and generated files

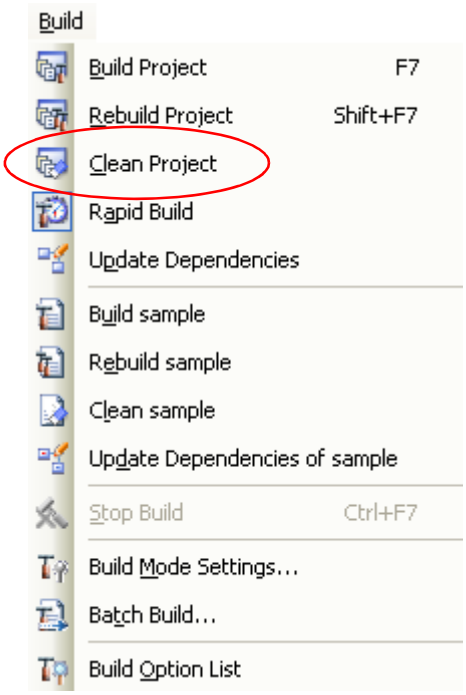
You can delete all the intermediate files and generated files output by running a build (hereafter referred to as "clean").

Running a clean is performed for the entire project (main project and subprojects) or active project (see "2.17.4 Change the file build target project").

(1) When running a clean of the entire project

From the [Build] menu, select [Clean Project].

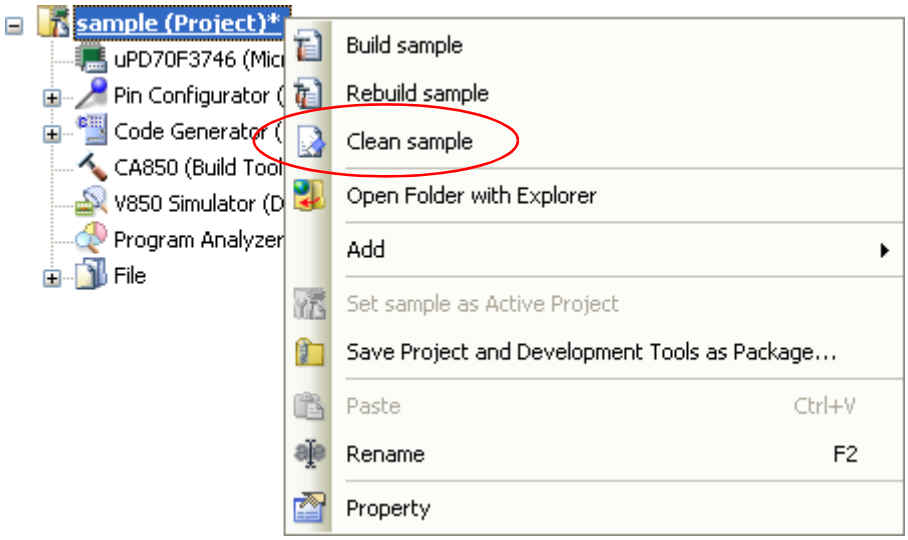
Figure 2-113. [Clean Project] Item



(2) When running a clean of the active project

Select the project, and then select [Clean *active project*] from the context menu.

Figure 2-114. [Clean *active project*] Item



2.19 Estimate the Stack Capacity

To estimate the stack capacity, use the the stack usage tracer.

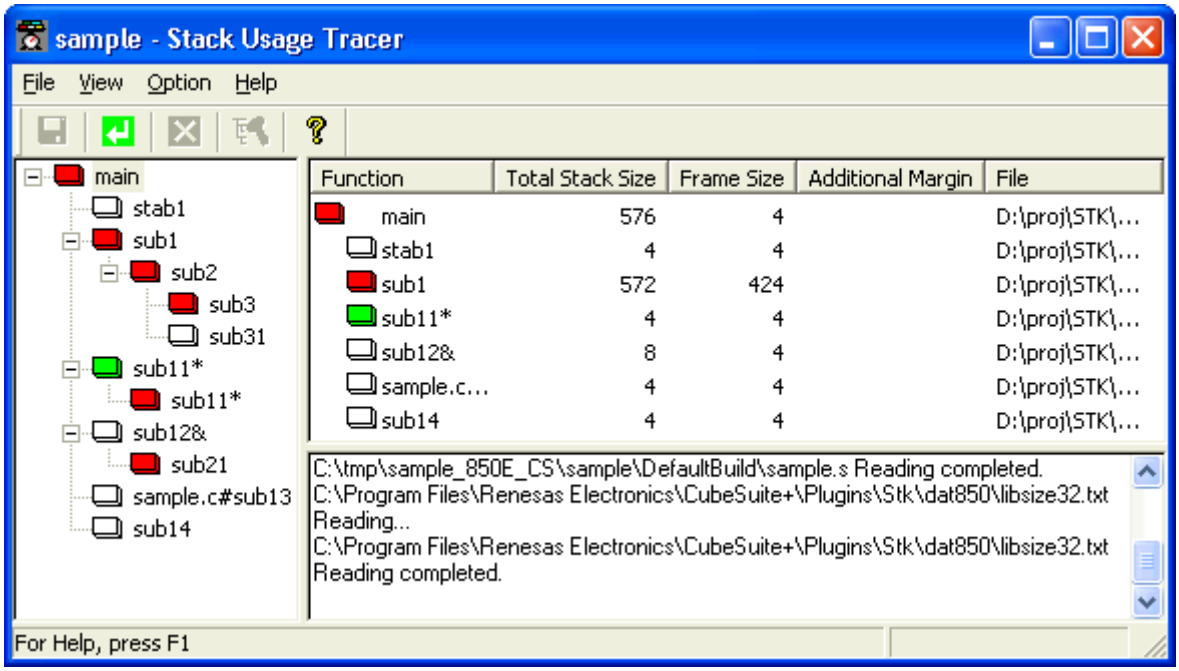
The stack usage tracer performs a static analysis, and displays the functions called by a function in a tree format, as well as stack information for each function (function name, total stack size, frame size, additional margin, and file name) in list format.

2.19.1 Starting and exiting

To start the stack usage tracer, from the Main window, select the [Tool] menu >> [Startup Stack Usage Tracer].

After the stack usage tracer finishes starting up, it will display the function call relationship and stack information for each function in the tree display area/list display area of the Stack Usage Tracer window.

Figure 2-115. Starting Up Stack Usage Tracer

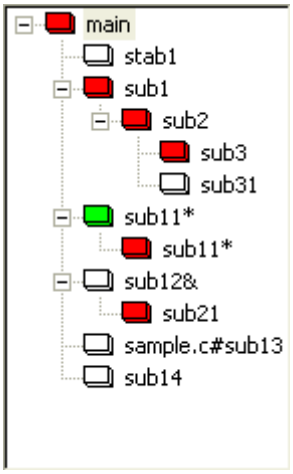


To exit the stack usage tracer, from the Stack Usage Tracer window, select [File] menu >> [Exit sk850].

2.19.2 Check the call relationship

You can check the function-call relationship in the tree display area of the Stack Usage Tracer window.

Figure 2-116. Tree Display Area



Remark The table below shows the meaning of the icon displayed to the left of the string representing the function name.
The display priority for icons is from High: to Low: .

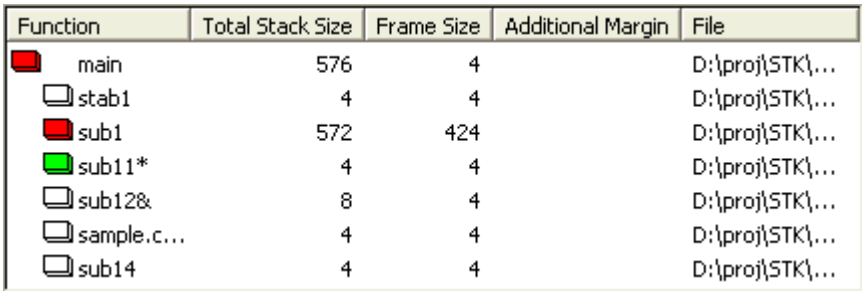
	The function directly called by a given function with the largest total stack size
	Information (additional margin, recursion depth, or callee functions) has been modified via the Adjust Stack Size dialog box or a stack size specification file
	Recursive function
	The stack usage tracer has not acquired any stack information for this function
	Other than the above

2.19.3 Check the stack information

You can check the stack information (function name, total stack size, frame size, additional margin, and file name) from the list display area of the Stack Usage Tracer window.

- Total stack size (including stack size of callee functions)
- Frame size (not including stack size of callee functions)
- Additional margin (value mandatorily added to frame size)

Figure 2-117. List Display Area



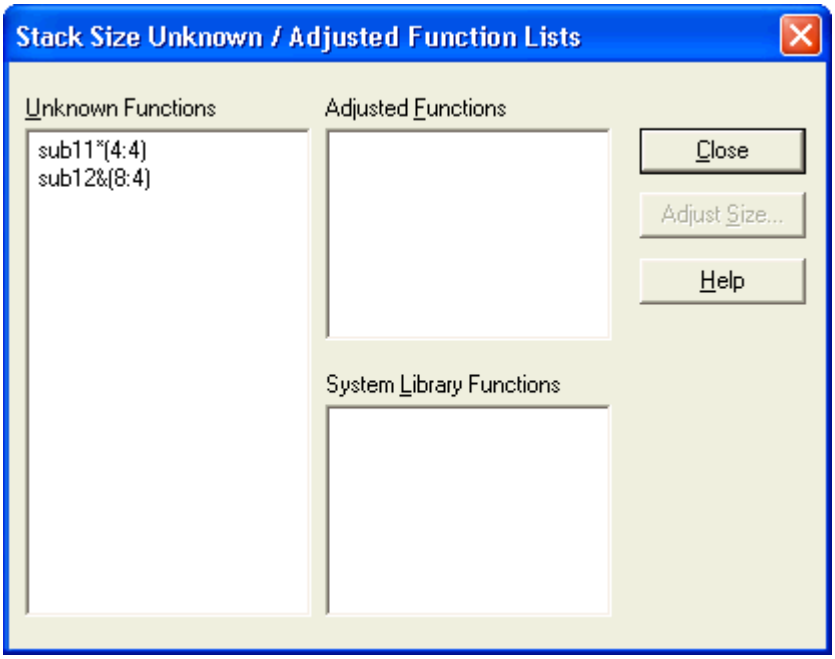
Function	Total Stack Size	Frame Size	Additional Margin	File
main	576	4		D:\proj\STK\...
stab1	4	4		D:\proj\STK\...
sub1	572	424		D:\proj\STK\...
sub11*	4	4		D:\proj\STK\...
sub12&	8	4		D:\proj\STK\...
sample.c...	4	4		D:\proj\STK\...
sub14	4	4		D:\proj\STK\...

Remark If you make changes to the project that will affect the total stack size while the stack usage tracer is running (e.g. you edit the files in your project so that the total stack size changes), then after rebuilding the project, click to update the display.

2.19.4 Check unknown functions

You can check functions for which the stack usage tracer could not obtain stack information in the Stack Size Unknown / Adjusted Function Lists dialog box, under [Unknown Functions].

Figure 2-118. Stack Size Unknown / Adjusted Function Lists Dialog Box



Remark Functions will appear under [Unknown Functions] in the following circumstances.

- The frame size could not be measured.
- A recursive function for which the recursion depth has not been set in the Adjust Stack Size dialog box.
- The function includes indirect function calls which are not set as callee functions in the Adjust Stack Size dialog box.

2.19.5 Change the frame size

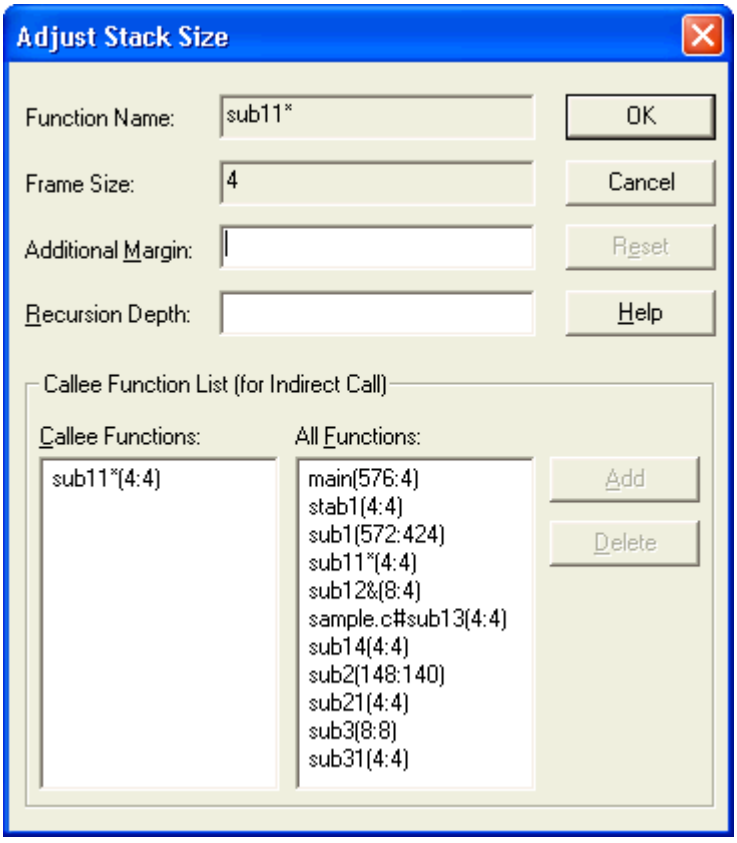
You can dynamically change the frame size of functions for which the stack usage tracer was not able to obtain stack information, or for functions that you intentionally want to modify, using the Adjust Stack Size dialog box or a stack size specification file.

(1) Using the Adjust Stack Size dialog box

The procedure for using the Adjust Stack Size dialog box is as follows.

- Select the desired item in the tree display area of the Stack Usage Tracer window, then click toolbar >>  .
  The Adjust Stack Size dialog box opens.

Figure 2-119. Adjust Stack Size Dialog Box



- After setting [Additional Margin], [Recursion Depth], and [Callee Functions], click the [OK] button.

(2) Using a stack size specification file

Below is the procedure for using a stack size specification file.

- Create a stack size specification file

  Write the functions in the stack size specification file that you would like to set dynamically, using the following format.

  function name [, ADD=additional margin] [, RECTIME=recursion depth] [, CALL=callee function] ...

Figure 2-120. Sample Stack Size Specification File

```
# Set the frame size of function "_flib" written in assembly
# language to 50
[flib], ADD=50

# Set the frame size of function "sub2" written in C to 100
sub2, ADD=100

#Set the recursion depth of recursive function "sub3" written
# in C to 123
sub3, RECTIME=123
```

- From the Stack Usage Tracer window, select [File] menu >> [Load Stack Size Specification File...]. The Open dialog box opens. Specify the stack size specification file, then click the [Open] button.

CHAPTER 3 BUILD OUTPUT LISTS

This chapter describes format and other aspects of lists output by the build via various commands.

3.1 Assembler

This section describes the assemble list. An assemble list is a list-formatted version of the code that is produced when the source has been compiled and assembled. It can be used to check the code resulting from compilation and assembly.

Remark See "B.2.1 I/O files" for details about input and output files of the assembler.

3.1.1 Output method

The assemble list can be output as follows.

(1) Command input

When the -a option has been specified, the assemble list is output via standard output. If the -a option is specified along with the -l option which specifies an output file name, the assemble list is output to the specified file.
When using the C compiler to compile the C source, if the "output assemble list" has been specified along with "output source comment" (via the -Xc option), the C source line that corresponds to the code appears as comments in the assemble list.
However, the code line and source line may not correspond if optimization has been forced.

(2) CubeSuite+

On the Project Tree panel, select the Build tool node, and then select the [Assemble Options] tab on the Property panel. To output the assemble list file, in the [Assemble List] category, set the [Output assemble list file] property to [Yes(-a -l)]. The output destination is the folder set in the [Output folder for assemble list file] property.
The list is output to a file, and the file name extension is changed to ".v".
When compiling the C source, open the [Compile Options] tab , then in the [Output File] category, set the [Output assemble list file] property to [Yes(-Fv)]. And then, in the [Output Code] category, set the [Output comment to assembly language source file] property to [Yes(-Xc)]. The C source line that corresponds to the code appears as comments in the assemble list.
However, the code line and source line may not correspond if optimization has been forced.

3.1.2 Output example

An assemble list output example is shown below.
An example of the assemble list that is output by compiling the C source in the example and then assembling the output assembler source file.

- C source file

```
void main(void)
{
int     a;
}
```

- Output assemble list

```
(1)    (2)         (3)      (4)                (5)
        :
A-X- 00000000              41            .file “c:\work\src\a.c“
A-X- 00000000              42            .align 4
A-X- 00000000              43            #@BF
A-X- 00000000              44            .frame _main, .s2
A-X- 00000000              45            .globl _main
A-X- 00000000              46    _main:
A-X- 00000000              47            #@B_PROLOGUE
A-X- 00000000 D505         48            jbr     .L15
A-X- 00000002              49    .L16:
A-X- 00000002              50    .G17:
A-X- 00000002              51    .G18:
A-X- 00000002              52    .G9:
A-X- 00000002              53    .G11:
A-X- 00000002              54    .G19:
A-X- 00000002              55            #@B_EPILOGUE
A-X- 00000002 23FF0100     56            ld.w    -4+.F2[sp], lp
A-X- 00000006 441A         57            add     .S2, sp
A-X- 00000008 7F00         58            jmp     [lp]    --0
A-X- 0000000A              59            #@E_EPILOGUE
A-X- 0000000A              60    .L15:
A-X- 0000000A 5C1A         61            add     -.S2, sp
A-X- 0000000C 63FF0100     62            st.w    lp, -4+.F2[sp]
A-X- 00000010              63            #@E_EPILOGUE
A-X- 00000010 95F0         64            jbr     .L16
A-X- 00000012              65            #@FUNC_ARG
A-X- 00000012              66    .G5:
A-X- 00000012              67            .set    .S2, 0x4
A-X- 00000012              68            .set    .F2, 0x4
A-X- 00000012              69            .set    .A2, 0x0
A-X- 00000012              70            .set    .T2, 0x0
A-X- 00000012              71            .set    .P2, 0x0
A-X- 00000012              72            .set    .R2, 0x0
A-X- 00000012              73            .set    .X2, 0x0
        :
```

Item Number	Description
(1)	Section attribute These are section attributes for sections stored in the corresponding line. Section attributes and their meanings are as follows. A: Section occupying memory W: Section that can be written X: Executable section G: Section allocated to memory area that can be referenced by using global pointer (gp) and 16-bit displacement
(2)	Location counter value This is the location counter value for the beginning of the line of code.
(3)	Code This is the code, expressed as a hexadecimal number.
(4)	Line number This is the line number, expressed as a decimal number.
(5)	Source program This is the assembly language source program on the line. If instruction expansion is executed for the instruction on that line, the instruction string resulting from the instruction expansion is indicated following --. The C source program corresponding to that line's assembly source program is also displayed in this area.

3.2 Linker

This section describes the link map output by the linker.

A link map is where link result-related information is written. It can be referenced for information such as a section's allocation addresses.

3.2.1 Output method

The link map can be output as follows.

(1) Command input

Specify the -m option to display the link map in standard output when linking ends. If the -mo option is specified, display in the old format of CA850 Ver. 2.60 or earlier. A file name is specified as the -m=*file* option or the -mo=*file* option to output to a file.

(2) CubeSuite+

On the Project Tree panel, select the Build tool node, and then select the [Link Options] tab on the Property panel. To output the link map, in the [Link Map] category, set the [Output link map file] property to [Yes(-m)]. The output destination is the folder set in the [Output folder for link map file] property and the [link map file name] property . It is also shown on the Project Tree panel, under the Build tool generated files node.

3.2.2 Link map output example

A link map output example is shown below.

An example of the link map that is output when object files have been linked.

- Objects

  crtN.o

  main.o

  func.o

  libc.a (standard library)

- Link map output example

```
                ********** MEMORY ALLOCATION MAP **********

(1)OUTPUT     (2)SEGMENT      (3)VIRTUAL      (4)SIZE(16)     (5)SIZE(10)
   SEGMENT       ATTRIBUTE       ADDRESS

   TEXT          RX              0x00000000      0x00000082          130
   DATA          RW              0x00000088      0x00000018           24

                ********** LINK EDITOR ALLOCATION MAP **********

(6)OUTPUT     (7)INPUT        (8)VIRTUAL      (9)SIZE        (10)INPUT
   SECTION       SECTION         ADDRESS                        FILE

   .text                         0x00000000      0x00000082
                 .text           0x00000000      0x0000001a     crtN.o
                 .text           0x0000001c      0x0000002c     main.o
```

```
                .text           0x00000048      0x00000018      func.o
                .text           0x00000060      0x00000022      strcmp.o(..\lib850\

.sdata                          0x00000088      0x0000000e
                .sdata          0x00000088      0x0000000e      main.o

.sbss                           0x00000098      0x00000008
                .sbss           0x00000098      0x00000004      func.o
                .sbss           0x0000009c      0x00000004      *(GpCommon)*
```

Item Number	Description
(1)	Output segment Names of output segments configuring the object file to be generated (names of the output segments are not stored in the generated object file)
(2)	Segment attribute R: Read W: Write X: Executable
(3)	Address Start address of the output segment
(4)	Size (hexadecimal) Size of the memory including the alignment conditions between sections and the align hole (hexadecimal)
(5)	Size (decimal) Size of the memory including the alignment conditions between sections and the align hole (decimal)
(6)	Output section Section name output to the load module (displayed up to 12 characters)
(7)	Input section Name of input section configuring output section (displayed up to 12 characters)
(8)	Address The start address of output section or input section
(9)	Size Size of output section or input section
(10)	Input file Object file names belonging to an input section

If an area is allocated by using the .comm quasi directive, the area is common to all the files, and its section is displayed as "*(Common)*" or "*(GpCommon)*". If the object file to which the input section belongs is an object file in an archive file (library), the archive file is displayed in the following format.

- Object file name (archive file name)

If display in the old format of CA850 Ver. 2.60 or earlier is specified by using the -mo option, *(nil)* is displayed for the section created with the linker, and sections created with the assembler such as .symtab, .strtab, and.shstrtab.

Remark *(nil)*

(nil) may appear in the data areas of the .sbss and .sdata sections. This indicates that a globally declared variable without an initial value has been allocated. Even if a variable with the same name is used for a

different file, it is still inevitably part of the load module, so the file name containing the variable becomes undefined and therefore appears as *(nil)* in the link map.
However, if data without an initial value was declared using the #pragma section "data" instruction, the file name appears instead of *(nil)* since the file's allocation is identified.

3.3 Hex Converter

This section describes the hx850 output file formats.

To configure the hex file output in CubeSuite+, on the Project Tree panel, select the Build tool node, then on the Property panel, make the settings from the [Hex Convert Options] tab.

In the [Output File] category, set the [Output hex file] property to [Yes]. The output destination is the folder set in the [Output folder for hex file] property and the [Hex file name] property . The setting for the output file format is performed in the [Hex file format] property in the [Hex Format] category. The Hex file is also shown on the Project Tree panel, under the Build tool generated files node.

Remark See "B.5.1 I/O files" for details about input and output files of the hex converter.

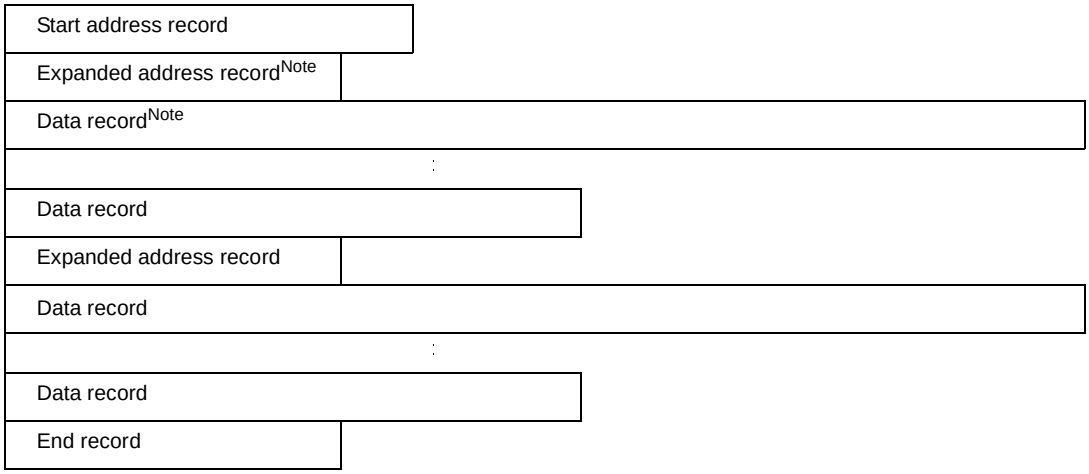
3.3.1 Intel expanded

Intel expanded hex format files, which consist of four records[Note]: the start address record, expanded address record, data record, and end record

Note Each record is output in ASCII code.

The following figure shows a file configuration in Intel expanded hex format.

Figure 3-1. File Configuration in Intel Expanded Hex Format



Note The expanded address record and data record are repeated.

Each record consists of the following fields.

```
:       CC      AAAA    TT      [field]...      SS      NL
(1)     (2)      (3)    (4)                     (5)     (6)
```

Item Number	Description
(1)	Record mark
(2)	Number of bytes number of bytes expressed as 2-digit hexadecimal numbers of [field]...

Item Number	Description
(3)	Location address
(4)	Record type 03: Start address record, 02: Expanded address record, 00: Data record, 01: End record
(5)	Checksum The value expressed as 2-digit hexadecimal number in records (other than :, SS, and NL) sequentially subtracted from initial value 0 and that lower 1 byte expressed as a 2-digit hexadecimal number
(6)	New line (\n)

- Start address record

This record indicates an entry point address.

```
:       04      0000    03      PPPP    OOOO    SS      NL
        (1)     (2)     (3)     (4)     (5)
```

Item Number	Description
(1)	Number of bytes Fixed at 04
(2)	Fixed at 0000
(3)	Record type 03
(4)	Paragraph value of entry point address[Note]
(5)	Offset value of entry point address

Note The address is calculated by (paragraph value << 4) + offset value.

- Expanded address record

This record indicates the paragraph value of a load address[Note].

Note The value is output if the segment is renewed at the beginning of a segment (when the data record is output) or when the offset value of the data record's load address exceeds the maximum value of 0xffff.

```
:       02      0000    02      PPPP    SS      NL
        (1)     (2)     (3)     (4)
```

Item Number	Description
(1)	Number of bytes Fixed at 02
(2)	Fixed at 0000
(3)	Record type 02

Item Number	Description
(4)	Paragraph value of segment

- Data record

This record indicates the value of a code.

```
:       CC      AAAA    00      DD...DD         SS      NL
        (1)     (2)     (3)       (4)
```

Item Number	Description
(1)	Number of bytes[Note]
(2)	Location address
(3)	Record type 00
(4)	Code Each byte of code expressed as 2-digit hexadecimal number

Note This is limited to the range of 0x1 to 0xff (the minimum value for the number of bytes of code indicated by one data record is 1 and the maximum value is 255).

Example

```
:       04      0100    00      3C58E01B        6C      NL
        (1)     (2)     (3)       (4)           (5)
```

Item Number	Description
(1)	Number of bytes of 3C58E01B expressed as 2-digit hexadecimal number
(2)	Location address
(3)	Record type 00
(4)	Code Each byte of code expressed as 2-digit hexadecimal number
(5)	Checksum The lower 1 byte of two's complement E6C of 04 + 01 + 00 + 00 + 3C + 58 + E0 + 1B = 194 is expressed as a 2-digit hexadecimal number.

- End record

This record indicates the end of a code.

```
:       00      0000    01      FF      NL
        (1)     (2)     (3)     (4)
```

Item Number	Description
(1)	Number of bytes Fixed at 00
(2)	Fixed at 0000
(3)	Record type 01
(4)	Checksum Fixed at FF

Remark Intel hex

An allocation address in the Intel hex format is 2 bytes (16 bits). Therefore, only a 64 KB space can be directly specified. To extend this area, the Intel extended hex format adds an extension address of 16 bits so that a space up to 1 M byte (20 bits) can be used.

Specifically, a record type that specifies a 16-bit extension address is added. This extension address is shifted 4 bits and added to the allocation address to express a 20-bit address.

To indicate FFFFFH, for example, F000H is set as the extension address, and FFFFH is specified as the location address.

In the Intel extended hex format, only 0 to FFFFFH can be addressed. To express 100000H, another object format must be used.

The hex converter outputs a message if the rule of this format is violated with this address and size used.

In the Intel extended hex format, a value that can be expressed is 20 bits, or 1 M byte (0x100000).

```
W8737 : The start address of convert area exceeds the maximum value of the address
that can be expressed in the Intel expanded hex format
```

If the message "W8737" is output, the start address of the area to be converted into the hex format exceeds 1 M byte.

```
W8735: The address of convert area exceeds the maximum value of the address that
can be expressed in the Intel expanded hex format
```

If the message "W8735" is output, the address to be converted into the hex format exceeds 1 M byte (20 bits).

The above error occurs in the following cases even if 1 M byte is not exceeded.

Examples 1. An offset that starts from the address specified by the -d option is not used
-> The absolute address is stored in the hex format.

2. A section is allocated in the vicinity of the upper limit of the address that can be expressed by 20 bits
-> The start address fits in 20 bits, but 20 bits are exceeded in the middle of the section.

If these two patterns are satisfied, the message "W8735" is output even if the area to be converted is as small as 4 bytes.

3.3.2 Motorola S type

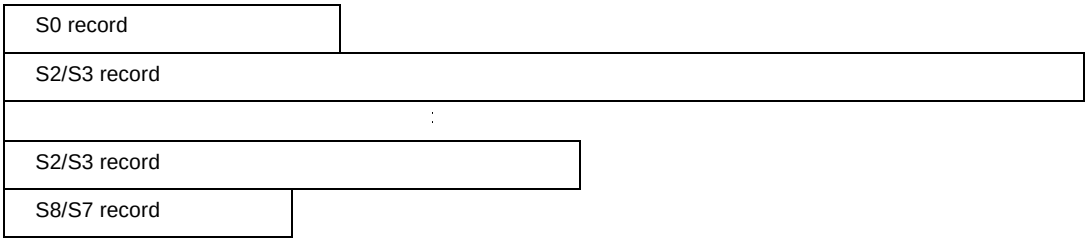
A file in the Motorola S type hex format consists of five records[Note 1]: S0 record as a header record, S2/S3 records as data records, and S8/S7 records as end records[Note 2].

The following figure shows the file configuration of the Motorola S type hex format.

Notes 1. Each record is output in ASCII code.

2. The Motorola S type hex formats are divided into two types: (24-bit) standard address and 32-bit address types. The format of the standard address type consists of S0, S2, and S8 records, and the format of the 32-bit address type consists of S0, S3, and S7 records.

Figure 3-2. File Configuration of Motorola S Type Hex Format



Each record consists of the following fields.

ST	LL	field [field]...	SS	NL
(1)	(2)		(3)	(4)

Item Number	Description
(1)	Record type
(2)	Record length field (number of bytes expressed as 2-digit hexadecimal numbers of [field]...) + number of bytes expressed by SS[Note]
(3)	Checksum Lower 1 byte expressed as 2-digit hexadecimal number of one's complement of total of number of bytes in records (other than ST, SS, and NL) expressed as 2-digit hexadecimal number
(4)	New line (\)

Note This is 1.

- S0 record

This record indicates a file name.

S0	LL	FF...FF	SS	NL
(1)		(2)		

Item Number	Description
(1)	Record type S0

Item Number	Description
(2)	File name Specified file name indicated in ASCII code

- S2 record

This record indicates the value of a code.

```
S2      LL      AAAAAA          DD...DD         SS      NL
(1)             (2)             (3)
```

Item Number	Description
(1)	Record type S2
(2)	Load address 24 bits[Note]
(3)	Code Each byte of code expressed as 2-digit hexadecimal number

Note The range is 0x0 to 0xffffff.

- S3 record

This record indicates the value of a code.

```
S3      LL      AAAAAAAA        DD...DD         SS      NL
(1)             (2)             (3)
```

Item Number	Description
(1)	Record type S3
(2)	Load address 32 bits[Note]
(3)	Code Each byte of code expressed as 2-digit hexadecimal number

Note The range is 0x0 to 0xffffffff.

- S7 record

This record indicates an entry point address.

```
S7      LL      AAAAAAAA        SS      NL
(1)             (2)
```

Item Number	Description
(1)	Record type S7
(2)	Entry point address 32 bits[Note]

Note The range is 0x0 to 0xffffffff.

- S8 record

This record indicates an entry point address.

```
S8      LL      AAAAAA          SS      NL
(1)             (2)
```

Item Number	Description
(1)	Record type S8
(2)	Entry point address 24 bits[Note]

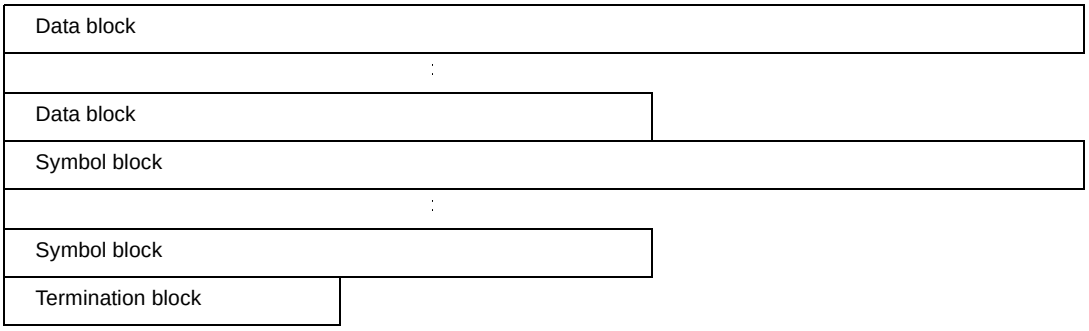
Note The range is 0x0 to 0xffffff.

3.3.3 Expanded tektronix

A file in the expanded tektronix hex format consists of three types of blocks: a data block, symbol block, and termination block.

The following figure shows the file configuration of the expanded Tek hex format.

Figure 3-3. File Configuration of Expanded Tek Hex Format



Each block consists of the following fields.

```
%       LL      T       SS      field [field]...        NL
(1)     (2)     (3)     (4)                             (5)
```

Item Number	Description
(1)	Header character
(2)	Block length Number of characters in blocks other than % and NL
(3)	Type of block[Note 1]
(4)	Checksum Remainder expressed as 2-digit hexadecimal number that results from dividing total value[Note 2] of characters in blocks other than %, SS, and NL, by 256
(5)	New line (\)

Notes 1. 6: data block, 3: symbol block, 8: termination block

2. The value for each character is determined as follows: 0 to 9: 0 to 9, A to Z: 10 to 35, $: 36, %: 37, .: 38, -: 39, a to z: 40 to 65

- Data block

This record indicates the value of a code.

```
%       LL      T       SS      L A...A         D...D           NL
                (1)             (2)             (3)
```

Item Number	Description
(1)	Block type
(2)	Number of digits in load address and the load address
(3)	Code Each byte of code expressed as 2-digit hexadecimal number

Example

```
%       15      6       1C      3 100           020202020202    NL
        (1)     (2)     (3)       (4)               (5)
```

Item Number	Description
(1)	Block length
(2)	Block type
(3)	Checksum Remainder expressed as 2-digit hexadecimal number that results from dividing 1 + 5 + 6 + 3 + 1 + 0 + 0 + 0 + 2 + 0 + 2 + 0 + 2 + 0 + 2 + 0 + 2 + 0 + 2 = 28 by 256
(4)	Number of digits in load address is 3, and load address is 100.
(5)	Code

- Symbol block

This block indicates the value of a symbol.

```
%       LL      T       SS      L N...N [SEDF]          SYDF [SYDF]     NL
                (1)             (2)     (3)             (4)
```

Item Number	Description
(1)	Block type
(2)	Number of characters of the section name and the section name
(3)	Section definition field (SEDF)Note 1
(4)	Symbol definition field (SYDF)Note 2

Notes 1. One section definition field must exist in each section. A section definition field can be followed by or can follow any of symbol definition fields.

```
0       L B...B         L L...L
(1)       (2)             (3)
```

Item Number	Description
(1)	Indicates that this field is a section definition field.
(2)	Number of digits in the base address of a section and the base address of the section
(3)	Number of digits in the length of a section and the length of the section

2. Symbol definition field

```
T       L S...S         L V...V
(1)       (2)             (3)
```

Item Number	Description
(1)	Type of symbol 1: global address (symbol having binding class GLOBAL and type other than ABS) 2: global scalar (symbol having binding class GLOBAL and type ABS) 5: local address (symbol having binding class LOCAL and type other than ABS) 6: local scalar (symbol having binding class LOCAL and type ABS)
(2)	Number of characters of symbol and the symbol
(3)	Number of digits in symbol value and value of symbol

Examples 1.

```
%   37  3   60  8SVCSTUFF   02402C6 22CR1D14OPEN25014READ25815WRITE260 NL
    (1) (2) (3)     (4)       (5)                   (6)
```

Item Number	Description
(1)	Block length
(2)	Block type
(3)	Checksum
(4)	Number of characters of section name is 8 and the section name is SVCSTUFF.
(5)	Section definition field number of digits in the base address of the section is 2, the base address of the section is 40, the number of digits in the length of the section is 2, and the length of the section is C6
(6)	Symbol definition field 22CR1D/14OPEN250/14READ258/15WRITE260

2.

```
%   37  3   C8  8SVCSTUFF   15CLOSE26814EXIT27029BUFLENGTH28013BUF278 NL
    (1) (2) (3)     (4)                         (5)
```

Item Number	Description
(1)	Block length
(2)	Block type
(3)	Checksum
(4)	Number of characters of section name is 8 and section name is SVCSTUFF.
(5)	Symbol definition field 15CLOSE268/14EXIT270/29BUFLENGTH280/13BUF278

- Termination block

Indicates an entry point address.

```
%       LL      T       SS      L A...A         NL
                (1)             (2)
```

Item Number	Description
(1)	Block type
(2)	Number of digits in entry point address and the entry point address

Example

```
%       08      8       1A      2 80    NL
        (1)     (2)     (3)      (4)
```

Item Number	Description
(1)	Block length
(2)	Block type
(3)	Checksum
(4)	Number of digits in entry point address is 2, and entry point address is 80.

3.4 Section File Generator

Section files are text files that are input at compile time to revise the sections where variables are to be allocated. They enable variable allocation settings to be changed without having to modify any C source files. Allocation specifications made via section files take priority over specifications made via #pragma section directives in C-language source programs.

To configure the section file output in CubeSuite+, on the Project Tree panel, select the Build tool node, and then select the [Section File Generate Options] tab on the Property panel. To output the link map, in the [Output File] category, set the [Use section file generator] property to [Yes]. The output destination is the folder set in the [Output folder for section file] property and the [Section file name] property . It is also shown on the Project Tree panel, under the File node.

The C compiler enables the user to specify the section files output by the section file generator at compile time. The section file generator merges the information from several files that have been input and outputs a single section file as specified via the C compiler's options.

An example of a section file output by the section file generator is shown below.

```
[tidata]
// [file:[func:]]variable  // section size total_freq Byte_freq Word_freq
"main.c:val1"  // data 4 10 10 0
"main.c:val2"  // data 4 8 8 0
"main.c:func1:val3" // -4 5 5 0
"i" // -4 3 3 0
"j" // -2 1 1 0
```

In each file, all content that follows "//" is regarded as comments.
Variables are displayed in section files as shown below.

```
[Section type]
file-name:function-name:variable-name" //comment
"file-name:variable-name" // comment
"variable-name" // comment
```

There are three ways to display variables, according to the type of variable. The variable types are listed below.

Table 3-1. Variable Types and Displays

Display	Meaning
file-name:function-name:variable-name	Static variable declared in a function The function name and file name are also displayed.
file-name:variable-name	Static variable declared in a file The file name is also displayed.
variable-name	External variable Only the variable name is displayed.

Comments are output in the following format.

```
section size total_freq Byte_freq Word_freq
```

The displayed variables and their meanings are listed below.

Table 3-2. Variable Displays and Their Meanings

Display	Meaning
section	Section to which allocation of the variable is explicitly specified If the variable is not explicitly specified, "-" is displayed.
size	Size of variable (in bytes) If the size is unknown, "0" is displayed.
total_freq	Frequency of variable references This indicates the number of load/store instructions that have appeared for a particular variable.
Byte_freq	For the given variable reference frequency, this indicates the number of variable references in byte units.
Word_freq	For the given variable reference frequency, this indicates the number of variable references in word units.

The section file generator outputs a section file in which all variables are allocated to the .tidata section. Since the .tidata section's memory capacity is 256 bytes, if the variables exceed that amount, they must be revised as determined on the user side.

However, if the -O option is specified, the file can be input to the C compiler as it is because the variables will be sorted according to use frequency and only the more frequently used variables will be included up to the .tidata section's capacity. Also, when specifying the -O option, the user can choose to have the output sent to "tidata_word" and "tidata_byte" instead of just "tidata".

A section file example output when the "-O option" is specified is shown below.

```
[tidata_byte]
// [file:[func:]]variable  // section size total_freq Byte_freq Word_freq
"a.c:si1"       // - 4 10 10 0
"a.c:si2"       // - 4 8 8 0
"a.c:f1:sfil"   // - 4 5 2 3
"j"     // - 2 2 1 1
"i"     // - 4 3 3 0
[tidata_word]
"a.c:si3"       // - 4 10 0 10
"a.c:si4"       // - 4 8 0 8
"a.c:f1:sfi2"   // - 4 5 0 5
"1"     // - 4 3 0 3
"m"     // - 2 1 0 1
```

A section file example output when the "-O2 option" is specified is shown below.

```
[tidata_byte]
// [file:[func:]]variable  // section size total_freq Byte_freq Word_freq
"a.c:si1"       // - 4 10 10 0
"a.c:si2"       // - 4 8 8 0
"a.c:f1:sfil"   // - 4 5 2 3
"j"     // - 2 2 1 1
"i"     // - 4 3 3 0
[tidata_word]
"a.c:si3"       // - 4 10 0 10
"a.c:si4"       // - 4 8 0 8
"a.c:f1:sfi2"   // - 4 5 0 5
"l"     // - 4 3 0 3
"m"     // - 2 1 0 1
[sidata]
"huge3" // - 30000 3 3 0
[sedata]
"huge1" // - 30000 2 2 0
[sdata]
"huge2" // - 30000 1 1 0
```

The specifiable types of output sections include other types besides tidata-attribute sections, tidata.word-attribute sections, tidata.byte-attribute sections, sidata-attribute sections, sedata-attribute sections, and sdata-attribute sections.

The following character strings can be used to specify section types.

Table 3-3. Types of Sections Specifiable by C Compiler

Type Specification Character String	Target Section for Allocation
tidata	Byte data for which a default value has been set is allocated to the .tidata.byte section and half-word (or larger) data for which a default value has been set is allocated to the .tidata.word section. Byte data for which a default value has not been set is allocated to the .tibss.byte section and half-word (or larger) data for which a default value has not been set is allocated to the .tibss.word section.
data	If a default value has been set, allocation is to the .data section. If a default value has not been set, allocation is to the .bss section.
sdata	If a default value has been set, allocation is to the .sdata section. If a default value has not been set, allocation is to the .sbss section.
sedata	If a default value has been set, allocation is to the .sedata section. If a default value has not been set, allocation is to the .sebss section.
sidata	If a default value has been set, allocation is to the .sidata section. If a default value has not been set, allocation is to the .sibss section.
const	Allocation is to the .const section.
sconst	Allocation is to the .sconst section.

3.4.1 Cautions

- Do not insert blank spaces before or after a section name when specifying the section name in square brackets ([ ]).
  For example, in the case of [tidata], blank spaces cannot be inserted before or after "tidata".
- Enclose a variable name in a section file with "(double quotate). (The format of CA850 Ver. 2.60 or earlier can be used.)
- Only one variable can be used per line. Do not modify the code to specify two or more variables per line and do not make one variable specification occupy more than one line.
- Do not insert blank spaces before or after ":".
- Do not specify the path when specifying file names.
- If a function or variable definition is included in a header file, the "file name" in the section file is not the header file name; it is the C source file name that includes the header file.
- Comments in the form of "/* */" or "//" can be inserted.
  However, a section name or variable name must not be delimited by a comment. A blank space is required immediately after a variable name. ASCII code and EUC (Japanese) code can be used in comments.
- If a variable for which "data" has been specified as the section type in a section file is referenced by another assembler source file, use the .option quasi directive to specify "data" so that the assembler will be notified of the data/bss attribute. Also, if a variable for which "sdata" has been specified is referenced by another assembler source file, use the .option quasi directive to specify "sdata" so that the assembler will be notified of the sdata/sbss attribute.
  A code example is shown below.

```
// Section file
[data]
"a.c:dat1"  // With default value; allocation is to .data section.
"b.c:dat2"  // Without default value; allocation is to .bss section.
[sdata]
"a.c:sdat1" // With default value; allocation is to .sdata section.
"b.c:sdat2" // Without default value; allocation is to .sbss section.

# Assembler source file
        .option data _dat1
        .text
        ld.w    $_dat1, r11
        -- Allocation to .data section is assumed; instruction is expanded.
        .option data _dat2
        .text
        ld.w    $_dat2, r12
        -- Allocation to .bss section is assumed; instruction is expanded.
        .option sdata _sdat1
        .text
        ld.w    $_sdat1, r13
        -- Allocation to .sdata section is assumed; instruction is not expanded.
        .option sdata _sdat2
        .text
        ld.w    $_sdat2, r14
        -- Allocation to .sbss section is assumed; instruction is not expanded.
```

3.5 Dump Tool

This section describes the display format of the dump tool.

To configure the using the dump tool in CubeSuite+, on the Project Tree panel, select the Build tool node, and then select the [Dump Options] tab on the Property panel. In the [Dump Tool] category, set the [Use dump tool] property to [Yes]. The output file name is “dump.txt”. It is also shown on the Project Tree panel, under the Build tool generated files node.

3.5.1 Dump list display contents

(1) Archive header

Display the contents of the archive header.

```
                        ***ARCHIVE HEADER***
(1)Date         (2)Uid      (3)Gid      (4)Mode     (5)Size     (6)Member Name
   0x3158DE73     0           0           0100664     0x2B8       atof.o
```

Item Number	Description
(1)	Member update date
(2)	User ID
(3)	Group ID
(4)	Member permission
(5)	Total number of bytes for members
(6)	Member name

(2) Archive symbol table

Display the contents of the archive symbol table.

```
                        ***ARCHIVE SYMBOL TABLE***
        (1)Offset       (2)Name
           0x1f3c          _abs
```

Item Number	Description
(1)	Offset in file to member including symbol
(2)	Symbol name

(3) Archive string table

Display the contents of the archive string table.

```
                        ***ARCHIVE STRING TABLE***
        (1)Offset       (2)Name
           0x1100          foo.o
```

Item Number	Description
(1)	Offset
(2)	Member name

(4) ELF header

Display the contents of the ELF header.

```
                        ***ELF HEADER***
(1) Class       (2) Data        (3) Type        (4) Machine     (5) Version
(6) Entry       (7) Phoff       (8) Shoff       (9) Flags       (10)Ehsize
(11)Phentsize   (12)Phnum       (13)Shentsz     (14)Shnum       (15)Shstrndx
    1               1               1               070377          1
    0x0             0x0             0x2A4           0x84            0x34
    0x20            0               0x28            6               5
```

Item Number	Description
(1)	Class
(2)	Byte order
(3)	Type
(4)	Processor
(5)	Version number
(6)	Entry point address
(7)	Offset in file of program header table
(8)	Offset in file of section header table
(9)	Flag
(10)	Size of ELF header
(11)	Entry size of program header table
(12)	Number of entries in program header table
(13)	Entry size of section header table
(14)	Number of entries in section header table
(15)	Section header table index of string table containing section name

(5) Program header table

Display the contents of the program header table.

```
                        ***PROGRAM HEADER***
(1)No.      (2)Type     (3)Offset   (4)Vaddr    (5)Paddr
            (6)Filesz   (7)Memsz    (8)Flags    (9)Align
  1.            0           0x0         0x0         0x0
                0x0         0x0         0x0         0x0
```

Item Number	Description
(1)	Index
(2)	Segment type
(3)	Offset in file
(4)	Virtual address
(5)	Physical address
(6)	File size
(7)	Memory size
(8)	Segment attribute
(9)	Alignment condition

(6) Section header table

Display the contents of the section header table.

```
                        ***SECTION HEADER***
(1)No.      (2)Type     (3)Flags    (4) Addr    (5) Offset   (6)Size     (7)Name
            (8)Link     (9)Info     (10)Adralgn (11)Entsize
  1.          0x1         0x6          0x0         0x1         0x7556      .text
              0x0         0x0          0x4         0x0
```

Item Number	Description
(1)	Index
(2)	Section type
(3)	Section attribute
(4)	Start address
(5)	Offset in file
(6)	Size
(7)	Section name
(8)	Section header table index link
(9)	Information
(10)	Alignment condition
(11)	Size of entry

(7) String table

Display the contents of the string table.

```
                      ***STRING TABLE INFORMATION***
        (1)Index      (2)String
           0x1           .text
```

Item Number	Description
(1)	Index
(2)	Character string

(8) Symbol table

Display the contents of the symbol table.

```
                        ***SYMBOL TABLE INFORMATION***
(1)No.   (2)Value   (3)Size    (4)Bind    (5)Type    (6)Other   (7)Shndx   (8)Name
   1.       0x0        0x0        0          3          0          0x1        .text
```

Item Number	Description
(1)	Index
(2)	Value
(3)	Size
(4)	Binding class
(5)	Type
(6)	Unused
(7)	Section header table index
(8)	Symbol name

(9) Relocation information

Display the contents of the relocation information (array of relocation entries).

```
                      ***RELOCATION INFORMATION***
        (1)Offset       (2)Sym          (3)Type         (4)Addend
           0x20            6               0x23            0x0
```

Item Number	Description
(1)	Offset
(2)	Symbol table index
(3)	Relocation type
(4)	Added constant

(10) Register mode information

Display the contents of the register mode information.

```
                     ***REGISTER MODE INFORMATION***
        (1)SymIdx       (2)TmpReg       (3)ParReg
           0x1             0x5             0x5
```

Item Number	Description
(1)	Symbol table index
(2)	Number of working registers
(3)	Number of registers for register variables

(11) Global pointer table

Display the contents of the global pointer table.

```
                    ***GPTAB INFORMATION***
      (1)Gnum       (2)Gsize
         0x4           0xc
```

Item Number	Description
(1)	Value specified by -G*num*or maximum size of symbol
(2)	0 or size of section

(12) Line number information

Display the contents of the line number information.

```
                        ***LINE NUMBER INFORMATION***
(1)Bfunc (2)Maddr (3)Daddr (4)Pad (5)Function Name (6)Num (7)Snum (8)Offset (9)Flags
   0x0       0xA2      0xE28     0x0     _main             0x5     0x0      0x0        0x1
```

Item Number	Description
(1)	Start of subsection
(2)	Address of function
(3)	Address of debug information
(4)	Padding
(5)	Function name
(6)	Line number
(7)	Position of statement
(8)	Offset
(9)	Flag

(13) Debug information

Display the contents of the debug information.

```
                    ***DEBUG INFORMATION***
      (1)Tag        (2)Attr       (3)Aux
         0x0016
         size          0x00000026
                       0x000c        0x00000E1C
```

Item Number	Description
(1)	Tag
(2)	Attribute
(3)	Auxiliary information

(14) PROGBITS data

Display the contents of the PROGBITS data.

```
                    ***PROGBITS DATA in HEX***
0x00000000 : 40 0E 00 00 21 2E 00 00 ...
```

Display the raw data contents of the section having section type PROGBITS in hexadecimal numbers.

3.5.2 Element values and meanings

When the -v option has been specified, the following information indicates that character strings are used instead of numerical values to indicate the meanings of the values for some elements.

- ELF header
- Program header table
- Section header table
- Symbol table
- Relocation information
- Debug information

The values, the display when -v is specified, and the meanings of the elements that are displayed as character strings when -v has been specified is shown below.

Note The value is displayed using the number base output by the dump tool.

(1) "Flags" in ELF headers

Value	Display When -v Is Specified	Meaning
0x1	L_____	.vline section exists.
0x2	_D_____	.vdebug section exists.
0x4	__P_____	Object is a PIC (Position Independent Code) object.
0x10	___R_____	Register mode is 22-register mode or 26-register mode.
0x20	____d_____	Different register modes are mixed.

Value	Display When -v Is Specified	Meaning
0x40	_____r____	Object is output by ROMization processor.
0x80	______N___	Default function call specification (call does not use old specification).
0x100	_______M__	Uses mask register function.
0x200	________U_	Code making a call using the prolog or epilog runtime callt convention may be output.
0x400	_________S	CTBP is configured to make calls using the prolog or epilog runtime callt convention.

(2) "Type" in program header table

Value	Display When -v Is Specified	Meaning
1	Load	Segment is loaded into memory.
4	Note	Segment, including auxiliary information

(3) "Type" in section header table

Value	Display When -v Is Specified	Meaning
0x1	Progbits	Section that corresponds to an entity that contains an actual value in an object file (machine language instruction and data with an initial value)
0x2	Symtab	Symbol table
0x3	Strtab	String table
0x4	Rela	Relocation information
0x8	Nobits	Section that corresponds to an entity that does not contain an actual value in an object file (data without an initial value)
0x9	Rel	Relocation information
0x70000000	Gptab	Global pointer table (in which the first entry contains *num* of -G*num* specified for the C compiler or assembler, and 0, the 2nd and subsequent entries indicate the size when aligned with data size and word)
0x70000001	Regmode	Section that exists in a linkable object file created using the register mode function (Information concerning the number of registers used internally by the C compiler is stored)

(4) "Bind" in symbol table

Value	Display When -v Is Specified	Meaning
0	Local	Symbol that is not used to resolve external reference
1	Global	Symbol that is used to resolve external reference

(5) "Type" in symbol table

Value	Display When -v Is Specified	Meaning
1	Object	Ordinary object (label)
2	Func	Function name
3	Section	Section
4	File	Ordinary file name
13	Devfile	Device file name

(6) "Shndx" in symbol table

Value	Display When -v Is Specified	Meaning
0x0	Undef	Undefined symbol
0xFF00	GpCommon	Undefined external symbol that is referenced by global pointer (gp) and 16-bit displacement
0xFFF1	Abs	Symbol indicating constant
0xFFF2	Common	Undefined external symbol that is referenced by global pointer (gp) and 32-bit displacement

See "3.9 Format of Object File" for further description of object file formats.

3.6 Disassembler

A disassembler output example is shown below.

```
C:\>dis850 -A a.out
```

```
  Address      Offset       Opecode
                              _main:
0x00000000 : 0x00000000 : 45D5            br    _main + 0x8a
0x00000002 : 0x00000002 : D800            mov   zero, r27
0x00000004 : 0x00000004 : E6230000        movea  0, sp, r28
0x00000008 : 0x00000008 : 301C            mov   r28, r6
0x0000000A : 0x0000000A : FF800176        jarl  _getToken[pc], lp
0x0000000E : 0x0000000E : 580A            mov   r10, r11
0x00000010 : 0x00000010 : 5A7F            cmp   -0x1, r11
0x00000012 : 0x00000012 : 1D92            bz    _main + 0x44
0x00000014 : 0x00000014 : EE2300E8        movea 0x3e8, zero, r29
0x00000018 : 0x00000018 : D9FD            cmp   r29, r27
0x0000001A : 0x0000001A : 15DE            bge   _main + 0x44
0x0000001C : 0x0000001C : 301C            mov   r28, r6
0x0000001E : 0x0000001E : FF800000        jarl  0[pc], lp
0x00000022 : 0x00000022 : 580A            mov   r10, r11
0x00000024 : 0x00000024 : 501B            mov   r27, r10
0x00000026 : 0x00000026 : 52C2            shl   0x2, r10
0x00000028 : 0x00000028 : 66230020        movea 0x20, sp, r12
0x0000002C : 0x0000002C : 61CA            add   r10, r12
0x0000002E : 0x0000002E : 5F6C0001        st.w  r11, 0[r12]
0x00000032 : 0x00000032 : DA41            add   0x1, r27
0x00000034 : 0x00000034 : 301C            mov   r28, r6
0x00000036 : 0x00000036 : FF80014A        jarl  _getToken[pc], lp
0x0000003A : 0x0000003A : 580A            mov   r10, r11
0x0000003C : 0x0000003C : 5A7F            cmp   -0x1, r11
0x0000003E : 0x0000003E : 05B2            bz    _main + 0x44
        :
```

Among the information in the file a.out, the disassembler displays addresses, offsets, codes (according to instruction format), and titles, along with assembly language instructions. Registers are displayed using aliases.

3.7 Cross Reference Tool

This section describes details about each output format of the cross reference tool.

To configure the using the cross reference tool in CubeSuite+, on the Project Tree panel, select the Build tool node, and then select the [Cross Reference Options] tab on the Property panel. In the [Cross Reference Tool] category, set the [Use cross reference tool] property to [Yes]. The output destination of the information files is the folder set from the [Common Options] tab, in the [Output File Type And Path] category, in the [Intermediate file output folder] property. It is also shown on the Project Tree panel, under the Build tool generated files node.

Remark See "B.10.1 Input/Output" for details about input and output of the cross reference tool.

3.7.1 Cross reference

The cross reference tool outputs cross reference information of variables and functions that are used within the file, for each file. The output destination is "standard output (default)" or a "text file." When information is output to a file, the default output file name is "cxref."

- Cross reference output example

```
C:\>cxref -x apli.c
```

```
**** apli.c
 G V NULL    20 30 43 90 91 199 204 205 235
 G F combine #163 187 190
 G F delete  #216 257
 G V deleted #22 203 220 222
        ...
 L V printtree:depth #232 236 242
 G F removeitem #118 178 209
 G F restore #182 208 212
 G V root #20 42 113 115 115 221 223 224 224 224 261
        ...
```

The information is output in alphabetical order of the identifiers. Four types of information are output sequentially from left to right on each line.

(1) Linkage and storage class

The linkage and storage class are indicated by the following symbols.

G	Static external variable or function having external linkage
L	Static variable, function, or static variable within a function, having internal linkage
?	Unknown

(2) Type

The type is indicated by the following symbols.

F	Function
V	Variable

?	Unknown

(3) Identifier name

The identifier name is the function name or variable name itself.
However, since duplicate names may exist for variables that are defined within functions, identifier names are indicated in the format "function-name:variable-name".

(4) Line number

The definition line number and reference line numbers are listed with the following symbols appended.

!line-number	Declaration line
#line-number	Definition line
?line-number	Whether it is a declaration or definition or a reference is unknown
No symbol	Reference line

3.7.2 Tag information

The cross reference tool outputs the definition file name and line number information (tag jump information) for variables and functions. The output destination is "standard output (default)" or a "text file." When information is output to a file, the default output file name is "ctags."

- Tag information output example

```
C:\>cxref -t apli.c
```

```
apli.c          163     G F combine
apli.c          216     G F delete
apli.c          22      G V deleted
apli.c          194     G F deletesub
apli.c          22      G V done
apli.c          108     G F insert
apli.c          54      G F insertitem
apli.c          86      G F insertsub
apli.c          21      G V key
       ...
```

The information is output in alphabetical order of the identifiers. Five types of information are output sequentially from left to right on each line.

(1) File name

Indicates the name of the file in which the variable or function is defined.

(2) Line number

Indicates the location of the variable or function definition.

(3) Linkage and storage class

The linkage and storage class are indicated by the following symbols.

G	Static external variable or function having external linkage
L	Static variable, function, or static variable within a function, having internal linkage
?	Unknown

(4) Type

The type is indicated by the following symbols.

F	Function
V	Variable
?	Unknown

(5) Identifier name

The identifier name is the function name or variable name itself.

However, since duplicate names may exist for variables that are defined within functions, identifier names are indicated in the format "function-name:variable-name".

3.7.3 Call tree

When a call tree information output option such as -c is specified for the cross reference tool, the functions called by certain functions are output in tree format.

The output file format is text format or CSV format. To directly reference the main important information, output the data in text format. To reference detailed information in tabular form, output the data in CSV format.

(1) Text-format output example

If the -c option is specified, the call tree is output in text format. The default output file name is "ccalltre.lst".

The text-format output is as follows.

- Call tree text-format output example

```
C:\>cxref -c apli.c
```

```
1       @newpage
2       |---malloc?
3       |---printf?
4       +---exit?
5       @search
6       @insertitem
7       @split
8       |---newpage...(1)
9       |---insertitem...(6)
10      +---insertitem...(6)
11      @insertsub
12      |---insertsub*
13      |---insertitem...(6)
14      +---split...(7)
       ...
```

- The group of functions to be processed are output in tree format.
- An ampersand "@" is appended to the front of a function name that is the tree root.
- Functions of provided libraries are also included in the tree.
- The meanings of symbols that are displayed after function names are as follows.

?	Indicates a function that is not defined in the file to be processed.
... (numerical value)	Indicates that subsequent outputs are omitted because it was output once. The numerical value indicates the line number for the first output. Indicates the defined source file.
*	Indicates that subsequent outputs were suspended because a recursive function was calling itself.

(2) CSV-format output example

If the -cc option is specified, the call tree is output in CSV format. A CSV-format file can be read by spreadsheet software such as Microsoft Excel®. The default output file name is "ccalltre.csv".
The CSV-format output is as follows.

- Call tree CSV-format output example

```
C:\>cxref -cc apli.c
```

```
[SrcFileList]
 No,SrcFileName,FilePath
 1,apli.c,

 [Funcs]
 No,FuncName,SrcFileNo,LineNo,Ret1,Arg1,Ret2,Arg2
 1,free,0,0,,,,
 2,main,1,248,int,(),,
 3,scanf,0,0,,,,
 4,delete,1,217,void,(void),,
 5,search,1,38,void,(void),,
        ...
 [Calltree]
 No,FuncNo,FuncAttr,TopFlg,ElimNo,ChildPtr,ChildCnt,RefFileNo,RefLine
 1,8,0,1,0,1,3,0,0
 2,7,0x21,0,0,0,0,1,30
 3,12,0x21,0,0,0,0,1,31
 4,9,0x21,0,0,0,0,1,32
 [ChildFuncs]
 No,CalltreeNo
 1,2
 2,3
 3,4
 4,8
 5,9
```

```
 6,10
 7,12
 8,13
 9,14
10,16
        ...
```

(a) [SrcFileList]

The name of the source file in which the functions used by the program are defined is output.

FileName	Source file name
FilePath	Source file path This is output only when the path was specified for the file that was input.

(b) [Funcs]

All of the functions used by the program are output.

FuncName	Function name
SrcFileNo	Source file number Uses the "No" value in [SrcFileList] to indicate the source file in which that function is defined.
LineNo	Line number Indicates the line at which that function's definition begins in the source file.
Ret1,Ret2	Return values of the function When the analysis cannot be performed, nothing is output.
Arg1,Arg2	Arguments of the function When the analysis cannot be performed, nothing is output.

(c) [Calltree]

The call tree is output.

FuncNo	Function number Uses the "No" value in [Funcs] to indicate the function.
FuncAttr	Function attribute Indicates the tree attributes by using a combination of the following numerical values. If there is no attribute, 0 is output. 0x0001: There is no program description. 0x0002: It is a recursive function. 0x0004: Omits subsequent tree output. 0x0008: Outputs source file name and description starting line. 0x0010: Outputs return values and arguments. 0x0020: Outputs reference information.
TopFlag	Top flag When the function is the tree root, 1 is output. When it is not the tree root, 0 is output.

ElimNo	Tree number for previous output When the function corresponds to "0x0004" for "FuncAttr," this uses "No" in [Calltree] to indicate the tree in which that function was previously output. If it does not correspond to "0x0004," 0 is output.
ChildPtr	Starting position of child function display Uses "No" in [ChildFuncs] to indicate the position at which the first child function of the function is output.
ChildCnt	Number of child functions Indicates the number of child functions registered in [ChildFuncs]. If there is no child function, 0 is output.

(d) [ChildFuncs]

The tree in which that child function exists is output as child function information.

CallTreeNo	Tree number Uses "No" in [Calltree] to indicate the tree in which that child function exists.

3.7.4 Function metrics

When a function metrics information output option such as -m is specified for the cross reference tool, the information is output in terms of individual functions. The output file format is text format or CSV format. To directly reference the main important information, output the data in text format. To reference detailed information in tabular form, output the data in CSV format.

(1) Text-format output example

If the -m option is specified, the function metrics are output in text format. The default output file name is "cmeasure.lst".

The text-format output is as follows.

- Function metrics text-format output example

```
C:\>cxref -m apli.c
```

```
                File            Line   Called
 newpage        apli.c           27      2
 search         apli.c           38      1
 insertitem     apli.c           55      3
 split          apli.c           68      1
 insertsub      apli.c           87      2
 insert         apli.c          109      1
 removeitem     apli.c          119      2
 moveright      apli.c          128      1
 moveleft       apli.c          146      1
 combin         apli.c          164      2
 restore        apli.c          183      2
 deletesub      apli.c          195      3
 delete         apli.c          217      1
 printtree      apli.c          231      3
```

```
main            apli.c          248      0
          ...
```

(a) File

File name

Indicates the name of the source file in which that function is defined.

(b) Line

Starting line

Indicates the line number in the source file at which that function is defined.

(c) Called

Call histogram

Indicates the frequency with which that function was called. The frequencies that are output are based on the assumption that the function is called once for each function call description.

(2) CSV-format output example

If the -mc option is specified, the function metrics are output in CSV format. A CSV-format file can be read by spreadsheet software such as Microsoft Excel. The default output file name is "cmeasure.csv".
The CSV-format output is as follows.

- Function metrics CSV-format output example

```
C:\>cxref -mc apli.c
```

```
[SrcFileList]
 No,SrcFileName,FilePath
 1,apli.c,


 [Funcs]
 No,FuncName,SrcFileNo,LineNo,Ret1,Arg1,Ret2,Arg2
 1,free,0,0,,,,
 2,main,1,248,int,(),,
 3,scanf,0,0,,,,
 4,delete,1,217,void,(void),,
 5,search,1,38,void,(void),,
        ...
 [Measure]

No,FuncNo,FuncSz,Clk,TClk,Stk,TStk,CalledCnt,StkUp,StkUpPtr,StkUpCnt,ClkUp,ClkUpPtr,ClkUp
Cnt,StkDw,StkDwPtr,StkDwCnt,ClkDw,ClkDwPtr,ClkDwCnt
 1,8,64,37,37,12,68,2,68,1,4,496,5,4,12,0,0,37,0,0
 2,5,208,118,118,12,24,1,24,9,1,237,10,1,12,0,0,118,0,0
 3,19,148,71,71,16,72,3,72,11,4,530,15,4,16,0,0,71,0,0
        ...
```

(a) [SrcFileList]

The name of the source file in which the functions used by the program are defined is output.

FileName	Source file name
FilePath	Source file path This is output only when the path was specified for the file that was input.

(b) [Funcs]

All of the functions used by the program are output.

FuncName	Function name
SrcFileNo	Source file number Uses the "No" value in [SrcFileList] to indicate the source file in which that function is defined.
LineNo	Line number Indicates the line at which that function's definition begins in the source file.
Ret1,Ret2	Return values of the function When the analysis cannot be performed, nothing is output.
Arg1,Arg2	Arguments of the function When the analysis cannot be performed, nothing is output.

(c) [Measure]

Function metrics information is output.

FuncNo	Function number Uses the "No" value in [Funcs] to indicate the function.
CalledCnt	Call histogram Indicates the frequency with which that function was called. The frequencies that are output are based on the assumption that the function is called once for each function call description.

3.7.5 Call database

When a call database information output option such as -b is specified for the cross reference tool, the functions called by a given function and the number of times each function is called by that function are output. The output file format is text format or CSV format. To directly reference the main important information, output the data in text format. To reference detailed information in tabular form, output the data in CSV format.

(1) Text-format output example

If the -b option is specified, the call database is output in text format. The default output file name is "cprofile.dat". The text-format output is as follows.

- Call database text-format output example

```
C:\>cxref -b apli.c
```

```
newpage,apli.c,malloc,0,1
newpage,apli.c,printf,0,1
newpage,apli.c,exit,0,1
split,apli.c,newpage,apli.c,1
split,apli.c,insertitem,apli.c,2
insertsub,apli.c,insertsub,apli.c,1
insertsub,apli.c,insertitem,apli.c,1
insertsub,apli.c,split,apli.c,1
insert,apli.c,insertsub,apli.c,1
insert,apli.c,newpage,apli.c,1
combine,apli.c,removeitem,apli.c,1
combine,apli.c,free,0,1
       ...
```

Five types of information are output sequentially from left to right on each line.

(a) Calling function name

(b) Name of source file in which calling function is defined
If no analysis can be performed, "???" is output.

(c) Called function name

(d) Name of source file in which called function is defined
Since the source file name is unknown for a function in a library, 0 is output.

(e) Number of times called function is called within calling function

(2) CSV-format output example

If the -bc option is specified, the call database is output in CSV format. A CSV-format file can be read by spreadsheet software such as Microsoft Excel. The default output file name is "cprofile.csv".
The CSV-format output is as follows.

- Call database CSV-format output example

```
C:\>cxref -bc apli.c
```

```
[SrcFileList]
No,SrcFileName,FilePath
1,apli.c,

[Funcs]
No,FuncName,SrcFileNo,LineNo,Ret1,Arg1,Ret2,Arg2
1,free,0,0,,,,
2,main,1,248,int,(),,
3,scanf,0,0,,,,
4,delete,1,217,void,(void),,
5,search,1,38,void,(void),,
       ...
[CallDataBase]
No,FuncNo,ChildFuncNo,CallCnt
1,8,7,1
2,8,12,1
3,8,9,1
4,11,8,1
5,11,19,2
       ...
```

(a) [SrcFileList]

The name of the source file in which the functions used by the program are defined is output.

FileName	Source file name
FilePath	Source file path This is output only when the -p option is specified.

(b) [Funcs]

All of the functions used by the program are output.

FuncName	Function name
SrcFileNo	Source file number Uses the "No" value in [SrcFileList] to indicate the source file in which that function is defined.
LineNo	Line number Indicates the line at which that function's definition begins in the source file.
Ret1,Ret2	Return values of the function When the analysis cannot be performed, nothing is output.
Arg1,Arg2	Arguments of the function When the analysis cannot be performed, nothing is output.

(c) [CallDataBase]

Call database information is output.

FuncNo	Calling function number Uses the "No" value in [SrcFileList] to indicate the calling function number.
ChildFuncNo	Called function number Uses the "No" value in [SrcFileList] to indicate the called function number.
CalledCnt	Number of times called Number of times called function is called within calling function

3.8 Memory Layout Visualization Tool

This section describes details about each output format of the memory layout visualization tool.

To configure the using the memory layout visualization tool in CubeSuite+, on the Project Tree panel, select the Build tool node, and then select the [Memory Layout Visualization Options] tab on the Property panel. In the [Memory Layout Visualization Tool] category, set the [Use memory layout visualization tool] property to [Yes]. The output destination of the information files is the folder set from the [Common Options] tab, in the [Output File Type And Path] category, in the [Intermediate file output folder] property. It is also shown on the Project Tree panel, under the Build tool generated files node.

Remark See "B.11.1 Input/Output" for details about input and output of the memory layout visualization tool.

3.8.1 Memory map table

The memory layout visualization tool outputs a memory map table that shows variable names, sizes, and the memory layout. The output destination is "standard output" or a "file." When information is output to a file, the output file format is text format or CSV format. To directly reference the main important information, output the data in text format. To reference detailed information in tabular form, output the data in CSV format.

- The memory map table has 16 bytes per line.
- For a variable name, the name in the C source file is displayed in the following format (when the variable name is assumed to be "name").

External variable	_name
Local variable within file	*file-name*@_name
Static variable or string constant within function	*file-name*@LL*number*

- The size is displayed in the format "(number of bytes in decimal notation)" following the variable name.

(1) Text-format output example

If the -m option is specified, the memory map table is output in text format. The default output file name is "rammap.txt".

The text-format output is as follows.

- Memory map table text-format output example

```
C:\>rammap -m a.out
```

```
Address    +0  +1  +2  +3  +4  +5  +6  +7  +8  +9  +A  +B  +C  +D  +E  +F
-----------+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
0x00000000  |
:
0x00FFE000  |crtN.s@__argc(>|crtN.s@__argv(>|               |test.c@LL29(5)-
0x00FFE010  |-->|           |test.c@_svar(4>|_var(4)------->|_gAppName(8)---
0x00FFE020  |-------------->|_c>|           |_tmp(4)------->|_buf(100)------
:
0x00FFE080  |------------------------------------------------------------>|
0x00FFE090  |_var2(4)------>|_c>|           |crtN.s@__stack(512)------------
:
0x00FFE290  |------------------------------>|
:
0xFFFFFFF0  |
-----------+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
:
```

- The variable name and size are displayed left-aligned at the start of the relevant address.
- A variable name that cannot fit in the memory layout frame is displayed as far as it fits.
- A colon (:) is output for a line that has no variable name, and the line is omitted. Unused area, the text attribute section, and the interior of large variables correspond to these kinds of lines.

(2) CSV-format output example

If the -mc option is specified, the memory map table is output in CSV format. A CSV-format file can be read by spreadsheet software such as Microsoft Excel. The default output file name is "rammap.csv".
The CSV-format output is as follows.

- Memory map table CSV-format output example

```
C:\>rammap -mc a.out
```

```
Address,0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F
0x00000000,,,,,,,,,,,,,,,,
:
0x00FFE000,crtN.s@__argc(4),,,,crtN.s@__argv(4),,,,,,,,test.c@LL29(5),,,
0x00FFE010,,,,,test.c@_svar(4),,,,_var(4),,,,_gAppName(8),,,
0x00FFE020,,,,,_cInput(1),,,,_tmp(4),,,,_buf(100),,,
:
0x00FFE090,_var2(4),,,,_c(1),,,,crtN.s@__stack(512),,,,,,,
:
0xFFFFFFF0,,,,,,,,,,,,,,,,
...
```

- A colon (:) is output for a line that has no variable name, and the line is omitted. Unused area, the text attribute section, and the interior of large variables correspond to these kinds of lines.

3.9 Format of Object File

This section describes the format of the object file used with the C compiler.

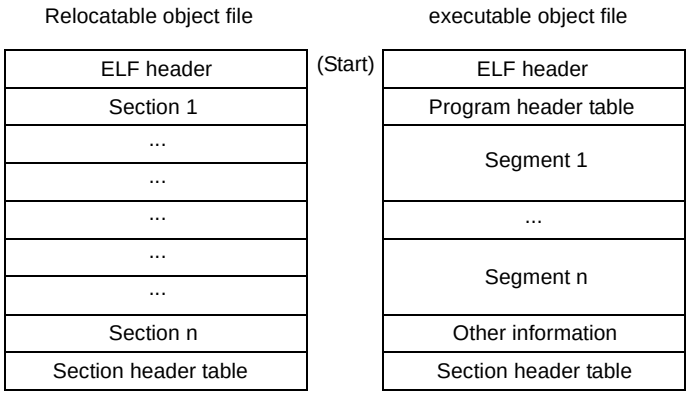
3.9.1 Structure of object file

The format of the object file used with the C compiler conforms to the ELF format, a standard object file format.

The structure of an object file in this format differs somewhat between relocatable object files and executable object files (see the following figure). A relocatable object file contains the information that is needed to create an executable object file, and an executable object file contains the information needed to execute the object file.

The following sections describe the ELF header, program header table, section header table, section, and segment, which are constituent elements in ELF-format object files.

Figure 3-4. Object File Structures



3.9.2 ELF header

This section describes the ELF header, which is a constituent element in ELF-format object files.

The ELF header is at the start of the object file and contains the information needed to interpret the object file or to access the other constituent elements in the object file (see “Figure 3-4. Object File Structures”).

Table 3-4. Constituent Elements of ELF Header and Their Meanings

Constituent Elements	Meaning
ident[CLASS]	Class of this object file
ident[DATA]	Byte order of data in this object file (2MSB if big endian, or 2LSB if little endian)
type	Type of this object file
machine	Target processor of this object file
version	Version number of this object file format
entry	Entry point address
phoff	Offset in file of program header table
shoff	Offset in file of section header table
flags	Unique flag for processor that this object file runs on
ehsize	Byte size of this ELF header
phentsize	Size of program header table entry
phnum	Number of program header table entries
shentsize	Size of section header table entries

Constituent Elements	Meaning
shnum	Number of section header table entries
shstrndx	Section header table index of string table .shstrtab that contains the section name

3.9.3 Program header table

This section describes the program header table, which is a constituent element in ELF-format object files.

The program header table is an array of program header table entries that contain information about all the segments included in the object file (see the following table).

An index (i.e. a subscript) to this array is called a program header table index, which is used to reference the program header table entries.

Table 3-5. Constituent Elements of Program Header Table Entries and Their Meanings

Constituent Elements	Meaning
type	Segment type of corresponding segment (type is LOAD if segment is loaded to memory, or NOTE if segment has auxiliary information)
offset	Offset in file of corresponding segment
vaddr	Virtual address of corresponding segment
paddr	Physical address of corresponding segment
filesz	Size of corresponding segment in file[Note]
memsz	Size of corresponding segment in memory
flags	Segment attribute of corresponding segment (attribute is R for segment that can be read, W for segment that can be written, or X for executable segment)
align	Alignment condition of corresponding segment

Note If a section having section type NOBITS (section not having an actual value in the object file) is allocated to the corresponding segment, a value other than the memsz value is set.

3.9.4 Section header table

This section describes the section header table that is a constituent element in ELF-format object files.

The section header table is an array of section header table entries that contain information about all of the sections included in the object file. An index (subscript) to this array is called a section header table index, which is used to reference the section header table entries.

Table 3-6. Constituent Elements of Section Header Table Entries and Their Meanings

Constituent Elements	Meaning
name	Name of corresponding section (index to string table .shstrtab that contains the section name)
type	Section type of corresponding section (see "(1) Section type")
flags	Section attribute of corresponding section (attribute is A for a section occupying memory, W for a section that can be written, X for an executable section, and G for a section that is allocated to a memory range that can be referenced using global pointer (gp) with 16-bit displacement)
addr	Start address of corresponding section
offset	Offset in file of corresponding section
size	Size of corresponding section

Constituent Elements	Meaning
link	Section header table index link of corresponding section (see "(2) Constituent elements (link/info) dependent on section type")
info	Information dependent on section type of corresponding section (see "(2) Constituent elements (link/info) dependent on section type")
addralign	Alignment condition of corresponding section
entsize	Size of entries in corresponding section

(1) Section type

The section types indicated by the constituent element “type” in the section header table are shown with an explanation of their meanings in the following table.

Table 3-7. Section Types and Their Meanings

Section Type	Meaning
GPTAB	Global pointer table (in which the first entry contains *num* of -G*num* specified for the C compiler or assembler, and 0, the 2nd and subsequent entries indicate the size when aligned with data size and word)
NOBITS	Section for data that does not have an actual value in the object file (e.g., data for which no initial value is specified)
PROGBITS	Section for data that has an actual value in the object file (e.g., data for which a machine language instruction or initial value has been specified)
REGMODE	Section existing in relocatable object file created using the register mode function[Note] (stores information on the number of registers internally used by the C compiler)
REL (not supported)	Relocation information
RELA	Relocation information
SYMTAB	Symbol table (see “(1) Symbol table”)
STRTAB	String table (”(2) String table”)

Note See the explanation of the register mode specification option (-reg) of the C compiler.

(2) Constituent elements (link/info) dependent on section type

The meanings of the section header table's constituent elements “link” and “info”, which are dependent on section type, are shown below.

Table 3-8. Meanings of Link and Info

Section Type	Meaning of Link	Meaning of Info
GPTAB	---	Section header table index of section to which corresponding data is allocated
REL (not supported)	Section header table index of corresponding symbol table	Section header table index of section to be relocated
RELA	Section header table index of corresponding symbol table	Section header table index of section to be relocated
SYMTAB	Section header table index of corresponding string table	Symbol table index of symbol that appears first when table is not local

3.9.5 Sections

The following describes the sections that are constituent elements in ELF-format object files.

A section is a main constituent element of object files. Its contents include machine language instructions, data, symbol tables, string tables, debug information, and line number information.

A section must meet the following conditions.

- One section header table entry corresponding to the section header table must exist in each section.
- In some cases (such as a section having section type NOBITS), a section may have only a section header table entry but no actual value exists in the object file.
- A section that has an actual value in the object file occupies a contiguous area in the object file.
- Sections do not share an area in the object file. In other words, there is no area that belongs to more than one section.

(1) Symbol table

The following describes the symbol table, a type of section.

The symbol table, a section of section type SYMTAB, is an array of symbol table entries containing information about all of the symbols included in the object file.

An index (subscript) to this array is called a symbol table index, and the symbol table entries are referenced using this symbol table index[Note].

Note An entry with symbol table index 0 is reserved, and each constituent element's value is 0.

Table 3-9. Constituent Elements of Symbol Table Entries and Their Meanings

Constituent Elements	Meaning
name	Name of corresponding symbol (index to string table .strtab)
value	Value of corresponding symbol
size	Size of corresponding symbol
BIND (info)	Binding class of corresponding symbol (binding class is GLOBAL for a symbol used to resolve an external reference, or LOCAL for a symbol not used to resolve an external reference)
TYPE (info)	Type of corresponding symbol (type is FILE for a normal file name, FUNC for a function name, NOTYPE for an undefined symbol, OBJECT for a symbol indicating a normal label, SECTION for a section name, or DEVFILE for a device file name)
other	---
shndx	Section header table index of section for corresponding symbol (which takes one of the following values: ABS for a symbol indicating a constant, COMMON for an undefined external symbol that is referenced using a global pointer (gp) with 32-bit displacement, GPCOMMON for an undefined external symbol that is referenced using a global pointer (gp) with 16-bit displacement, or UNDEF for an undefined symbol)

(2) String table

The following describes the string table, a type of section.

The string table, a section of section type STRTAB, consists of a character string that ends with a null character (\0). This character string is referenced using an index that is an offset from the beginning of the string table[Note]. An ELF-format object file uses this character string to hold the names of symbols and sections. For example, the constituent element “name” in the section header table entry has an index to the string table .shstrtab which holds a section name.

Note The rule is that the first byte expressed by index 0 is a null character.

Table 3-10. Relationship Between Indexes and Character Strings in String Table

Index	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9
0	\0	n	a	m	e	.	\0	V	a	r
+10	i	a	b	l	e	\0	a	b	l	e
+20	\0	\0	x	x	\0					

Index	String
0	null string
+1	name
+7	Variable
+11	able
+16	able
+24	null string

(3) Reserved sections

In ELF-format object files, several sections are reserved as reserved sections.

The following table lists the names, section types, and section attributes of these reserved sections.

Table 3-11. Reserved Sections

Name[Note 1]	Description	Section Type	Section Attribute
.bss	.bss section	NOBITS	AW
.const	.const section	PROGBITS	A
.data	.data section	PROGBITS	AW
.ext_info .ext_info_boot	Information section for flash/external ROM re-link function	PROGBITS	None
.ext_table	Branch table section for flash/external ROM re-link function	PROGBITS	AX
.ext_tgsym	Information section for flash/external ROM re-link function	PROGBITS	None
.gptabname	Global pointer table [Note 2]	GPTAB	None
.pro_epi_runtime	Prologue/epilogue run-time call section	PROGBITS	AX
.regmode	Register mode information	REGMODE	None
.relname	Relocation information	REL	None
.relaname	Relocation information	RELA	None
.sbss	.sbss section	NOBITS	AWG
.sconst	.sconst section	PROGBITS	A
.sdata	.sdata section	PROGBITS	AWG
.sebss	.sebss section	NOBITS	AW
.sedata	.sedata section	PROGBITS	AW
.shstrtab	String table containing section names	STRTAB	None

Name[Note 1]	Description	Section Type	Section Attribute
.sibss	.sibss section	NOBITS	AW
.sidata	.sidata section	PROGBITS	AW
.strtab	String table	STRTAB	None
.symtab	Symbol table	SYMTAB	None
.text	.text section	PROGBITS	AX
.tibss	.tibss section	NOBITS	AW
.tibss.byte	.tibss.byte section	NOBITS	AW
.tibss.word	.tibss.word section	NOBITS	AW
.tidata	.tidata section	PROGBITS	AW
.tidata.byte	.tidata.byte section	PROGBITS	AW
.tidata.word	.tidata.word section	PROGBITS	AW
.vdbstrtab	Symbol table for debug information	STRTAB	None
.vdebug	Debug information	PROGBITS	None
.version	Version information section	PROGBITS	None
.vline	Line number information	PROGBITS	None

Notes 1. The name part of .gptabname, .relname, and .relaname indicates the name of the section corresponding to each respective section.

2. This is information that is used when processing the linker's -A option.

APPENDIX A WINDOW REFERENCE

This appendix explains windows/panels/dialog boxes used in build process.

A.1 Description

The following lists the windows/panels/dialog boxes used in build process.

Table A-1. List of Windows/Panels/Dialog Boxes

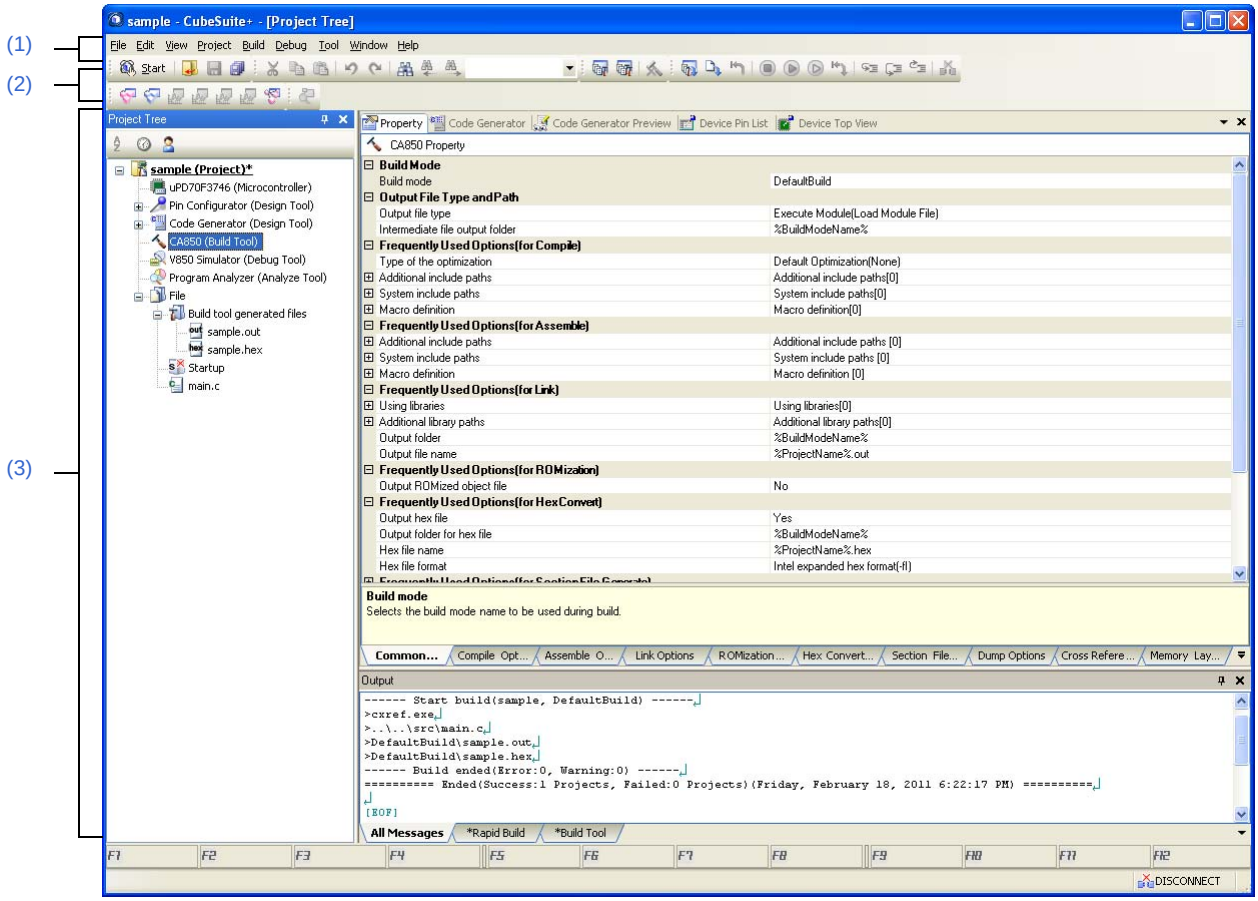
Window/Panel/Dialog Box Name	Function Description
Main window	This is the first window to be open when CubeSuite+ is launched.
Project Tree panel	This panel is used to display the project components in tree view.
Property panel	This panel is used to display the detailed information on the build tool, file, or category that is selected on the Project Tree panel and change the settings of the information.
Editor panel	This panel is used to display/edit text files/source files.
Output panel	This panel is used to display the message that is output from the build tool.
Add File dialog box	This dialog box is used to create a new file and add it to the project.
Add Folder and File dialog box	This dialog box is used to add existing files and folder hierarchies to the project.
Character String Input dialog box	This dialog box is used to input and edit characters in one line.
Text Edit dialog box	This dialog box is used to input and edit texts in multiple lines.
Path Edit dialog box	This dialog box is used to edit or add the path.
System Include Path Order dialog box	This dialog box is used to refer the system include paths specified for the compiler and set their specified sequence.
Build Tool Warning Messages Settings dialog box	This dialog box is used to set the warning messages output by the build tool.
File Save Settings dialog box	This dialog box is used to set the encoding and newline code of the file that is editing on the Editor panel.
Link Directive File Generation dialog box	This dialog box is used to generate a link directive file.
Object File Select dialog box	This dialog box is used to select an object file and retrieve it for the caller.
Segment Select dialog box	This dialog box is used to select a segment and retrieve it for the caller.
Link Order dialog box	This dialog box is used to display object module files and library files to input to the linker and configure these link order.
Build Mode Settings dialog box	This dialog box is used to add and delete build modes and configure the current build mode in batch.
Batch Build dialog box	This dialog box is used to do build, rebuild and clean process in batch with the build mode that each project has.
Go to the Location dialog box	This dialog box is used to move the caret to the designated location.
Progress Status dialog box	This dialog box is used to show how the process has been progressed.
Option dialog box	This dialog box is used to configure the CubeSuite+ environment.
Add Existing File dialog box	This dialog box is used to select existing files to add to projects.
Browse For Folder dialog box	This dialog box is used to select a folder and retrieve it for the caller.

Window/Panel/Dialog Box Name	Function Description
Specify Boot Area Object File dialog box	This dialog box is used to select the boot area object file to set in the caller of the dialog box.
Specify Function Information File dialog box	This dialog box is used to select the function information file to set in the caller of the dialog box.
Specify Intermediate Language File for External Variable Sorting dialog box	This dialog box is used to select the intermediate language file for external variable sorting to set in the caller of the dialog box.
Specify Far Jump File dialog box	This dialog box is used to select the Far Jump file to set in the caller of the dialog box.
Specify ROMization Area Reservation Code File dialog box	This dialog box is used to select the ROMization area reservation code file and retrieve it for the caller.
Save As dialog box	This dialog box is used to save the editing file or contents of each panel to a file with a name.
Open with Program dialog box	This dialog box is used to select the application to open the file.
Stack Usage Tracer window	This is the first window to be open when the stack usage tracer is launched.
Stack Size Unknown / Adjusted Function Lists dialog box	This dialog box is used to display a list of functions for which the stack usage tracer could not obtain stack information; functions for which information was changed intentionally, and functions for which the stack usage tracer forcibly set an additional margin.
Adjust Stack Size dialog box	This dialog box is used to change the information for the selected function.
Open dialog box	This dialog box is used to open an existing stack size specification file.

Main window

This is the first window to be open when CubeSuite+ is launched.
This window is used to control the user program execution and open panels for the build process.

Figure A-1. Main Window



The following items are explained here.

- [How to open]
- [Description of each area]

[How to open]

- Select Windows [start] >> [All programs] >> [Renesas Electronics CubeSuite+] >> [CubeSuite+].

[Description of each area]

(1) Menu bar

Displays the menu relates to build.

(a) [Project]

The [Project] menu shows menu items to operate the project and others.

Add New Subproject...	Closes the current project and opens the Create Project dialog box to create a new project. If the currently open project or file has been modified but it has not been saved yet, a confirmation message is displayed to ask you whether you want to save it.
Open Project...	Closes the current project and opens the Open Project dialog box to open the existing project. If the currently open project or file has been modified but it has not been saved yet, a confirmation message is displayed to ask you whether you want to save it.
Favorite Projects	Displays a cascading menu to use to open or save your favorite project.
1 *path*	[Opens your favorite project registered with [Favorite Projects] >> [1 Register to Favorite Project]. If no project has been registered,"Favorite Project" is displayed.
2 *path*	[Opens your favorite project registered with [Favorite Projects] >> [2 Register to Favorite Project]. If no project has been registered,"Favorite Project" is displayed.
3 *path*	[Opens your favorite project registered with [Favorite Projects] >> [3 Register to Favorite Project]. If no project has been registered,"Favorite Project" is displayed.
4 *path*	[Opens your favorite project registered with [Favorite Projects] >> [4 Register to Favorite Project]. If no project has been registered,"Favorite Project" is displayed.
1 Register to Favorite Project	The current project path is added to [1 *path*] in [Favorite Projects].
2 Register to Favorite Project	The current project path is added to [2 *path*] in [Favorite Projects].
3 Register to Favorite Project	The current project path is added to [3 *path*] in [Favorite Projects].
4 Register to Favorite Project	The current project path is added to [4 *path*] in [Favorite Projects].
Add	Shows the cascading menu to add subprojects to the project.
Add Subproject...	Opens the Add Existing Subproject dialog box to add an existing subproject to the project.
Add New Subproject...	Opens the Create Project dialog box to add a new subproject to the project.
Add File...	Opens the Add Existing File dialog box to add the selected file to the project.
Add New File...	Opens the Add File dialog box to create a file with the selected file type and add to the file to the project. The added file can be opened with the application corresponds to the file extension.
Add New Category	Adds a new category node to the root of the File node. This allows the category name to be changed. The default category name is "New category". The new category name can be changed to the same name as the existing category node. Note that this menu is disabled when the build tool is in operation.

Sets *selected project or sub-project* as Active Project.	Set the selected project or subproject as an active project.
Close Project	Closes the current project. If the currently open project or file has been modified but it has not been saved yet, a confirmation message is displayed to ask you whether you want to save it.
Save Project	Saves the configuration information of the current project to the project file.
Save Project As...	Opens the Save Project As dialog box to save the configuration information of the current project to the project file with another name.
Remove from Project	Removes the selected project or subproject from the project. The subproject files or the file themselves are not deleted from the file system.
Save Project and Development Tools as Package...	Saves a set of the this product and the project by copying them in a folder.

(b) [Build]

The [Build] menu shows menu items for the build process and others.

Build Project	Builds the project. The subproject is also built when it is added in the project. Note that this menu is disabled when the build tool is in operation.
Rebuild Project	Rebuilds the project. The subproject is also rebuilt when it is added in the project. Note that this menu is disabled when the build tool is in operation.
Clean Project	Cleans the project. The subproject is also cleaned when it is added in the project. Note that this menu is disabled when the build tool is in operation.
Rapid Build	Toggles the rapid build function between enabled (default) and disabled.
Update Dependencies	Updates the dependency of the file in the project to build. The dependency of the file in the subproject to build is also updated when the subproject is added to the project.
Build *active project*	Builds the active project. If the active project is the main project, its subproject is not built. Note that this menu is disabled when the build tool is in operation.
Rebuild *active project*	Rebuilds the active project. If the active project is the main project, its subproject is not rebuilt. Note that this menu is disabled when the build tool is in operation.
Clean *active project*	Cleans the active project. If the active project is the main project, its subproject is not cleaned. Note that this menu is disabled when the build tool is in operation.
Update Dependencies of *active project*	Updates the dependency of the file in the active project to build.
Stop Build	Cancels the build, rebuild, batch build and clean operation.
Build Mode Settings...	Opens the Build Mode Settings dialog box to modify and add to the build mode.
Batch Build...	Opens the Batch Build dialog box to batch build.
Build Option List	Lists the currently set build option in the Output panel.

(2) Toolbar

Buttons used in build process are displayed.

(a) Build toolbar

Build toolbar shows buttons used in build process.

	Builds projects. The subproject is also built when it is added in the project. Note that this button is disabled when the build tool is in operation.
	Rebuilds projects. The subproject is also rebuilt when it is added in the project. Note that this button is disabled when the build tool is in operation.
	Cancels the build, rebuild, batch build and clean in operation.

(3) Panel display area

The following panels are displayed in this area.

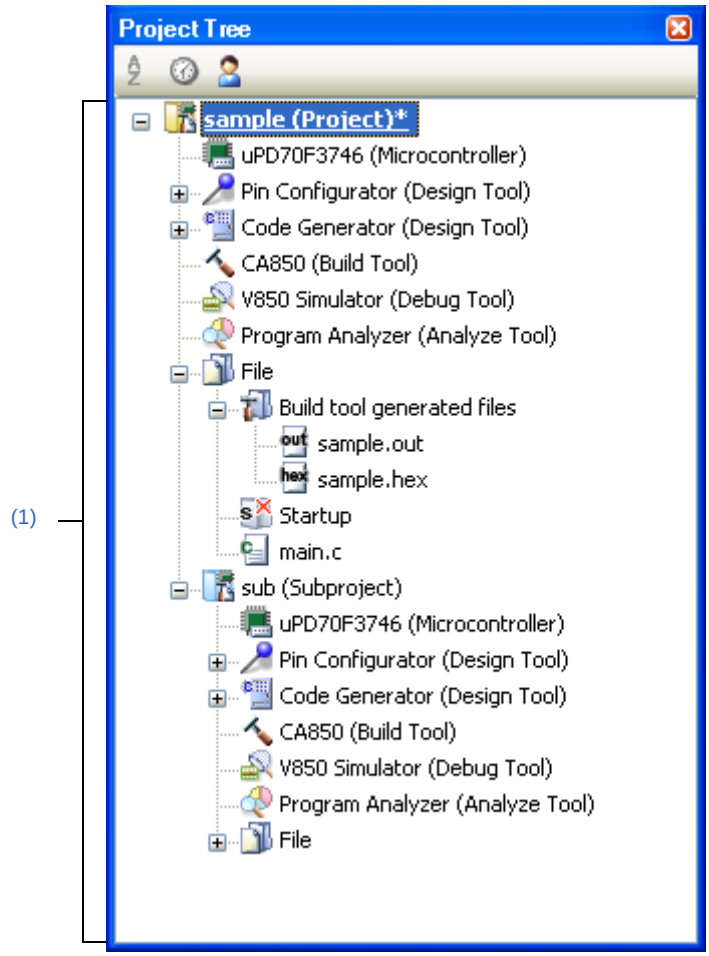
- Project Tree panel
- Property panel
- Editor panel
- Output panel

See the each panel section for details of the contents of the display.

Project Tree panel

This panel is used to display the project components such as the build tool, source files, etc. in tree view.

Figure A-2. Project Tree Panel



The following items are explained here.

- [How to open]
- [Description of each area]
- [[Edit] menu (only available for the Project Tree panel)]
- [Context menu]

[How to open]

- From the [View] menu, select [Project Tree].

[Description of each area]

(1) Project tree area

Project components are displayed in tree view with the following given node.

Node	Description
Project name (Project) (hereafter referred to as "Project node")	Project name.
Build tool name (Build tool) (hereafter referred to as "Build tool node")	The build tool (compiler, assembler, etc.) used in the project.
File (hereafter referred to as "File node")	The following files that are added to the project are displayed under the root of this node. - C source file (*.c) - Assembler source file (*.s) - Header file (*.h, *.inc) - Object file (*.o) - Library file (*.a) - Link directive file (*.dr, *.dir) - Section file (*.sf) - Other file (doc, xml, etc.)
Build tool generated files (hereafter referred to as "Build tool generated files node")	The following files generated by the build tool appear directly below the node generated during the build. - For other than library projects Load module file (*.out) Link map file (*.map) Hex file (*.hex) Dump list (dump.txt) Cross reference information (cxref) Tag information (ctags) Call tree information (ccalltre.csv, ccalltre.lst) Function metrics information (cmeasure.csv, cmeasure.lst) Call database information (cprofile.csv, cprofile.dat) Memory map table (rammap.csv) - For library projects Archive file (*.a) Dump list (dump.txt) Cross reference information (cxref) Tag information (ctags) Call tree information (ccalltre.csv, ccalltre.lst) Function metrics information (cmeasure.csv, cmeasure.lst) Call database information (cprofile.csv, cprofile.dat) Files displayed under this node cannot be renamed, deleted, or moved. This node is always placed lower than the File node. This node will no longer appear if you reload the project after building.
Startup (hereafter referred to as "Startup node")	This is a node for adding other than standard startup files to the project. This node is always placed lower than the File node.

Node	Description
Category name (hereafter referred to as "category node")	Categories that the user created to categorize files (see "2.3.6 Classify a file into a category"). This node is always placed lower than the File node.
Subproject name (Subproject) (hereafter referred to as "Subproject node")	Subprojects added to the project.

When each component (the node or file) is selected, the detailed information (property) is displayed in the Property panel. You can change the settings.

Remark When more than one components are selected, only the tab that is common to all the components is displayed.
When multiple files are selected and the values of their common properties are different, then the corresponding value fields are displayed blank.

This area has the following functions.

(a) Add files

You can add files by one of the following procedure.
The files are added under the File node.

<1> Add existing files

- Select either one of the Project node, Subproject node, File node or a file. Then select [Add] >> [Add File...] from the [File] menu. The Add Existing File dialog box appears. Select files to add.
- Select either one of the Project node, Subproject node, File node or a file. Then select [Add] >> [Add File...] from the context menu. The Add Existing File dialog box appears. Select files to add.
- Copy the file using windows explorer and the like and then point the mouse to this area. Select [Paste] from the [Edit] menu.
- Drag files using windows explorer and the like and then drop them at the location in this area where you want to add the files to.

Remark If the files are dragged from the windows explorer and the like and then dropped in the blank space under the lower project tree, it is regarded as dropped in the Main project.

<2> When new files are added

- Select either one of the Project node, Subproject node, File node or a file. Then select [Add] >> [Add New File...] from the [File] menu. The Add File dialog box appears. Designate the file to create.
- Select either one of the Project node, Subproject node, File node or a file. Then select [Add] >> [Add New File...] from the context menu. The Add File dialog box appears. Designate the file to create.

Remark A blank file is created at the location designated in the Add File dialog box.

(b) Remove the file from a project

You can remove files from the project by one of the following procedure.
The removed files are not deleted from the file system in this operation.

- Select the file you want to remove from the project. Then select [Remove from Project] from the [Project] menu.

- Select the file you want to remove from the project. Then select [Remove from Project] from the context menu.

(c) Move files

You can move files by the following procedure.
The file are moved under the File node.

- Drag the file you want to move and then drop it in the destination.

Remarks 1. Individual option is retained when the file is dropped in the main project or subproject.

2. The file is copied, not moved when the file is dropped between the different project, or in the main project or subproject in same project. Note that this operation does not retain the individual option set in each file.

(d) Add categories

You can add the category node by one of the following procedure.
The category node are added under the File node.

- Select [Add New Category] from the [Project] menu.
- Select [Add New Category] from the context menu of either one of the Project node, Subproject node, or File node.

Remarks 1. The default category name is "New category".

2. The new category name can be changed to the same name as the existing category node.

(e) Move categories

You can move the category node by the following procedure.
The category node are moved under the File node.

- Drag the category node you want to move and then drop it in the destination.

Remarks 1. Individual option set in the file in the category node is retained when the category node is dropped in the main project or subproject.

2. The category node is copied, not moved when the it is dropped between the different project, or in the main project or subproject in same project. Note that the individual option set in each file contained in the category node is not retained.

(f) Add folders

You can add folders from Explorer or the like by the following procedure.
The folders are added under the File node.
The folders are added as categories.

- Drag the folder from Explorer or the like, and drop it over its destination. The Add Folder and File dialog box opens. Specify the file types and subdirectory levels in the folder to add.

Caution You cannot drag and drop folders and files into this area simultaneously.

(g) Modify the display order of the subprojects placed in order of build

The subproject is displayed in order of build from the top. Therefore, the order of build can be changed by changing the display order of the subprojects.
The project must be built from the subproject then the main project.

(h) Configure the standard build option

When the standard build option is changed, the property is displayed in boldface in the Property panel.

You can change the standard build option to the current setting (cancel boldface) by the following procedure.

- Select the Build tool node and then select [Set to Default Build Option for Project] in the context menu.

Remark The configuration of the standard build option takes effect to the whole project (main project and subproject).

(i) Sort files and categories

You can sort files and category nodes in order of the file name, time stamp, or the user definition by the following procedure.

- Select one of the buttons in the toolbar.

The following table explains the buttons.
 is selected default by default.

Button	Description
	Sorts files and category nodes in order of their names.  : Ascending order  : Descending order  : Ascending order
	Sorts files and category nodes in order of their time stamp.  : Descending order  : Ascending order  : Descending order
	Sorts files and category nodes in order of the user definition (default). You can change the display order by dragging and dropping the file and category node.

(j) Display the file while editing

When the file added to the project is edited in the Editor panel and the file is not saved once, the file name is followed by "*". When the file is saved, "*" is deleted.

The file that is saved	 main.c
The file that is not saved after editing	 main.c*

(k) Display the source file in boldface that the individual build option is set

The source file icon whose option is different from the project general option (individual compile option, individual assemble option) is changed to a different one from the normal icon.

The file with project general option	 main.c
The file with individual build option	 main.c

(l) Highlight the file with read-only attribute

The read-only file added to the project is displayed in italic.

The file without read-only attribute	 main.c
The file with read-only attribute	 *main.c*

(m) Highlight the file that does not exist

The file that is added to the project but does not exist is grayed out and its icon is dimmed.

The file that exists	 main.c
The file that does not exist	 *main.c*

(n) Highlight the build-target file

<1> The file which the error occurred during building (rapid building), rebuilding, compiling or assembling is highlighted as the example below.

The file without errors or warnings	 main.c
The file with error	 main.c
The file with warning	 main.c

Remarks 1. The file with both the error and the warning is highlighted in red.

2. The highlight is canceled when the build option (general option or individual option) or the build mode is changed.

<2> The names of the following files are displayed in boldface.

- The source files that have not been compiled after edited
- The source files after cleaning has been executed
- The source files after build tool options have been changed
- The source files after any build mode has been changed

Remark The file names are all displayed in boldface right after the project is opened. The boldface display is canceled after building is executed.

(o) Highlight non build-target file

The file that is set as non build-target is highlighted as shown in the example below.

Build-target file	 main.c
Non build-target file	 main.c

(p) Highlight the project that has been changed

The file component that is added to the project and the property of the project component are changed, the project name is followed by "*" and is displayed in boldface.

The boldface is canceled when the project is saved.

The project that has not been changed	 sample (Project)
The project that has been changed	 **sample (Project)***

(q) Highlight the active project

The active projects is underlined.

Non-active project	 **sample (Project)***
Active project	 **sample (Project)***

(r) Run the editor

Open the file with the specific extension in the Editor panel. When an external editor is specified to use in the Option dialog box, open the file with the external editor. Other files are opened with the application associated with the OS.

Caution The files with the extensions that are not associated with the OS are not displayed.

You can open the editor by one of the following procedure.

- Double click the file.
- Select the file and then select [Open] from the context menu.
- Select the file and then press the [Enter] key.

The files that can be opened in the Editor panel are as follows.

- C source file (.c)
- Assembler source file (.s)
- Header file (.h, .inc)
- Link directive file (.dr, .dir)
- Section file (.sf)
- Map file (.map)
- Hex file (.hex)
- Text file (.txt)

Remark You can use one of the methods below to open files other than those listed above in the Editor panel.

- Drag the file and drop it into the Editor panel.
- Select the file and then select [Open with Internal Editor...] from the context menu.

[[Edit] menu (only available for the Project Tree panel)]

Copy	Copies the selected file or category node to the clipboard. While editing the file name or the category name, the characters of the selection are copied to the clipboard. Note that this menu is only enabled when the file or category node is selected.
Paste	Inserts the contents of the clipboard directly below the selected node on the project tree. While editing the file name or the category name, insert the contents of the clipboard. Note that this menu is disabled when the contents of the clipboard exist in the same project, when multiple files and category nodes are selected, and when the build tool is in operation.
Rename	You can rename the selected project, subproject, file, and category node. Press the [Enter] key to confirm the rename. Press the [ESC] key to cancel. When the file is selected, the actual file name is also changed. When the selected file is added to other project, those file names are also changed. Note that this menu is only enabled when the project, subproject, file, and category node is selected. Note that rename is disabled when the build tool is in operation.

[Context menu]

(1) When the Project node is selected

Build *active project*	Builds the active project. If the active project is the main project, its subproject is not built. Note that this menu is disabled when the build tool is in operation.
Rebuild *active project*	Rebuilds the active project. If the active project is the main project, its subproject is not rebuilt. Note that this menu is disabled when the build tool is in operation.
Clean *active project*	Cleans the active project. If the active project is the main project, its subproject is not cleaned. Note that this menu is disabled when the build tool is in operation.
Open Folder with Explorer	Opens the folder that contains the project file of the selected project with Explorer.
Add	Shows the cascading menu to add subprojects and files to the project.
Add Subproject...	Opens the Add Existing Subproject dialog box to add the selected subproject to the project.
Add New Subproject...	Opens the Create Project dialog box to add the created subproject to the project.
Add File...	Opens the Add Existing File dialog box to add the selected file to the project.
Add New File...	Opens the Add File dialog box to create a file with the selected file type and add to the project. The added file can be opened with the application corresponds to the file extension.
Add New Category	Adds a new category node to the root of the File node. This allows the category name to be changed. Up to 200 characters can be specified. The default category name is "New category". The new category name can be changed to the same name as the existing category node. This menu is disabled while the build tool is running, and if categories are nested 20 levels.
Set *selected project* as Active Project	Sets the selected project to an active project.
Save Project and Development Tools as Package...	Saves a set of the this product and the project by copying them in a folder.
Paste	This menu is always disabled.
Rename	You can rename the selected project.
Property	Displays the selected project's property on the Property panel.

(2) When the Subproject node is selected

Build *active project*	Builds the active project. Note that this menu is disabled when the build tool is in operation.
Rebuild *active project*	Rebuilds the active project. Note that this menu is disabled when the build tool is in operation.
Clean *active project*	Cleans the active project. Note that this menu is disabled when the build tool is in operation.
Open Folder with Explorer	Opens the folder that contains the subproject file of the selected subproject with Explorer.
Add	Shows the cascading menu to add subprojects, files, and category nodes to the project.
Add Subproject...	Opens the Add Existing Subproject dialog box to add the selected subproject to the project. The subproject cannot be added to another subproject.
Add New Subproject...	Opens the Create Project dialog box to add the created subproject to the project. The subproject cannot be added to another subproject.
Add File...	Opens the Add Existing File dialog box to add the selected file to the project.
Add New File...	Opens the Add File dialog box to create a file with the selected file type and add to the project. The added file can be opened with the application corresponds to the file extension.
Add New Category	Adds a new category node to the root of the File node. This allows the category name to be changed. Up to 200 characters can be specified. The default category name is "New category". The new category name can be changed to the same name as the existing category node. This menu is disabled while the build tool is running, and if categories are nested 20 levels.
Set *selected subproject* as Active Project	Sets the selected subproject to an active project.
Remove from Project	Removes the selected subproject from the project. The subproject file itself is not deleted from the file system with this operation. When the selected subproject is the active project, it cannot be removed from the project. Note that this menu is disabled when the build tool is in operation.
Paste	This menu is always disabled.
Rename	You can rename the selected subproject.
Property	Displays the selected subproject's property on the Property panel.

(3) When the Build tool node is selected

Build Project	Builds the selected project (main project or subproject). The subproject is also built when it is added in the project. Note that this menu is disabled when the build tool is in operation.
Rebuild Project	Rebuilds the selected project (main project or subproject). The subproject is also rebuilt when it is added in the project. Note that this menu is disabled when the build tool is in operation.
Clean Project	Cleans the selected project (main project or subproject). The subproject is also cleaned when it is added in the project. Note that this menu is disabled when the build tool is in operation.
Set to Default Build Option for Project	Sets the current build option to the standard option for the selected project. When the subproject is added, it is not set. When the build option that is different from the standard option is set, its property is displayed in boldface.
Set Link Order...	Opens the Link Order dialog box to display object module files and library files and to setup their link order. Note that this menu is disabled when the build tool is in operation.
Create Link Directive File...	Opens the Link Directive File Generation dialog box ot create the link directive file.
Property	Displays the selected build tool's property on the Property panel.

(4) When the File node is selected

Add	Shows the cascading menu to add files and category nodes to the project.
Add File...	Opens the Add Existing File dialog box to add the selected file to the project. The file is added directly below this node. The added file can be opened with the application corresponds to the file extension.The file is added directly below this node.
Add New File...	Opens the Add File dialog box to create a file with the selected file type and add to the project. The file is added directly below this node. The added file can be opened with the application corresponds to the file extension.
Add New Category	Adds a new category node to the root of this node. You can rename the category. Up to 200 characters can be specified. The default category name is "New category". The new category name can be changed to the same name as the existing category node. This menu is disabled while the build tool is running, and if categories are nested 20 levels.
Remove from Project	This menu is always disabled.
Copy	This menu is always disabled.
Paste	Inserts the contents of the clipboard directly below this node. However, this menu is disabled when the contents of the clipboard exist in the same project.
Rename	This menu is always disabled.
Property	Displays the selected category node's property on the Property panel.

(5) When a file is selected

Compile	Compiles the selected C source file. Note that this menu is only displayed when a C source file (except for non build-target file) is selected. Note that this menu is disabled when the build tool is in operation.
Assemble	Assembles the selected assembler source file. Note that this menu is only displayed when an assembler source file (except for non build-target file) is selected. Note that this menu is disabled when the build tool is in operation.
Open	Opens the selected file with the application corresponds to the file extension (see "(r) Run the editor"). Note that this menu is disabled when multiple files are selected.
Open with Internal Editor...	Opens the selected file with the Editor panel. Note that this menu is disabled when multiple files are selected.
Open with Selected Application...	Opens the Open with Program dialog box to open the selected file with the designated application. Note that this menu is disabled when multiple files are selected.
Open Folder with Explorer	Opens the folder that contains the selected file with Explorer.
Add	Shows the cascading menu to add files and category nodes to the project.
Add File...	Opens the Add Existing File dialog box to add the selected file to the project. The file is added to the same level as the selected file.
Add New File...	Opens the Add File dialog box to create a file with the selected file type and add to the project. The file is added to the same level as the selected file. The added file can be opened with the application corresponds to the file extension.
Add New Category	Adds a new category node at the same level as the selected file. You can rename the category. Up to 200 characters can be specified. The default category name is "New category". The new category name can be changed to the same name as the existing category node. This menu is disabled while the build tool is running, and if categories are nested 20 levels.
Remove from Project	Removes the selected file from the project. The removed file is not deleted from the file system in this operation. Note that this menu is disabled when the build tool is in operation.
Copy	Copies the selected file to the clipboard. When the file name is in editing, the characters of the selection are copied to the clipboard.
Paste	This menu is always disabled.
Rename	You can rename the selected file. The actual file is also renamed. When the selected file is added to another projects, it is also renamed.
Property	Displays the selected file's property on the Property panel.

(6) When the Build tool generated files node is selected

Property	Displays this node 's property on the Property panel.

(7) When the Startup node is selected

Add	Shows the cascading menu to add files and category nodes to the project.
Add File...	Opens the Add Existing File dialog box to add the selected file to the project. The file is added directly below this node. The added file can be opened with the application corresponds to the file extension.
Add New File...	Opens the Add File dialog box to create a file with the selected file type and add to the project. The file is added directly below this node. The added file can be opened with the application corresponds to the file extension.
Add New Category	Adds a new category node to the root of this node. You can rename the category. Up to 200 characters can be specified. The default category name is "New category". The new category name can be changed to the same name as the existing category node. This menu is disabled while the build tool is running, and if categories are nested 20 levels.
Remove from Project	This menu is always disabled.
Copy	This menu is always disabled.
Paste	Inserts the contents of the clipboard directly below this node. However, this menu is disabled when the contents of the clipboard exist in the same project.
Rename	This menu is always disabled.
Property	Displays this node 's property on the Property panel.

(8) When a category node is selected

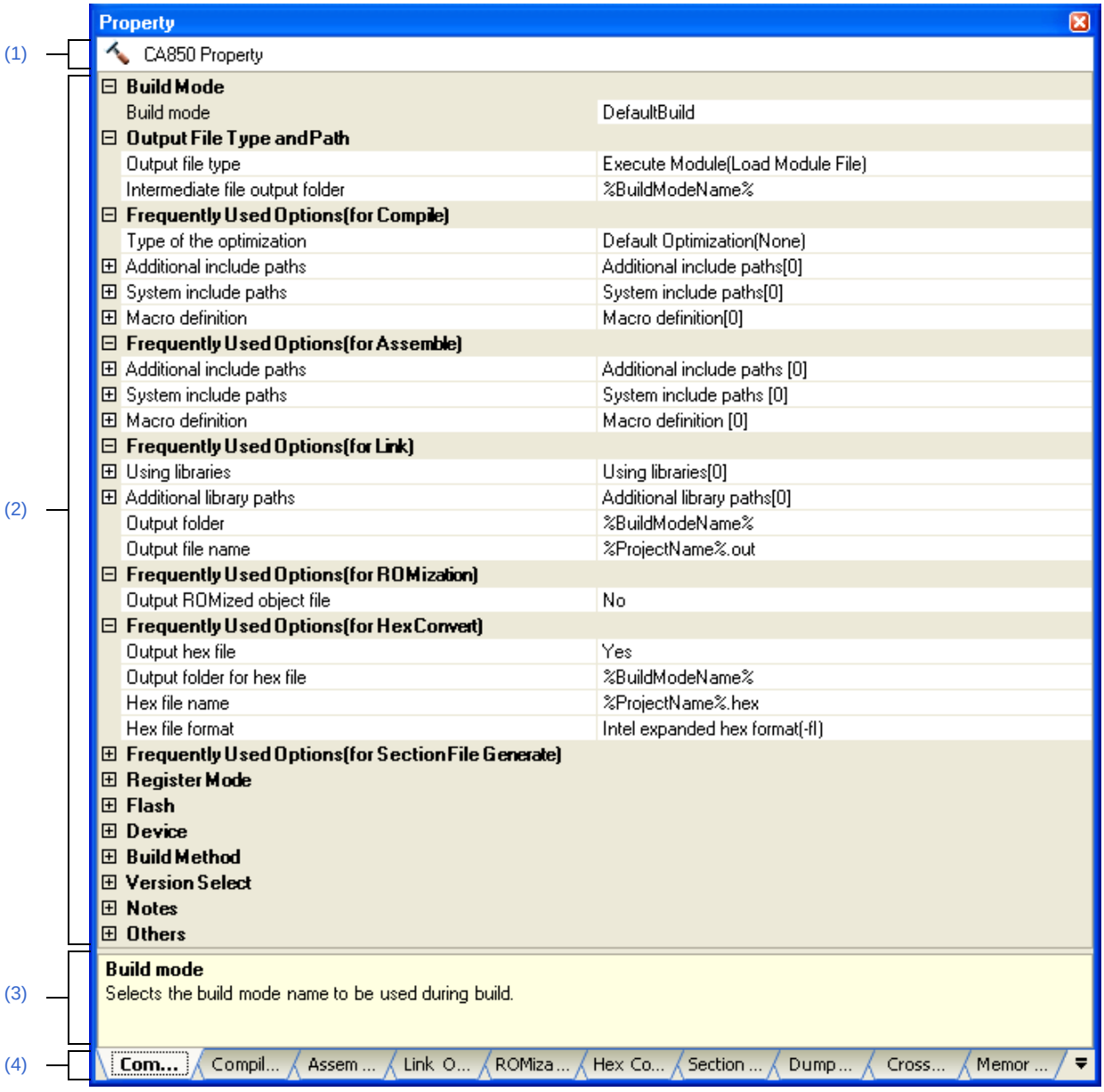
Add	Shows the cascading menu to add files and category nodes to the project.
Add File...	Opens the Add Existing File dialog box to add the selected file to the project. The file is added directly below this node. The added file can be opened with the application corresponds to the file extension.
Add New File...	Opens the Add File dialog box to create a file with the selected file type and add to the project. The file is added directly below this node. The added file can be opened with the application corresponds to the file extension.
Add New Category	Adds a new category node to the root of this node. You can rename the category. Up to 200 characters can be specified. The default category name is "New category". The new category name can be changed to the same name as the existing category node. This menu is disabled while the build tool is running, and if categories are nested 20 levels.
Remove from Project	Removes the selected category node from the project. Note that this menu is disabled when the build tool is in operation.
Copy	Copies the selected category node to the clipboard. When the category name is in editing, the characters of the selection are copied to the clipboard.

Paste	Inserts the contents of the clipboard directly below this node. However, this menu is disabled when the contents of the clipboard exist in the same project. When the category name is in editing, the contents of the clipboard are inserted.
Rename	You can rename the selected category node.
Property	Displays the selected category node's property on the Property panel.

Property panel

This panel is used to display the detailed information on the Build tool node, file, or category node that is selected on the Project Tree panel by every category and change the settings of the information.

Figure A-3. Property Panel



The following items are explained here.

- [How to open]
- [Description of each area]
- [[Edit] menu (only available for the Project Tree panel)]
- [Context menu]

[How to open]

- On the Project Tree panel, select the Build tool node, file, or category node, and then select [Property] from the [View] menu or [Property] from the context menu.

Remark When either one of the Build tool node, file, or category node on the Project Tree panel while the Property panel is opened, the detailed information of the selected node is displayed.

[Description of each area]

(1) Selected node area

Display the name of the selected node on the Project Tree panel.
When multiple nodes are selected, this area is blank.

(2) Detailed information display/change area

In this area, the detailed information on the Build tool node, file, or category node that is selected on the Project Tree panel is displayed by every category in the list. And the settings of the information can be changed directly.
Mark ⊟ indicates that all the items in the category are expanded. Mark ⊞ indicates that all the items are collapsed. You can expand/collapse the items by clicking these marks or double clicking the category name.
Mark HEX indicates that only the hex number is allowed to input in the text box.
See the section on each tab for the details of the display/setting in the category and its contents.

(3) Property description area

Display the brief description of the categories and their contents selected in the detailed information display/change area.

(4) Tab selection area

Categories for the display of the detailed information are changed by selecting a tab.
In this panel, the following tabs are contained (see the section on each tab for the details of the display/setting on the tab).

(a) When the Build tool node is selected on the Project Tree panel

- [Common Options] tab
- [Compile Options] tab
- [Assemble Options] tab
- [Link Options] tab
- [ROMization Process Options] tab
- [Hex Convert Options] tab
- [Archive Options] tab
- [Section File Generate Options] tab
- [Dump Options] tab
- [Cross Reference Options] tab
- [Memory Layout Visualization Options] tab

(b) When a file is selected on the Project Tree panel

- [Build Settings] tab (for C source file, assembler source file, link directive file, section file, object file, and library file)
- [Individual Compile Options] tab (for C source file)
- [Individual Assemble Options] tab (for assembler source file)
- [File Information] tab

(c) When the category node, File node, Build tool generated files node, or Startup node is selected on the Project Tree panel

- [Category Information] tab

Remark When multiple components are selected on the Project Tree panel, only the tab that is common to all the components is displayed. If the value of the property is modified, that is taken effect to the selected components all of which are common to all.

[[Edit] menu (only available for the Project Tree panel)]

Undo	Cancels the previous edit operation of the value of the property.
Cut	While editing the value of the property, cuts the selected characters and copies them to the clip board.
Copy	Copies the selected characters of the property to the clip board.
Paste	While editing the value of the property, inserts the contents of the clip board.
Delete	While editing the value of the property, deletes the selected character string.
Select All	While editing the value of the property, Selects all the characters of the selected property.

[Context menu]

Undo	Cancels the previous edit operation of the value of the property.
Cut	While editing the value of the property, cuts the selected characters and copies them to the clip board.
Copy	Copies the selected characters of the property to the clip board.
Paste	While editing the value of the property, inserts the contents of the clip board.
Delete	While editing the value of the property, deletes the selected character string.
Select All	While editing the value of the property, selects all the characters of the selected property.
Reset to Default	Restores the configuration of the selected item to the default configuration of the project. For the [Individual Compile Options] tab and [Individual Assemble Options] tab, restores to the configuration of the general option.
Reset All to Default	Restores all the configuration of the current tab to the default configuration of the project. For the [Individual Compile Options] tab and [Individual Assemble Options] tab, restores to the configuration of the general option.

[Common Options] tab

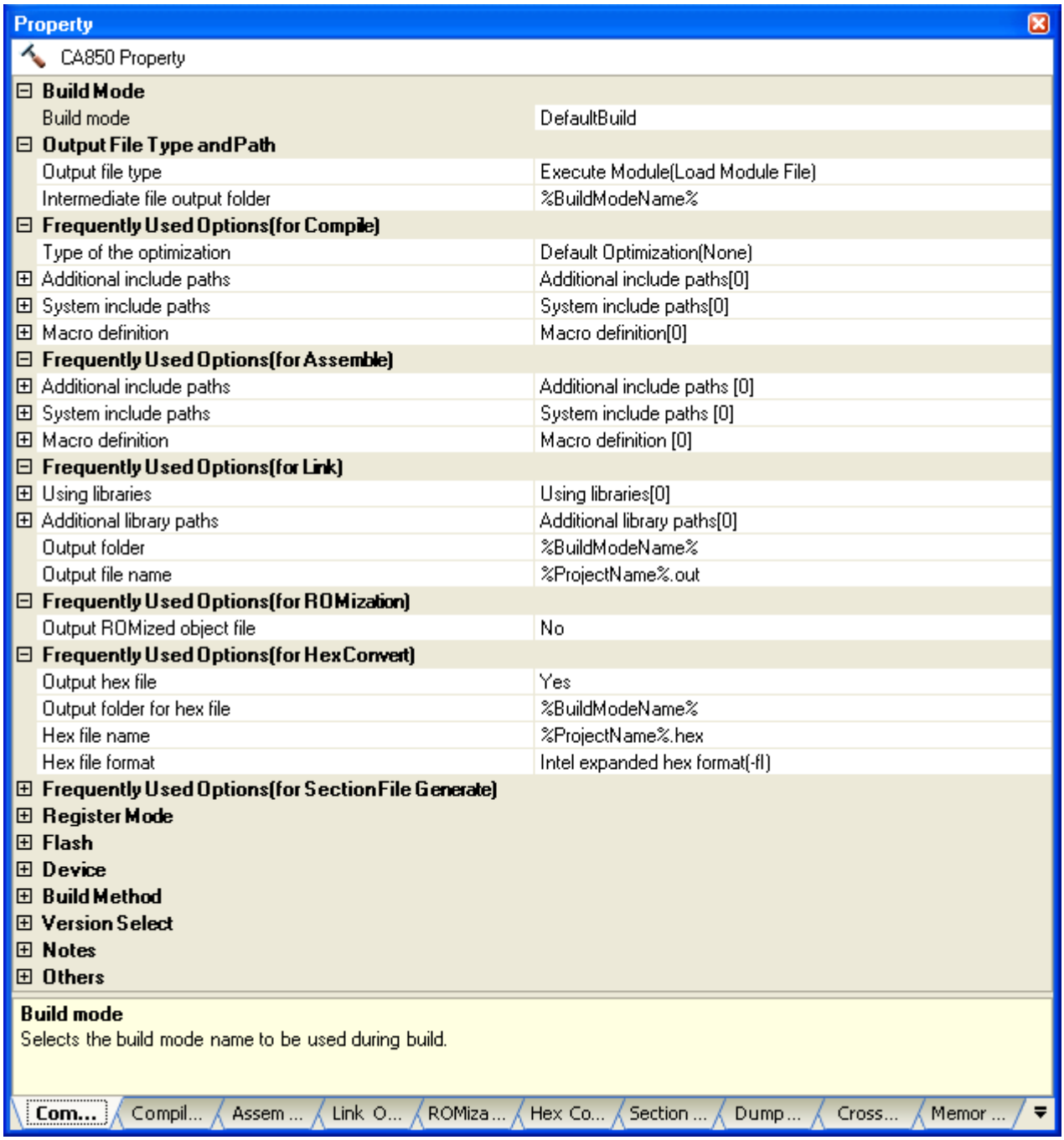
This tab shows the detailed information on the build tool categorized by the following and the configuration can be changed.

(1) [Build Mode]
(2) [Output File Type and Path]
(3) [Frequently Used Options(for Compile)]
(4) [Frequently Used Options(for Assemble)]
(5) [Frequently Used Options(for Link)]
(6) [Frequently Used Options(for ROMization)]
(7) [Frequently Used Options(for Hex Convert)]
(8) [Frequently Used Options(for Section File Generate)]
(9) [Register Mode]
(10) [Flash]
(11) [Device]
(12) [Build Method]
(13) [Version Select]
(14) [Notes]
(15) [Others]

Remark If the property in the [Frequently Used Options] category is changed, the value of the property having the same name contained in the corresponding tab will be changed accordingly.

Category from [Common Options] Tab	Corresponding Tab
[Frequently Used Options(for Compile)] category	[Compile Options] tab
[Frequently Used Options(for Assemble)] category	[Assemble Options] tab
[Frequently Used Options(for Link)] category	[Link Options] tab
[Frequently Used Options(for ROMization)] category	[ROMization Process Options] tab
[Frequently Used Options(for Hex Convert)] category	[Hex Convert Options] tab
[Frequently Used Options(for Section File Generate)] category	[Section File Generate Options] tab

Figure A-4. Property Panel: [Common options] Tab



[Description of each category]

(1) [Build Mode]

The detailed information on the build mode is displayed and the configuration can be changed.

Build mode	Select the build mode to be used during build. Note that this property is not applied to [Reset All to Default] from the context menu.		
	Default	DefaultBuild	
	How to change	Select from the drop-down list.	
	Restriction	DefaultBuild	Builds with the default build mode that is set when a new project is created.
		Build mode that is added to the project (other than DefaultBuild)	Builds with the build mode that is added to the project (other than DefaultBuild).

(2) [Output File Type and Path]

The detailed information on output file types and paths are displayed and the configuration can be changed.

Output file type	Select the type of the file to be generated during build. The file type set here is subject to debugging. For other than library projects, only [Execute Module(ROMization Module)], [Execute Module(Load Module File)], and [Execute Module(Hex File)] are displayed. However, only [Execute Module(ROMization Module)] and [Execute Module(Load Module File)] is displayed when [Yes] is selected in the [Output hex file] property in the [Output File] category from the [Hex Convert Options] tab. Only [Execute Module(Load Module File)] and [Execute Module(Hex File)] is displayed when [No] is selected in the [Output ROMized object file] property in the [Output File] category from the [ROMization Process Options] tab. For library projects, only [Library] is displayed.		
	Default	- For other than library projects Execute Module(Load Module File) - For library projects Library	
	How to change	Select from the drop-down list.	
	Restriction	Execute Module(ROMization Module)	The file to be generated during build is regarded as the executable format (ROMization module file).
		Execute Module(Load Module File)	The file to be generated during build is regarded as the executable format (load module file).
		Execute Module(Hex File)	The file to be generated during build is regarded as the executable format (hex file).
		Library	The file to be generated during build is regarded as the library format (library file).

Output common object file for various devices	Select whether to output the objects common to the various devices. This corresponds to the -cn, -cnv850e and -cnv850e2 options of the compiler and assembler. This property is displayed only for library projects.		
	Default	No(specific device)(None)	
	How to change	Select from the drop-down list.	
	Restriction	Yes(V850 core common)(-cn)	Outputs an object that can be used commonly in the V850 core. The resultant object can be linked with the V850/V850ES/V850E1/V850E2 core object.
		Yes(V850E/ES core common)(-cnv850e)	Outputs an object that can be used commonly in the V850E/ES core. The resultant object can be linked with the V850ES/V850E1/V850E2 core object.
		Yes(V850E2 core common)(-cnv850e2)	Outputs an object that can be used commonly in the V850E2 core. The resultant object can be linked with the V850E2 core object.
		No(specific device)(None)	The object having information specific to the specified device is output. It is possible to use SFR names and interrupts in the description contained in the library.
Intermediate file output folder	Specify the path to the folder to which intermediate files are to be output. If a relative path is specified, the reference point of the path is the main project or subproject folder. If an absolute path is specified, the reference point of the path is the main project or subproject folder (unless the drives are different). The following macro names are available as embedded macros. %BuildModeName%: Replaces with the build mode name. If this is blank, it is treated as if the project folder is specified.		
	Default	%BuildModeName%	
	How to change	Directly enter to the text box or edit by the Browse For Folder dialog box which appears when clicking the [...] button.	
	Restriction	Up to 247 characters	

(3) [Frequently Used Options(for Compile)]

The detailed information on frequently used options for compilation are displayed and the configuration can be changed.

<table>
<tr><td rowspan="9">Type of the optimization</td><td colspan="3">Select the type of the optimization for compiling.
This corresponds to the -O* option of the compiler.</td></tr>
<tr><td>Default</td><td colspan="2">Default Optimization(None)</td></tr>
<tr><td>How to change</td><td colspan="2">Select from the drop-down list.</td></tr>
<tr><td rowspan="6">Restriction</td><td>Optimize for Debugging(-Od)</td><td>Performs optimization with the debug precedence.
Generates codes emphasizing source debugging, without putting stress on the ROM capacity and execution speed.</td></tr>
<tr><td>Default Optimization(None)</td><td>Generates codes emphasizing source debugging.
Performs optimization within a range where source debugging is not affected.</td></tr>
<tr><td>Standard Optimization(-Og)</td><td>Performs appropriate optimization.
Performs optimization that allows debugging of the C source in most cases.</td></tr>
<tr><td>Level 1 Advanced Optimization(-O)</td><td>Performs advanced optimization.
Performs optimization emphasizing the ROM capacity.</td></tr>
<tr><td>Level 2 Advanced Opt.(Code size precedence)(-Os)</td><td>Performs more advanced optimization (object size precedence).
Performs the maximum optimization placing the utmost emphasis on the ROM capacity.</td></tr>
<tr><td>Level 2 Advanced Opt.(Speed precedence)(-Ot)</td><td>Performs more advanced optimization (execution speed precedence).
Performs the maximum optimization placing the utmost emphasis on the execution speed.</td></tr>
<tr><td rowspan="4">Additional include paths</td><td colspan="3">Specify the additional include paths during compiling.
The following macro names are available as embedded macros.
%BuildModeName%: Replaces with the build mode name.
%ProjectName%: Replaces with the project name.
%MicomToolPath%: Replaces with the absolute path of the product install folder.
When this property is omitted, only the standard folder of the compiler is searched. The reference point of the path is the project folder.
This corresponds to the -I option of the compiler.
The specified include path is displayed as the subproperty.
When the include path is added to the project tree, the path is added to the top of the subproperties.
Uppercase characters and lowercase characters are not distinguished for the include paths.</td></tr>
<tr><td>Default</td><td colspan="2">Additional include paths[number of defined items]</td></tr>
<tr><td>How to change</td><td colspan="2">Edit by the Path Edit dialog box which appears when clicking the [...] button.
For the subproperty, you can use the text box directly enter the text.</td></tr>
<tr><td>Restriction</td><td colspan="2">Up to 259 characters
Up to 64 items can be specified.</td></tr>
</table>

System include paths	The include paths which the system set during compiling are displayed. The following macro names are available as embedded macros. %BuildModeName%: Replaces with the build mode name. %ProjectName%: Replaces with the project name. %MicomToolPath%: Replaces with the absolute path of the product install folder. The system include path is searched with lower priority than the additional include path. The reference point of the path is the project folder. This corresponds to the -i option of the compiler. The include path is displayed as the subproperty.	
	Default	System include paths[*number of defined items*]
	How to change	Edit by the System Include Path Order dialog box which appears when clicking the [...] button.
	Restriction	Changes not allowed (Only the specified order of the include paths can be changed.)
Macro definition	Specify the macro name to be defined. Specify in the format of "*macro name=defined value*", with one macro name per line. The "*=def*" part can be omitted, and in this case, "1" is used as the defined value. This corresponds to the -D option of the compiler. The specified macro is displayed as the subproperty.	
	Default	Macro definition[*number of defined items*]
	How to change	Edit by the Text Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.
	Restriction	Up to 256 characters Up to 256 items can be specified.

(4) [Frequently Used Options(for Assemble)]

The detailed information on frequently used options for assembling are displayed and the configuration can be changed.

Additional include paths	Specify the additional include paths during assembling. The following macro names are available as embedded macros. %BuildModeName%: Replaces with the build mode name. %ProjectName%: Replaces with the project name. %MicomToolPath%: Replaces with the absolute path of the product install folder. When this property is omitted, only the standard folder of the assembler is searched. The reference point of the path is the project folder. This corresponds to the -I option of the assembler. The specified include path is displayed as the subproperty. When the include path is added to the project tree, the path is added to the top of the subproperties. Uppercase characters and lowercase characters are not distinguished for the include paths.	
	Default	Additional include paths[*number of defined items*]
	How to change	Edit by the Path Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.
	Restriction	Up to 259 characters Up to 64 items can be specified. However, this also includes the number of paths used by linked tools.

System include paths	The include paths which the system set during assembling are displayed. The following macro names are available as embedded macros. %BuildModeName%: Replaces with the build mode name. %ProjectName%: Replaces with the project name. %MicomToolPath%: Replaces with the absolute path of the product install folder. The system include path is searched with lower priority than the additional include path. The reference point of the path is the project folder. This corresponds to the -i option of the assembler. The include path is displayed as the subproperty.	
	Default	System include paths[*number of defined items*]
	How to change	Edit by the System Include Path Order dialog box which appears when clicking the [...] button.
	Restriction	Changes not allowed (Only the specified order of the include paths can be changed.)
Macro definition	Specifies the macro name to be defined. Specify in the format "macro name=defined value", with one macro name per line. The "=def" part can be omitted, and in this case, "1" is used as the defined value. This corresponds to the -D option of the assembler. The specified macro is displayed as the subproperty.	
	Default	Macro definition[*number of defined items*]
	How to change	Edit by the Text Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.
	Restriction	Up to 256 characters Up to 256 items can be specified.

(5) [Frequently Used Options(for Link)]

The detailed information on frequently used options for linking are displayed and the configuration can be changed.
This category is not displayed for library projects.

Using libraries	Specify the library file name (lib*string*.a) to be used other than the standard libraries. Specify only the "*string*" part (example: if you specify "abc", "libabc.a" is assumed to be specified). Add one file in one line. The library files are searched from the library path. This corresponds to the -l option of the linker. The specified library file name is displayed as the subproperty.	
	Default	Using libraries[*number of defined items*]
	How to change	Edit by the Text Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.
	Restriction	Up to 63 characters Up to 256 items can be specified.

Additional library paths	Specify the search folder to be used other than the standard libraries. The following macro names are available as embedded macros. %BuildModeName%: Replaces with the build mode name. %ProjectName%: Replaces with the project name. %MicomToolPath%: Replaces with the absolute path of the product install folder. The library files are searched from the library path. If a relative path is specified, the reference point of the path is the project folder. This corresponds to the -L option of the linker. The specified library path name is displayed as the subproperty.		
	Default	Additional library paths[*number of defined items*]	
	How to change	Edit by the Path Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.	
	Restriction	Up to 259 characters Up to 256 items can be specified.	
Output folder	Specify the folder for saving the module that is generated. If a relative path is specified, the reference point of the path is the main project or subproject folder. If an absolute path is specified, the reference point of the path is the main project or subproject folder (unless the drives are different). The following macro name is available as an embedded macro. %BuildModeName%: Replaces with the build mode name. If this is blank, it is treated as if the project folder is specified.		
	Default	%BuildModeName%	
	How to change	Directly enter to the text box or edit by the Browse For Folder dialog box which appears when clicking the [...] button.	
	Restriction	Up to 247 characters	
Output file name	Specify the load module file name to be generated. The extension other than ".out" cannot be specified. If the extension is omitted, ".out" is automatically added. This corresponds to the -o option of the linker. The following macro name is available as an embedded macro. %ProjectName%: Replaces with the project name.		
	Default	%ProjectName%.out	
	How to change	Directly enter to the text box.	
	Restriction	Up to 259 characters	

(6) [Frequently Used Options(for ROMization)]

The detailed information on frequently used options for ROMization are displayed and the configuration can be changed.

This category is not displayed for library projects.

Output ROMized object file	Select whether to output the ROMized object file. This corresponds to the -Xr option of the compiler and the -lr option of the linker.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-Xr -lr)	Outputs the ROMized object file.
		No	Does not output the ROMized object file.
Output folder for ROMized object file	Specify the folder for saving the ROMized object file. This corresponds to the -o option of the ROMization processor. If a relative path is specified, the reference point of the path is the main project or subproject folder. If an absolute path is specified, the reference point of the path is the main project or subproject folder (unless the drives are different). The following macro name is available as an embedded macro. %BuildModeName%: Replaces with the build mode name. If this is blank, it is treated as if the project folder is specified. This property is displayed only when [Yes(-Xr -lr)] in the [Output ROMized object file] property is selected.		
	Default	%BuildModeName%	
	How to change	Directly enter to the text box or edit by the Browse For Folder dialog box which appears when clicking the [...] button.	
	Restriction	Up to 247 characters	
ROMized object file name	Specify the ROMized object file name. The extension other than ".out" cannot be specified. If the extension is omitted, ".out" is automatically added. This corresponds to the -o option of the ROMization processor. This property is displayed only when [Yes(-Xr -lr)] in the [Output ROMized object file] property is selected.		
	Default	romp.out	
	How to change	Directly enter to the text box.	
	Restriction	Up to 259 characters	

(7) [Frequently Used Options(for Hex Convert)]

The detailed information on frequently used options for hex conversion are displayed and the configuration can be changed.

This category is not displayed for library projects.

Output hex file	Select whether to output the hex file.		
	Default	Yes	
	How to change	Select from the drop-down list.	
	Restriction	Yes	Outputs the hex file.
		No	Does not output the hex file.

Output folder for hex file	Specify the folder for saving the hex file. This corresponds to the -o option of the hex converter. If a relative path is specified, the reference point of the path is the main project or subproject folder. If an absolute path is specified, the reference point of the path is the main project or subproject folder (unless the drives are different). The following macro name is available as an embedded macro. %BuildModeName%: Replaces with the build mode name. If this is blank, it is treated as if the project folder is specified. This property is displayed only when [Yes] in the [Output hex file] property is selected.		
	Default	%BuildModeName%	
	How to change	Directly enter to the text box or edit by the Browse For Folder dialog box which appears when clicking the [...] button.	
	Restriction	Up to 247 characters	
Hex file name	Specify the hex file name. This corresponds to the -o option of the hex converter. The extension can be freely specified. The following macro name is available as an embedded macro. %ProjectName%: Replaces with the project name. This property is displayed only when [Yes] in the [Output hex file] property is selected.		
	Default	%ProjectName%.hex	
	How to change	Directly enter to the text box.	
	Restriction	Up to 259 characters	
Hex file format	Select the format of the hex file to be generated. This corresponds to the -f option of the hex converter. This property is displayed only when [Yes] in the [Output hex file] property is selected.		
	Default	Intel expanded hex format(-fI)	
	How to change	Select from the drop-down list.	
	Restriction	Intel expanded hex format(-fI)	Specifies the Intel expanded hex format as the format of the hex file to be generated.
		Motorola S type format(standard address)(-fS)	Specifies the Motorola S type format (standard address) as the format of the hex file to be generated.
		Motorola S type format(32-bit address)(-fs)	Specifies the Motorola S type format (32-bit address) as the format of the hex file to be generated.
		Expanded Tektronix hex format(-fT)	Specifies the expanded Tektronix hex format as the format of the hex file to be generated.

(8) [Frequently Used Options(for Section File Generate)]

The detailed information on frequently used options for section file generation are displayed and the configuration can be changed.

Use section file generator	Select whether to use the section file generator.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes	Uses the section file generator. The section information file will be removed from the rapid build target.
		No	Does not use the section file generator.
Output folder for section file	Specify the folder for saving the section file. This corresponds to the -o option of the section file generator. If a relative path is specified, the reference point of the path is the main project or subproject folder. If an absolute path is specified, the reference point of the path is the main project or subproject folder (unless the drives are different). The following macro name is available as an embedded macro. %BuildModeName%: Replaces with the build mode name. If this is blank, it is treated as if the project folder is specified. This property is displayed only when [Yes] in the [Use section file generator] property is selected.		
	Default	%BuildModeName%	
	How to change	Directly enter to the text box or edit by the Browse For Folder dialog box which appears when clicking the [...] button.	
	Restriction	Up to 247 characters	
Section file name	Specify the section file name. The extension other than ".sf" cannot be specified. If the extension is omitted, ".sf" is automatically added. This corresponds to the -o option of the section file generator. The following macro name is available as an embedded macro. %ProjectName%: Replaces with the project name. This property is displayed only when [Yes] in the [Use section file generator] property is selected.		
	Default	%ProjectName%.sf	
	How to change	Directly enter to the text box.	
	Restriction	Up to 259 characters	

(9) [Register Mode]

The detailed information on register modes are displayed and the configuration can be changed.

Select register mode	Selects the register mode (number of registers used by the C compiler)[Note] of the software register bank function. This corresponds to the -reg option of the compiler and linker.		
	Default	32-register mode(None)	
	How to change	Select from the drop-down list.	
	Restriction	32-register mode(None)	Sets the register mode to 32.
		26-register mode(-reg26)	Sets the register mode to 26.
		22-register mode(-reg22)	Sets the register mode to 22.

Use mask registers	Select whether to use the r20 register and the r21 register as mask registers. This corresponds to the -Xmask_reg option of the compiler, the -m option of the assembler, and the -mask_reg option of the linker.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-Xmask_reg,-m, -mask_reg)	Outputs codes, assuming that an 8-bit mask value, 0xff, is set to r20 and a 16-bit mask value, 0xffff, is set to r21. When [32-register mode(None)] in the [Select register mode] property is selected, the library for a mask register function is referenced.
		No	Does not use the mask register function.

Note Register modes provided by the C compiler are shown below.

Register Mode	Working Registers	Registers for Register Variables
22-register mode	r10 to r14	r25 to r29
26-register mode	r10 to r16	r23 to r29
32-register mode	r10 to r19	r20 to r29

(10) [Flash]

The detailed information on the flash are displayed and the configuration can be changed.

Output flash object file	Selects whether to generate the object file for flash. This must be specified for both the flash area and the boot area.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes	Generates the object file for flash.
		No	Does not generate the object file for flash.
Branch table address	Specify the start address of the branch table. Specify the same address for both the flash area and the boot area. This corresponds to the -ext_table option of the linker. This property is displayed only when [Yes] in the [Output flash object file] property is selected.		
	Default	0x0	
	How to change	Directly enter to the text box.	
	Restriction	0x0 to 0xffffffff (hexadecimal number)	
Object file type	Select the type of the object file to be generated. This corresponds to the -Wa, -zf option of the compiler, the -zf option of the assembler, and the -zf option of the linker. This property is displayed only when [Yes] in the [Output flash object file] property is selected.		
	Default	Boot area object file (None)	
	How to change	Select from the drop-down list.	
	Restriction	Boot area object file (None)	Generates a boot area object file.
		Flash area object file(-Wa, -zf)	Generates a flash area object file.

Boot area object file name	Specifies the name of the boot area object file. This corresponds to the -zf option of the linker. If a relative path is specified, the reference point of the path is the main project or subproject folder. If an absolute path is specified, the reference point of the path is the main project or subproject folder (unless the drives are different). This property is displayed only when [Flash area object file(-Wa, -zf)] in the [Object file type] property is selected.	
	Default	Blank
	How to change	Directly enter to the text box or edit by the Specify Boot Area Object File dialog box which appears when clicking the [...] button.
	Restriction	Up to 259 characters

(11) [Device]

The detailed information on the device is displayed and the configuration can be changed.

256 MB mode	In the case of a device with 256 MB of physical address space, select whether to create a program that uses an address space of more than 64 MB and up to 256 MB. This corresponds to the -256M option of the compiler, assembler, and linker.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-X256M)	Treats the memory space as having 256 MB.
		No	Treats the memory space as having 64 MB.
Programmable I/O area start address	Specify the use of the programmable I/O area and the start address. The address is aligned with 16 KB. This corresponds to the -Xbpc option of the compiler and the -bpc option of the assembler. Values saved in versions of CubeSuite below 1.20 may be outside the allowed setting range. If the values set outside the allowed range are restored, this property is blank. This property is not displayed when the device does not have a programmable I/O function.		
	Default	Blank	
	How to change	Directly enter to the text box.	
	Restriction	Hexadecimal number (depends on the selected device)	
Security ID	Specify the security ID of an on-chip flash memory device. This corresponds to the -Xsid option of the linker. This property is not displayed when the device does not have a security ID function.		
	Default	0xffffffffffffffffffff	
	How to change	Directly enter to the text box.	
	Restriction	0x00000000000000000000 to 0xffffffffffffffffffff (20-digit (10-byte) hexadecimal number)	

(12) [Build Method]

The detailed information on the build method is displayed and the configuration can be changed.

Handling the source file includes non-existing file	Selects whether to recompile/assemble the source file if there are no files that include it.		
	Default	Re-compile/assemble the source file	
	How to change	Select from the drop-down list.	
	Restriction	Re-compile/assemble the source file	Recompiles/assembles the source file if there are no files that include it.
		Ignore re-compiling/ assembling the source file	Does not recompile/assemble the source file if there are no files that include it.

(13) [Version Select]

The detailed information on the build tool version is displayed and the configuration can be changed.

Using compiler package install folder	Display the folder in which the compiler package to be used is installed.		
	Default	*Install folder name*	
	How to change	Changes not allowed	
Using compiler package version	Select the version of the compiler package to be used. This setting is common to all the build modes. If you have selected a compiler package that has not been installed (e.g. if you open a project created in another execution environment), then that version is also displayed. If the options change depending on the compiler package, then the display of the build tool's properties will change according to the selected version.		
	Default	Always latest version which was installed	
	How to change	Select from the drop-down list.	
	Restriction	Always latest version which was installed	Uses the latest version in the installed compiler packages.
		Versions of the installed compiler packages	Uses the selected version in the compiler package.
Latest compiler package version which was installed	Display the version of the compiler package to be used when [Always latest version which was installed] is selected in the [Using compiler package version] property. This setting is common to all the build modes. This property is displayed only when [Always latest version which was installed] in the [Using compiler package version] property is selected.		
	Default	*The latest version of the installed compiler packages*	
	How to change	Changes not allowed	

(14) [Notes]

The detailed information on notes is displayed and the configuration can be changed.

Memo	Add memos to the build tool. Add one item in one line. This setting is common to all the build modes. The added memos are displayed as the subproperty.	
	Default	Memo[*number-of-items*]
	How to change	Edit by the Text Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.
	Restriction	Up to 256 characters Up to 256 items can be specified.

(15) [Others]

Other detailed information on the build tool are displayed and the configuration can be changed.

Output message format	Specify the format of the message being built. This applies to the messages output by the build tool to be used, and commands added by plugins. It does not apply to the output messages of commands specified in the [Commands executed before build processing] or [Commands executed after build processing] property. The following macro names are available as embedded macros. %Program%: Replaces with the program name under execution. %Options%: Replaces with the command line option under build execution. %FileName%: Replaces with the file name being built. If this is blank, it is assumed that "%Program% %Options%" has been specified.		
	Default	%FileName%	
	How to change	Directly enter to the text box (up to 256 characters) or select from the drop-down list.	
	Restriction	%FileName%	Displays the file name in the output message.
		%FileName%: %Options%	Displays the file name and command line options in the output message.
		%Program% %Options%	Displays the program name and command line options in the output message.
Format of build option list	Specify the display format of the build option list (see "2.17.3 Display a list of build options"). This applies to the options of the build tool to be used, and commands added by plugins. It does not apply to the options of commands specified in the [Commands executed before build processing] or [Commands executed after build processing] property. The following macro names are available as embedded macros. %Program%: Replaces with the program name under execution. %Options%: Replaces with the command line option under build execution. %FileName%: Replaces with the file name being built. If this is blank, it is assumed that "%FileName% : %Program% %Options%" has been specified.		
	Default	%FileName% : %Program% %Options%	
	How to change	Directly enter to the text box or edit by the Character String Input dialog box which appears when clicking the [...] button.	
	Restriction	Up to 256 characters	

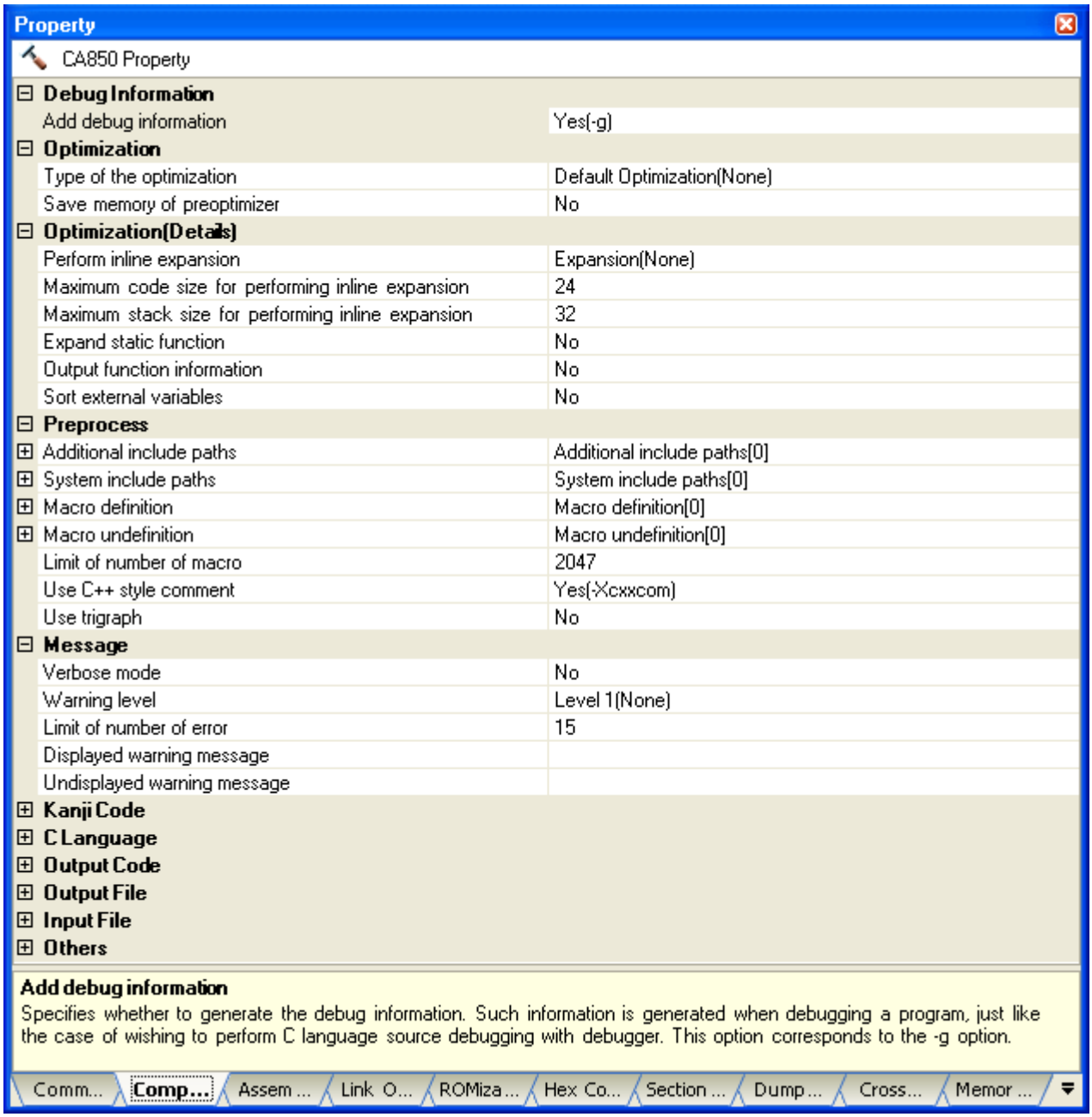
Temporary folder	Specify the folder to which the temporary files generated by each command included in the build tool during execution are saved. If a relative path is specified, the reference point of the path is the main project or subproject folder. If an absolute path is specified, the reference point of the path is the main project or subproject folder (unless the drives are different). If this is blank, it is treated as if the project folder is specified.	
	Default	Blank
	How to change	Directly enter to the text box or edit by the Browse For Folder dialog box which appears when clicking the [...] button.
	Restriction	Up to 200 characters
Commands executed before build processing	Specify the command to be executed before build processing. Use the call instruction to specify a batch file (example: call a.bat). The following macro names are available as embedded macros. %ProjectFolder%: Replaces with the absolute path of the project folder. %OutputFolder%: Replaces with the absolute path of the output folder. %OutputFile%: Replaces with the absolute path of the output file. The specified command is displayed as the subproperty.	
	Default	Commands executed before build processing[*number of defined items*]
	How to change	Edit by the Text Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.
	Restriction	Up to 1023 characters Up to 64 items can be specified.
Commands executed after build processing	Specify the command to be executed after build processing. Use the call instruction to specify a batch file (example: call a.bat). The following macro names are available as embedded macros. %ProjectFolder%: Replaces with the absolute path of the project folder. %OutputFolder%: Replaces with the absolute path of the output folder. %OutputFile%: Replaces with the absolute path of the output file. The specified command is displayed as the subproperty.	
	Default	Commands executed after build processing[*number of defined items*]
	How to change	Edit by the Text Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.
	Restriction	Up to 1023 characters Up to 64 items can be specified.

[Compile Options] tab

This tab shows the detailed information on the compiler categorized by the following and the configuration can be changed.

(1) [Debug Information]
(2) [Optimization]
(3) [Optimization(Details)]
(4) [Preprocess]
(5) [Message]
(6) [Kanji Code]
(7) [C Language]
(8) [Output Code]
(9) [Output File]
(10) [Input File]
(11) [External Register]
(12) [Others]

Figure A-5. Property Panel: [Compile Options] Tab



[Description of each category]

(1) [Debug Information]

The detailed information on debug information is displayed and the configuration can be changed.

Add debug information	Select whether to enable source level debugging by outputting symbol information for the source debugger. This corresponds to the -g option of the compiler.		
	Default	Yes(-g)	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-g)	Outputs symbol information for the source debugger.
		No	Does not output symbol information for the source debugger.

(2) [Optimization]

The detailed information on the optimization are displayed and the configuration can be changed.

Type of the optimization	Select the type of the optimization for compiling. This corresponds to the -O* option of the compiler.		
	Default	Default Optimization(None)	
	How to change	Select from the drop-down list.	
	Restriction	Optimize for Debugging(-Od)	Performs optimization with the debug precedence. Generates codes emphasizing source debugging, without putting stress on the ROM capacity and execution speed.
		Default Optimization(None)	Generates codes emphasizing source debugging. Performs optimization within a range where source debugging is not affected.
		Standard Optimization(-Og)	Performs appropriate optimization. Performs optimization that allows debugging of the C source in most cases.
		Level 1 Advanced Optimization(-O)	Performs advanced optimization. Performs optimization emphasizing the ROM capacity.
		Level 2 Advanced Opt.(Code size precedence)(-Os)	Performs more advanced optimization (object size precedence). Performs the maximum optimization placing the utmost emphasis on the ROM capacity.
		Level 2 Advanced Opt.(Speed precedence)(-Ot)	Performs more advanced optimization (execution speed precedence). Performs the maximum optimization placing the utmost emphasis on the execution speed.

Save memory of preoptimizer	Select whether to save the memory usage amount of the preoptimizer during compiling. Specify this property when the memory of the machine is insufficient and compile processing cannot be completed normally. This corresponds to the -Wp,-D option of the compiler.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-Wp,-D)	Saves the memory usage amount of the preoptimizer during compiling. However, the compiling speed decreases.
		No	Does not specify saving the memory usage amount of the preoptimizer during compiling.
Save memory of machine-dependent optimization module	Select whether to save the memory usage amount of the machine-dependent optimization module during compiling. Specify this property when the memory of the machine is insufficient and compile processing cannot be completed normally. This corresponds to the -Wi,-D option of the compiler. This property is not displayed when any of [Optimize for Debugging(-Od)], [Default Optimization(None)], or [Standard Optimization(-Og)] in the [Type of the optimization] property is selected.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-Wi,-D)	Saves the memory usage amount of the machine-dependent optimization module during compiling. However, the compiling speed decreases.
		No	Does not specify saving the memory usage amount of the machine-dependent optimization module during compiling.

(3) [Optimization(Details)]

The detailed information on the optimization are displayed and the configuration can be changed.

Perform inline expansion	Select whether to perform inline expansion. This corresponds to the -Wp,-inline option of the compiler.		
	Default	Expansion(None)	
	How to change	Select from the drop-down list.	
	Restriction	Expansion(None)	Performs inline expansion.
		Expansion only ‘inline‘ function(-Wp,-inline)	Performs inline expansion of only a function for which #pragma inline is specified.
		No Expansion(-Wp,-no_inline)	Does not specify inline expansion of all functions, including the function for which #pragma inline is specified.

<table>
<tr><td rowspan="4">Maximum code size for performing inline expansion</td><td colspan="3">Specify the maximum size in the intermediate language of the function for performing inline expansion.
For the function greater than the specified size, inline expansion is not performed.
This corresponds to the -Wp,-N option of the compiler.
As to a guide value for the size, see the function information file output by specifying the [Output function information] property.
This property is not displayed when [No Expansion(-Wp,-no_inline)] in the [Perform inline expansion] property is selected.</td></tr>
<tr><td>Default</td><td colspan="2">- When [Level 2 Advanced Opt.(Speed precedence)(-Ot)] in the [Type of the optimization] property is selected
128
- When other than [Level 2 Advanced Opt.(Speed precedence)(-Ot)] in the [Type of the optimization] property is selected
24</td></tr>
<tr><td>How to change</td><td colspan="2">Directly enter to the text box.</td></tr>
<tr><td>Restriction</td><td colspan="2">0 to 9999 (decimal number)</td></tr>
<tr><td rowspan="4">Maximum stack size for performing inline expansion</td><td colspan="3">Specify the maximum value (bytes) of the stack size in the intermediate language of the function for performing inline expansion.
For the function greater than the specified size, inline expansion is not performed.
This corresponds to the -Wp,-G option of the compiler.
As to a yardstick for the size, see the function information file output by specifying the [Output function information] property.
This property is not displayed when [No Expansion(-Wp,-no_inline)] in the [Perform inline expansion] property is selected.</td></tr>
<tr><td>Default</td><td colspan="2">32</td></tr>
<tr><td>How to change</td><td colspan="2">Directly enter to the text box.</td></tr>
<tr><td>Restriction</td><td colspan="2">0 to 9999 (decimal number)</td></tr>
<tr><td rowspan="5">Expand static function</td><td colspan="3">Specify whether to perform inline expansion against the static function that has been referenced only once.
This corresponds to the -Wp,-S option of the compiler.
This property is not displayed when [No Expansion(-Wp,-no_inline)] in the [Perform inline expansion] property is selected.</td></tr>
<tr><td>Default</td><td colspan="2">No</td></tr>
<tr><td>How to change</td><td colspan="2">Select from the drop-down list.</td></tr>
<tr><td rowspan="2">Restriction</td><td>Yes(-Wp,-S)</td><td>Performs inline expansion against the static function that has been referenced only once.</td></tr>
<tr><td>No</td><td>Does not specify inline expansion against the static function that has been referenced only once.</td></tr>
</table>

<table>
<tr><td rowspan="5">Output function information</td><td colspan="3">Specify whether to output the code size and stack size in the intermediate language of each function to a file.
Information that is output will serve as a yardstick when specifying values in the [Maximum code size for performing inline expansion] property and [Maximum stack size for performing inline expansion] property.
This corresponds to the -Wp,-I option of the compiler.
This property is not displayed when [No Expansion(-Wp,-no_inline)] in the [Perform inline expansion] property is selected.</td></tr>
<tr><td>Default</td><td colspan="2">No</td></tr>
<tr><td>How to change</td><td colspan="2">Select from the drop-down list.</td></tr>
<tr><td rowspan="2">Restriction</td><td>Yes(-Wp,-I)</td><td>Outputs the code size and stack size in the intermediate language of each function to a file.</td></tr>
<tr><td>No</td><td>Does not specify the output of the code size and stack size in the intermediate language of each function to a file.</td></tr>
<tr><td rowspan="4">Function information file name</td><td colspan="3">Specify the file name for outputting the code size and stack size in the intermediate language of each function.
This corresponds to the -Wp,-I option of the compiler.
If a relative path is specified, the reference point of the path is the main project or subproject folder.
If an absolute path is specified, the reference point of the path is the main project or subproject folder (unless the drives are different).
The following macro name is available as an embedded macro.
%BuildModeName%: Replaces with the build mode name.
If this is blank, it is assumed that "%BuildModeName%\FunctionData.txt" has been specified.
This property is not displayed when [No] in the [Output function information] property is selected.</td></tr>
<tr><td>Default</td><td colspan="2">%BuildModeName%\FunctionData.txt</td></tr>
<tr><td>How to change</td><td colspan="2">Directly enter to the text box or edit by the Specify Function Information File dialog box which appears when clicking the [...] button.</td></tr>
<tr><td>Restriction</td><td colspan="2">Up to 259 characters</td></tr>
<tr><td rowspan="5">Loop expansion</td><td colspan="3">Specify whether to expand the loops such as "for" and "while".
This corresponds to the -Wo,-Ol,-Xlo option of the compiler.
This property is displayed only when [Level 2 Advanced Opt.(Speed precedence)(-Ot)] in the [Type of the optimization] property is selected.</td></tr>
<tr><td>Default</td><td colspan="2">Yes(Adjust automatically unrolling number)(-Wo,-Ol)</td></tr>
<tr><td>How to change</td><td colspan="2">Select from the drop-down list.</td></tr>
<tr><td rowspan="3">Restriction</td><td>Yes(Adjust automatically unrolling number)(-Wo,-Ol)</td><td>Performs loop expansions so that the code size is minimized while keeping the number of times to expand below the value specified in the [Maximum number of loop expansions] property.</td></tr>
<tr><td>Yes(Constant unrolling number)(-Wo,-Ol,-Xlo)</td><td>Performs loop expansions for a number of times specified in the [Maximum number of loop expansions] property.</td></tr>
<tr><td>No(-Wo,-Ol0)</td><td>Does not specify loop expansion.</td></tr>
</table>

<table>
<tr><td rowspan="4">Maximum number of loop expansions</td><td colspan="3">Specify the maximum number of times to expand the loops such as "for" and "while".
This corresponds to the -Wo,-Ol option of the compiler.
This property is not displayed when [No(-Wo,-Ol0)] in the [Loop expansion] property is selected.</td></tr>
<tr><td>Default</td><td colspan="2">4</td></tr>
<tr><td>How to change</td><td colspan="2">Directly enter to the text box.</td></tr>
<tr><td>Restriction</td><td colspan="2">0 to 999 (decimal number)</td></tr>
<tr><td rowspan="4">Sort external variables</td><td colspan="3">Select whether to rearrange external variables allocated to a section other than const/sconst sequentially, starting from the largest alignment size.
This corresponds to the -Wo,-Op option of the compiler.</td></tr>
<tr><td>Default</td><td colspan="2">No</td></tr>
<tr><td>How to change</td><td colspan="2">Select from the drop-down list.</td></tr>
<tr><td>Restriction</td><td>Yes(-Wo,-Op)</td><td>Rearranges external variables allocated to a section other than const/sconst sequentially, starting from the largest alignment size.</td></tr>
<tr><td></td><td>No</td><td>Does not specify the rearrangement of external variables starting from the largest alignment size.</td></tr>
<tr><td rowspan="4">Intermediate language file name for external variable sorting</td><td colspan="3">Specify the name of the intermediate language file (.ic) created after sorting external variables.
Specify this property when sorting all external variables included in the project instead of sorting external variables within each source file.
This corresponds to the -Wo,-Op option of the compiler.
If a relative path is specified, the reference point of the path is the main project or subproject folder.
If an absolute path is specified, the reference point of the path is the main project or subproject folder (unless the drives are different).
The following macro name is available as an embedded macro.
%BuildModeName%: Replaces with the build mode name.
This property is not displayed when [No] in the [Sort external variables] property is selected.</td></tr>
<tr><td>Default</td><td colspan="2">Blank</td></tr>
<tr><td>How to change</td><td colspan="2">Directly enter to the text box or edit by the Specify Intermediate Language File for External Variable Sorting dialog box which appears when clicking the [...] button.</td></tr>
<tr><td>Restriction</td><td colspan="2">Up to 259 characters</td></tr>
<tr><td rowspan="4">Output branch instructions with code size priority</td><td colspan="3">Select whether to arrange and output branch instructions, giving precedence to the code size.
This corresponds to the -Wo,-XFo option of the compiler.
This property is not displayed when [Optimize for Debugging(-Od)] or [Default Optimization(None)] in the [Type of the optimization] property is selected.</td></tr>
<tr><td>Default</td><td colspan="2">No</td></tr>
<tr><td>How to change</td><td colspan="2">Select from the drop-down list.</td></tr>
<tr><td>Restriction</td><td>Yes(-Wo,-XFo)</td><td>Arranges and outputs branch instructions, giving precedence to the code size.</td></tr>
<tr><td></td><td>No</td><td>Outputs a code that the debug information is given priority for branch instructions.</td></tr>
</table>

<table>
<tr><td rowspan="5">Pack alignment</td><td colspan="3">Specify whether to inhibit the optimization that aligns branch destination labels.
This corresponds to the -Wi,-P option of the compiler.
This property is displayed only when [Level 1 Advanced Optimization(-O)], [Level 2 Advanced Opt.(Code size precedence)(-Os)], or [Level 2 Advanced Opt.(Speed precedence)(-Ot)] in the [Type of the optimization] property is selected.
However, when [Level 1 Advanced Optimization(-O)] or [Level 2 Advanced Opt.(Code size precedence)(-Os)] is selected, this function is included. Therefore, [Yes(-Wi,-P)] is always selected.</td></tr>
<tr><td>Default</td><td colspan="2">- When [Level 1 Advanced Optimization(-O)] or [Level 2 Advanced Opt.(Code size precedence)(-Os)] in the [Type of the optimization] property is selected
[Yes(-Wi,-P)]
- When [Level 2 Advanced Opt.(Speed precedence)(-Ot)] in the [Type of the optimization] property is selected
No</td></tr>
<tr><td>How to change</td><td colspan="2">Select from the drop-down list.</td></tr>
<tr><td rowspan="2">Restriction</td><td>Yes(-Wi,-P)</td><td>Inhibits the optimization that aligns branch destination labels.
The size of the execution code can be reduced.</td></tr>
<tr><td>No</td><td>Does not specify the inhibition of the optimization that aligns branch destination labels.</td></tr>
<tr><td rowspan="5">Perform advanced optimization</td><td colspan="3">Specify whether to execute the strongest optimization through strict data flow analysis.
Specify this property to perform the stronger optimization when performing the advanced optimization.
This corresponds to the -Wi,-O4 option of the compiler.
This property is displayed only when [Level 1 Advanced Optimization(-O)], [Level 2 Advanced Opt.(Code size precedence)(-Os)], or [Level 2 Advanced Opt.(Speed precedence)(-Ot)] in the [Type of the optimization] property is selected.</td></tr>
<tr><td>Default</td><td colspan="2">No</td></tr>
<tr><td>How to change</td><td colspan="2">Select from the drop-down list.</td></tr>
<tr><td rowspan="2">Restriction</td><td>Yes(-Wi,-O4)</td><td>Executes the strongest optimization through strict data flow analysis.
However, the compiling speed significantly decreases.</td></tr>
<tr><td>No</td><td>Does not specify advanced optimization.</td></tr>
</table>

(4) [Preprocess]

The detailed information on the preprocess are displayed and the configuration can be changed.

<table>
<tr><td>Additional include paths</td><td colspan="2">Specify the additional include paths during compiling.
The following macro names are available as embedded macros.
%BuildModeName%: Replaces with the build mode name.
%ProjectName%: Replaces with the project name.
%MicomToolPath%: Replaces with the absolute path of the product install folder.
When this property is omitted, only the standard folder of the compiler is searched. The reference point of the path is the project folder.
This corresponds to the -I option of the compiler.
The specified include path is displayed as the subproperty.
When the include path is added to the project tree, the path is added to the top of the subproperties.
Uppercase characters and lowercase characters are not distinguished for the include paths.</td></tr>
<tr><td></td><td>Default</td><td>Additional include paths[number of defined items]</td></tr>
<tr><td></td><td>How to change</td><td>Edit by the Path Edit dialog box which appears when clicking the [...] button.
For the subproperty, you can use the text box directly enter the text.</td></tr>
<tr><td></td><td>Restriction</td><td>Up to 259 characters
Up to 64 items can be specified.However, this also includes the number of paths used by linked tools.</td></tr>
<tr><td>System include paths</td><td colspan="2">The include paths which the system set during compiling are displayed.
The following macro names are available as embedded macros.
%BuildModeName%: Replaces with the build mode name.
%ProjectName%: Replaces with the project name.
%MicomToolPath%: Replaces with the absolute path of the product install folder.
The system include path is searched with lower priority than the additional include path.
The reference point of the path is the project folder.
This corresponds to the -i option of the compiler.
The include path is displayed as the subproperty.</td></tr>
<tr><td></td><td>Default</td><td>System include paths[number of defined items]</td></tr>
<tr><td></td><td>How to change</td><td>Edit by the System Include Path Order dialog box which appears when clicking the [...] button.</td></tr>
<tr><td></td><td>Restriction</td><td>Changes not allowed (Only the specified order of the include paths can be changed.)</td></tr>
<tr><td>Macro definition</td><td colspan="2">Specify the macro name to be defined.
Specify in the format of "macro name=defined value", with one macro name per line. The "=defined value" part can be omitted, and in this case, "1" is used as the defined value.
This corresponds to the -D option of the compiler.
The specified macro is displayed as the subproperty.</td></tr>
<tr><td></td><td>Default</td><td>Macro definition[number of defined items]</td></tr>
<tr><td></td><td>How to change</td><td>Edit by the Text Edit dialog box which appears when clicking the [...] button.
For the subproperty, you can use the text box directly enter the text.</td></tr>
<tr><td></td><td>Restriction</td><td>Up to 256 characters
Up to 256 items can be specified.</td></tr>
</table>

Macro undefinition	Specify the macro name to be undefined. Specify in the format of "*macro name*", with one macro name per line. This corresponds to the -U option of the compiler. The specified macro is displayed as the subproperty.		
	Default	Macro undefinition[*number of defined items*]	
	How to change	Edit by the Text Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.	
	Restriction	Up to 256 characters Up to 256 items can be specified.	
Limit of number of macro	Specify the upper limit for the number of macro identifiers. This corresponds to the -Xm option of the compiler.		
	Default	2047	
	How to change	Directly enter to the text box.	
	Restriction	1 to 999999 (decimal number)	
Use C++ style comment	Specify whether to enable C++ comment style (from "//" to the end of the line), in addition to regular comments. This corresponds to the -Xcxxcom option of the compiler.		
	Default	Yes(-Xcxxcom)	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-Xcxxcom)	Enables C++ comment style (from "//" to the end of the line), in addition to regular comments.
		No	Disables C++ comment style (from "//" to the end of the line).
Include comments in preprocessor output file	Specify whether to include the comments of the source program in the output of the C language source program's preprocessing. This corresponds to the -C option of the compiler. This property is not displayed when [No] in the [Output preprocessed source file] property in the [Output File] category is selected.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-C)	Includes the comments of the source program in the output of the C language source program's preprocessing.
		No	Does not include the comments of the source program in the output of the C language source program's preprocessing.
Use trigraph	Specify whether to replace trigraph sequences. A trigraph is a sequence of 3 characters replaced with a single character, defined in the ANSI standard. This corresponds to the -t option of the compiler.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-t)	Replaces trigraph sequences.
		No	Does not replace trigraph sequences.

(5) [Message]

The detailed information on messages are displayed and the configuration can be changed.

Verbose mode	Select whether to display the execution status of the compiler to the Output panel during build. This corresponds to the -v option of the compiler.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-v)	Displays the execution status of the compiler during build.
		No	Does not display the execution status of the compiler during build.
Warning level	Select the warning display level under compiling. This corresponds to the -w option of the compiler.		
	Default	Level 1(None)	
	How to change	Select from the drop-down list.	
	Restriction	No Output(-w)	Does not output warning messages.
		Level 1(None)	Outputs normal warning messages.
		Level 2(-w2)	Outputs detailed warning messages.
Limit of number of error	Specify the maximum number of error messages to be output. This corresponds to the -err_limit option of the compiler.		
	Default	15	
	How to change	Directly enter to the text box.	
	Restriction	15 to 50 (decimal number)	
Displayed warning message	Specify the warning message number to be displayed regardless of the setting of the [Warning level] property. If specifying multiple warning messages, delimit the message numbers with "," (comma) (example: 2042,2107). Also, the range can be set using "-" (hyphen) (example: 2222-2554,2699-2782). If the same number is specified in the [Undisplayed warning message] property and this property, the number specified in this property takes precedence. This corresponds to the -won option of the compiler.		
	Default	Blank	
	How to change	Directly enter to the text box or edit by the Build Tool Warning Messages Settings dialog box which appears when clicking the [...] button.	
	Restriction	Up to 2048 characters	

Undisplayed warning message	Specify the warning message number to not be displayed regardless of the setting of the [Warning level] property. If specifying multiple warning messages, delimit the message numbers with "," (comma) (example: 2042,2107). Also, the range can be set using "-" (hyphen) (example: 2222-2554,2699-2782). If the same number is specified in the [Displayed warning message] property and this property, the number specified in the [Displayed warning message] property takes precedence. This corresponds to the -woff option of the compiler.	
	Default	Blank
	How to change	Directly enter to the text box or edit by the Build Tool Warning Messages Settings dialog box which appears when clicking the [...] button.
	Restriction	Up to 2048 characters

(6) [Kanji Code]

The detailed information on kanji codes are displayed and the configuration can be changed.

Kanji character code of source	Specify the kanji code to be used for Japanese comments and character strings in the input file. This corresponds to the -Xk option of the compiler.		
	Default	Shift_JIS(None)	
	How to change	Select from the drop-down list.	
	Restriction	Shift_JIS(None)	Interprets the kanji code of the source as Shift_JIS.
		None(-Xk=none)	Interprets the source as not containing kanji codes. The code is not guaranteed.
		EUC-JP(-Xk=euc)	Interprets the kanji code of the source as EUC-JP.
Kanji character code for target	Specify the kanji code to be converted into for Japanese character strings. Set this property if you want to change the kanji code used during application development in the target. This corresponds to the -Xkt option of the compiler.		
	Default	None(None)	
	How to change	Select from the drop-down list.	
	Restriction	None(None)	Does not convert the kanji code of the target. The code is not guaranteed.
		Shift_JIS(-Xkt=sjis)	Converts the kanji code of the target into Shift_JIS.
		EUC-JP(-Xkt=euc)	Converts the kanji code of the target into EUC-JP.

(7) [C Language]

The detailed information on C language are displayed and the configuration can be changed.

Sign of bit field	Select whether int type bit fields without a type specifier (signed or unsigned) are handled as signed or unsigned. This corresponds to the -Xbitfield option of the compiler.		
	Default	signed	
	How to change	Select from the drop-down list.	
	Restriction	signed	Handles int type bit fields without a type specifier as signed.
		unsigned(-Xbit-field=unsigned)	Handles int type bit fields without a type specifier as unsigned.
Sign of char	Select whether char type bit fields without a type specifier (signed or unsigned) are handled as signed or unsigned. This corresponds to the -Xchar option of the compiler.		
	Default	signed	
	How to change	Select from the drop-down list.	
	Restriction	signed	Handles char type without a type specifier as signed.
		unsigned(-Xchar=unsigned)	Handles char type without a type specifier as unsigned.
Enumeration type	Specify which integer type matches with the enumeration type. This corresponds to the -Xenum_type option of the compiler.		
	Default	int(None)	
	How to change	Select from the drop-down list.	
	Restriction	int(None)	Matches int type with the enumeration type.
		signed char(-Xenum_type=char)	Matches signed char type with the enumeration type.
		unsigned char(-Xenum_type=uchar)	Matches unsigned char type with the enumeration type.
		short(-Xenum_type=short)	Matches short type with the enumeration type.
		unsigned short(-Xenum_type=ushort)	Matches unsigned short type with the enumeration type.
Compile strictly according to ANSI standards	Specify whether to apply the ANSI standard to the compiler processing strictly and display error and warning messages for descriptions that violate the standard. This corresponds to the -ansi option of the compiler.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-ansi)	Applies the ANSI standard to the compiler processing strictly and displays error and warning messages for descriptions that violate the standard.
		No	Confers compatibility with the conventional C language specifications and continues the compiler processing after warning message is output.

Use expansion of CC78K	Select whether to enable the expansion functions compatible with the 78K microcontrollers C compiler CC78K. This corresponds to the -cc78k option of the compiler.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-cc78k)	Enables the expansion functions compatible with the CC78K.
		No	Disables the expansion functions compatible with the CC78K.
Perform strictly integer operation	Specify whether to use runtime libraries ___mul/___mulu, ___div/___divu or mul, mulu, div, divu instructions without using the mulh and divh instructions, for integers of 16-bit data or less, in order to execute multiply and divide instructions strictly according to the ANSI standard. This corresponds to the -Xe option of the compiler.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-Xe)	Uses runtime libraries ___mul/___mulu or ___div/___divu for integers of 16-bit data or less.
		No	Uses runtime libraries mulh or divh instructions for integers of 16-bit data or less.
Treat tentative definition as definition	Specify whether to treat tentative definitions of variables as definitions. This corresponds to the -Xdefvar option of the compiler.		
	Default	Yes(-Xdefvar)	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-Xdefvar)	Treats tentative definition of variables as definition.
		No	Does not treat tentative definition of variables as definition.

(8) [Output Code]

The detailed information on output codes are displayed and the configuration can be changed.

Size threshold of sdata/sbss section allocation(Bytes)	Specify the upper limit size of the data length allocated to the .sdata/.sbss sections. However, the data for which the .sdata/.sbss sections are specified with the #pragma section directive or the section file is allocated to the .sdata/.sbss sections regardless of its size. This corresponds to the -G option of the compiler. If this property is changed, the value of the [Size threshold of sdata/sbss section allocation(Bytes)] property in the [Others] category from the [Assemble Options] tab will be changed accordingly.	
	Default	Blank
	How to change	Directly enter to the text box.
	Restriction	0 to 32767 (decimal number)

Allocate data to sconst section	Specify whether to allocate const attribute data and character string literals to the .sconst section. This corresponds to the -Xsconst option of the compiler.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-Xsconst)	Allocates const attribute data and character string literals to the .sconst section.
		No	Allocates const attribute data and character string literals to the .const section.
Size threshold of sconst section allocation(Bytes)	Specify the upper limit size (bytes) for allocating const attribute data and character string literals to the .const section. However, the data for which the .sconst sections are specified with the #pragma section directive or the section file is allocated to the .sconst sections regardless of its size. This corresponds to the -Xsconst option of the compiler. This property is not displayed when [No] in the [Allocate data to sconst section] property is selected.		
	Default	32767	
	How to change	Directly enter to the text box.	
	Restriction	0 to 32767 (decimal number)	
Use prologue/epilogue library	Specify whether to perform prologue/epilogue processing of functions through runtime library calls. This corresponds to the -Xpro_epi_runtime option of the compiler.		
	Default	Auto(None)	
	How to change	Select from the drop-down list.	
	Restriction	Auto(None)	In the [Type of the optimization] property in the [Optimization] category, corresponds to [No(-Xpro_epi_runtime=off)] when [Level 2 Advanced Opt.(Speed precedence)(-Ot)] is selected, [Yes(-Xpro_epi_runtime=on)] when any of other items is selected.
		No(-Xpro_epi_runtime=off)	Does not perform prologue/epilogue processing of functions through runtime library calls.
		Yes(-Xpro_epi_runtime=on)	Performs prologue/epilogue processing of functions through runtime library calls.

Output code of switch statement	Specify the code output mode for switch statements in programs. This corresponds to the -Xcase option of the compiler.		
	Default	Auto(None)	
	How to change	Select from the drop-down list.	
	Restriction	Auto(None)	Automatically judges the format considered optimum by the compiler.
		if-else(-Xcase=ifelse)	Outputs the code in the same format as the if-else statement along a string of case statements in programs. Because the case statements are compared starting from the top, unnecessary comparison can be reduced and the execution speed can be increased if the case statement that most often matches is written first or if the number of labels is few.
		Binary search(-Xcase=binary)	Outputs the code in the binary search format for switch statements in programs. Because a matching case statement is searched by using a binary search algorithm, when many labels are used, any case statement can be found at almost the same speed.
		Table jump(-Xcase=table)	Outputs the code in the table jump format for switch statements in programs. References a table indexed on the values in the case statements, and selects and processes case labels from the switch statement values. Code will branch to all the case statements with about the same speed. If case values are not used in succession, an unnecessary area is created.
Label size of switch table	Specify the size per label of the branch table for the case labels in switch statements. This corresponds to the -Xword_switch option of the compiler.		
	Default	2 bytes(None)	
	How to change	Select from the drop-down list.	
	Restriction	2 bytes(None)	Generates one 2-byte branch table per case label in a switch statement.
		4 bytes(-Xword_switch)	Generates one 4-byte branch table per case label in a switch statement. Select this item when a compile error occurs because the switch statement is long.

Structure packing	Selects the value of the structure packing. The specified alignment can be used without aligning structure members according to the type of each member. The data size can be reduced but the code size increases. This corresponds to the -Xpack option of the compiler.		
	Default	8 bytes(None)	
	How to change	Select from the drop-down list.	
	Restriction	1 byte(-Xpack=1)	Aligns structure members on a 1-byte boundary.
		2 bytes(-Xpack=2)	Aligns structure members on a 2-byte boundary.
		4 bytes(-Xpack=4)	Aligns structure members on a 4-byte boundary.
		8 bytes(None)	Aligns structure members on a 8-byte boundary.
Perform inline expansion of strcpy/strcmp	Selsect whether to perform inline expansion of strcpy() or strcmp() function calls, with regarding the alignment conditions of the array (including character strings) and the structure as 4 bytes. This improves the execution speed of the object but it also increases the code size. This corresponds to the -Xi option of the compiler. This property is displayed only when [8 bytes(None)] in the [Structure packing] property is selected.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-Xi)	Performs inline expansion of strcpy() or strcmp() function calls, with regarding the alignment conditions of the array (including character strings) and the structure as 4 bytes.
		No	Does not perform inline expansion of strcpy() or strcmp() function calls.
Perform pointer byte access	Select whether to perform an indirect address access of structure in byte units. Use this property if a limit is exceeded when the structure packing function is used. This corresponds to the -Xbyte option of the compiler.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-Xbyte)	Performs an indirect address access of structure in byte units.
		No	Does not perform an indirect address access of structure in byte units.
Output comment to assembly language source file	Select whether to output a C source program as a comment to the assembler source file to be output. This corresponds to the -Xc option of the compiler. This property is not displayed when [Yes(-Fs)] in the [Output assemble file] property or [Yes(-Fv)] in the [Output an assemble list] property is selected in the [Output File] category.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-Xc)	Outputs a C source program as a comment to the assembler source file.
		No	Does not output a C source program as a comment to the assembler source file.

Use jmp instruction for branch instruction of interruption	Select whether to use the jmp instruction for interrupt functions defined in C language. This corresponds to the -Xj option of the compiler.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-Xj)	Uses the jmp instruction for interrupt functions defined in C language.
		No	Uses the jr instruction for interrupt functions defined in C language.
Prohibit the operation that replaces word with bit instructions	Select whether to prohibit replacing the ld.w/ld.h and st.w/st.h instructions with 1-bit manipulation instructions (set1, clr1, tst1, and not1). This corresponds to the -Xno_word_bitop option of the compiler.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-Xno_word_bitop)	Prohibits replacing the ld.w/ld.h and st.w/st.h instructions with 1-bit manipulation instructions (set1, clr1, tst1, and not1).
		No	Replaces the ld.w/ld.h and st.w/st.h instructions with 1-bit manipulation instructions (set1, clr1, tst1, and not1).

(9) [Output File]

The detailed information on output files are displayed and the configuration can be changed.

Output assembly file	Select whether to output the assembler source file of the compile result for a C source. This corresponds to the -Fs option of the compiler.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-Fs)	Outputs the assembler source file.
		No	Does not output the assembler source file.
Output folder for assembly file	Specify the output destination folder of an assembler source file. The assembler source file is saved under the source file name with the extension replaced by ".s". This corresponds to the -Fs option of the compiler. If a relative path is specified, the reference point of the path is the main project or subproject folder. If an absolute path is specified, the reference point of the path is the main project or subproject folder (unless the drives are different). The following macro name is available as an embedded macro. %BuildModeName%: Replaces with the build mode name. If this is blank, it is treated as if the project folder is specified. This property is displayed only when [Yes(-Fs)] in the [Output assemble file] property is selected.		
	Default	%BuildModeName%	
	How to change	Directly enter to the text box or edit by the Browse For Folder dialog box which appears when clicking the [...] button.	
	Restriction	Up to 247 characters	

Output assemble list file	Select whether to output the assemble list of the compile result for a C source. This corresponds to the -Fv option of the compiler.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-Fv)	Outputs an assemble list.
		No	Does not output an assemble list.
Output folder for assemble list file	Specify the output destination folder of an assemble list. The assemble list is saved under the source file name with the extension replaced by ".v". This corresponds to the -Fv option of the compiler. If a relative path is specified, the reference point of the path is the main project or subproject folder. If an absolute path is specified, the reference point of the path is the main project or subproject folder (unless the drives are different). The following macro name is available as an embedded macro. %BuildModeName%: Replaces with the build mode name. If this is blank, it is treated as if the project folder is specified. This property is displayed only when [Yes(-Fv)] in the [Output assemble list file] property is selected.		
	Default	%BuildModeName%	
	How to change	Directly enter to the text box or edit by the Browse For Folder dialog box which appears when clicking the [...] button.	
	Restriction	Up to 247 characters	
Output frequency information file	Select whether to output the frequency information file for the variables used by the section file generator. This corresponds to the -Xcre_sec_data option of the compiler. This property is not displayed when [Yes] on the [Use section file generator] property in the [Output File] category from the [Section File Generate Options] tab is selected.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-Xcre_sec_data)	Outputs the frequency information file for the variables.
		No	Does not output the frequency information file for the variables.

Output folder for frequency information file	Specify the output destination folder of the frequency information file. The frequency information file is saved under the source file name with the extension replaced by ".sec". This corresponds to the -Xcre_sec_data option of the compiler. If a relative path is specified, the reference point of the path is the main project or subproject folder. If an absolute path is specified, the reference point of the path is the main project or subproject folder (unless the drives are different). The following macro name is available as an embedded macro. %BuildModeName%: Replaces with the build mode name. If this is blank, it is treated as if the project folder is specified. This property is not displayed when [No] in the [Output frequency information file] property is selected.		
	Default	%BuildModeName%	
	How to change	Directly enter to the text box or edit by the Browse For Folder dialog box which appears when clicking the [...] button.	
	Restriction	Up to 247 characters	
Output preprocessed source file	Select whether to execute the command that execute only preprocessing (preprocess processing) for a C source program prior to compile processing. The result is output under the source file name with the extension replaced by ".i". The line numbers and file name of the source program are not output.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-P)	Executes only preprocessing for a C source program and outputs the result.
		No	Does not execute only preprocessing for a C source program and does not output the result.

(10) [Input File]

The detailed information on input files are displayed and the configuration can be changed.

Section file names	Display the name of the section file that is used to define section that allocates global variable/static variable when the C compiler is activated. An effective section file to be added to the project is retrieved, and used. This corresponds to the -Xsec_file option of the compiler. The specified section file name is displayed as the subproperty. This property is not displayed when [Yes] on the [Use section file generator] property in the [Output File] category from the [Section File Generate Options] tab is selected.	
	Default	Section file name[*The name of the effective section file that is added to the project*]
	How to change	Changes not allowed

Far Jump file names	Specify the Far Jump file name. The Far Jump file outputs the code that uses the jmp instruction for branch instructions of functions described in the file. The linker outputs an error if the function is in a range that cannot be branched to by the jarl or jr directive (±2MB or more), in which case this property is used to recompile. Use the extension ".fjp". This corresponds to the -Xfar_jump option of the compiler. The specified Far Jump file name is displayed as the subproperty.	
	Default	Far Jump file names[*number of set items*]
	How to change	Edit by the Specify Far Jump File dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.
	Restriction	Up to 259 characters Up to 5000 items can be specified.

(11) [External Register]

The detailed information on external registers are displayed and the configuration can be changed.

This category is not displayed when [32-register mode(None)] in the [Select register mode] property in the [Register Mode] category from the [Common Options] tab is selected.

External variable assigned to the r15 register	Specify the external variables (symbol name excluding "_") assigned to the register. This corresponds to the -r15 option of the compiler. This property is not displayed when [26-register mode(-reg26)] in the [Select register mode] property in the [Register Mode] category from the [Common Options] tab is selected.	
	Default	Blank
	How to change	Directly enter to the text box.
	Restriction	Up to 1022 characters
External variable assigned to the r16 register	Specify the external variables (symbol name excluding "_") assigned to the register. This corresponds to the -r16 option of the compiler. This property is not displayed when [26-register mode(-reg26)] in the [Select register mode] property in the [Register Mode] category from the [Common Options] tab is selected.	
	Default	Blank
	How to change	Directly enter to the text box.
	Restriction	Up to 1022 characters
External variable assigned to the r17 register	Specify the external variables (symbol name excluding "_") assigned to the register. This corresponds to the -r17 option of the compiler.	
	Default	Blank
	How to change	Directly enter to the text box.
	Restriction	Up to 1022 characters
External variable assigned to the r18 register	Specify the external variables (symbol name excluding "_") assigned to the register. This corresponds to the -r18 option of the compiler.	
	Default	Blank
	How to change	Directly enter to the text box.
	Restriction	Up to 1022 characters

External variable assigned to the r19 register	Specify the external variables (symbol name excluding "_") assigned to the register. This corresponds to the -r19 option of the compiler.	
	Default	Blank
	How to change	Directly enter to the text box.
	Restriction	Up to 1022 characters
External variable assigned to the r20 register	Specify the external variables (symbol name excluding "_") assigned to the register. This corresponds to the -r20 option of the compiler. This property is not displayed when [Yes(-Xmask_reg,-m, -mask_reg)] on the [Use mask registers] property in the [Register Mode] category from the [Common Options] tab is selected.	
	Default	Blank
	How to change	Directly enter to the text box.
	Restriction	Up to 1022 characters
External variable assigned to the r21 register	Specify the external variables (symbol name excluding "_") assigned to the register. This corresponds to the -r20 option of the compiler. This property is not displayed when [Yes(-Xmask_reg,-m, -mask_reg)] on the [Use mask registers] property in the [Register Mode] category from the [Common Options] tab is selected.	
	Default	Blank
	How to change	Directly enter to the text box.
	Restriction	Up to 1022 characters
External variable assigned to the r22 register	Specify the external variables (symbol name excluding "_") assigned to the register. This corresponds to the -r22 option of the compiler.	
	Default	Blank
	How to change	Directly enter to the text box.
	Restriction	Up to 1022 characters
External variable assigned to the r23 register	Specify the external variables (symbol name excluding "_") assigned to the register. This corresponds to the -r23 option of the compiler. This property is not displayed when [26-register mode(-reg26)] in the [Select register mode] property in the [Register Mode] category from the [Common Options] tab is selected.	
	Default	Blank
	How to change	Directly enter to the text box.
	Restriction	Up to 1022 characters
External variable assigned to the r24 register	Specify the external variables (symbol name excluding "_") assigned to the register. This corresponds to the -r24 option of the compiler. This property is not displayed when [26-register mode(-reg26)] in the [Select register mode] property in the [Register Mode] category from the [Common Options] tab is selected.	
	Default	Blank
	How to change	Directly enter to the text box.
	Restriction	Up to 1022 characters

(12) [Others]

Other detailed information on compilation are displayed and the configuration can be changed.

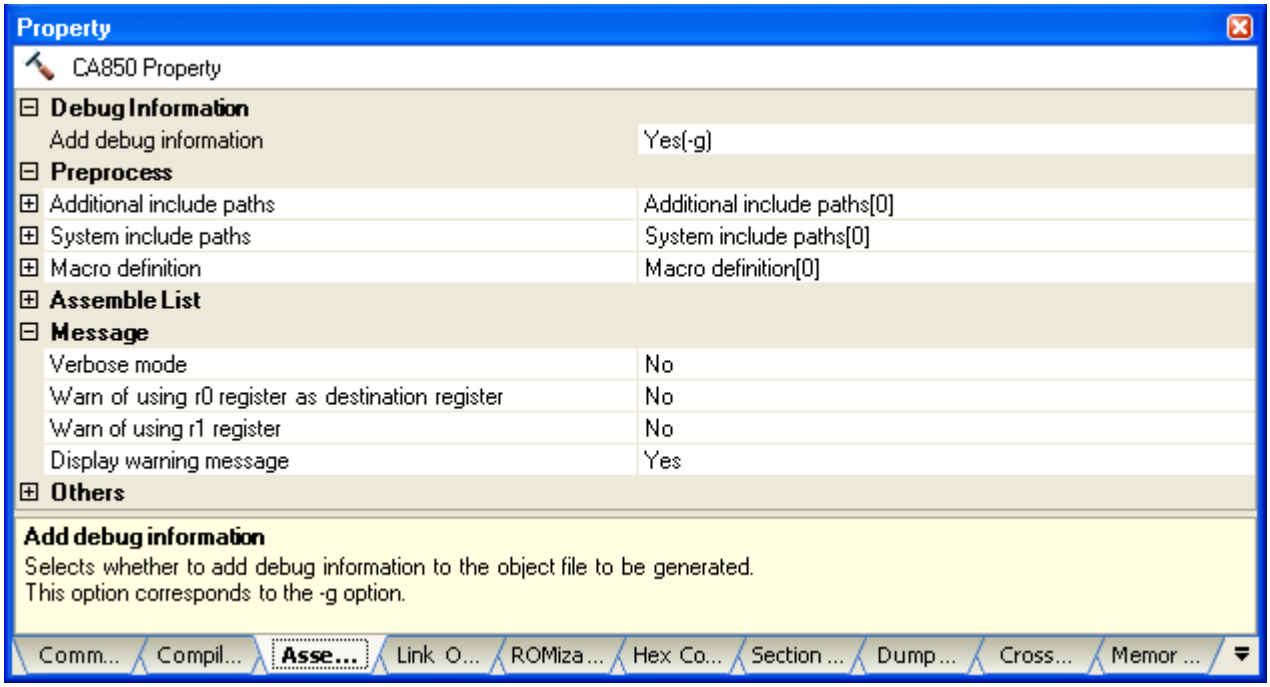
Commands executed before compile processing	Specify the command to be executed before compile processing. Use the call instruction to specify a batch file (example: call a.bat). The following macro names are available as embedded macros. %ProjectFolder%: Replaces with the absolute path of the project folder. %OutputFolder%: Replaces with the absolute path of the output folder. %OutputFile%: Replaces with the absolute path of the output file. %InputFile%: Replaces with the absolute path of the file to be compiled. %CompiledFile%: Replaces with the absolute path of the output file under compiling. The specified command is displayed as the subproperty.	
	Default	Commands executed before compile processing[*number of defined items*]
	How to change	Edit by the Text Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.
	Restriction	Up to 1023 characters Up to 64 items can be specified.
Commands executed after compile processing	Specify the command to be executed after compile processing. Use the call instruction to specify a batch file (example: call a.bat). The following macro names are available as embedded macros. %ProjectFolder%: Replaces with the absolute path of the project folder. %OutputFolder%: Replaces with the absolute path of the output folder. %OutputFile%: Replaces with the absolute path of the output file. %InputFile%: Replaces with the absolute path of the file to be compiled. %CompiledFile%: Replaces with the absolute path of the output file under compiling. The specified command is displayed as the subproperty.	
	Default	Commands executed after compile processing[*number of defined items*]
	How to change	Edit by the Text Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.
	Restriction	Up to 1023 characters Up to 64 items can be specified.
Other additional options	Input the compile options to be added additionally. The options set here are added at the end of the compile options group.	
	Default	Blank
	How to change	Directly enter to the text box or edit by the Character String Input dialog box which appears when clicking the [...] button.
	Restriction	Up to 259 characters

[Assemble Options] tab

This tab shows the detailed information on the assembler categorized by the following and the configuration can be changed.

(1) [Debug Information]
(2) [Preprocess]
(3) [Assemble List]
(4) [Message]
(5) [Others]

Figure A-6. Property Panel: [Assemble Options] Tab



[Description of each category]

(1) [Debug Information]

The detailed information on debug information is displayed and the configuration can be changed.

Add debug information	Select whether to enable source level debugging by adding debug information to the object file being generated. This corresponds to the -g option of the assembler.		
	Default	Yes(-g)	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-g)	Adds debug information to the object file being generated.
		No	Does not add debug information to the object file being generated.

(2) [Preprocess]

The detailed information on the preprocess are displayed and the configuration can be changed.

Additional include paths	Specify the additional include paths during assembling. The following macro names are available as embedded macros. %BuildModeName%: Replaces with the build mode name. %ProjectName%: Replaces with the project name. %MicomToolPath%: Replaces with the absolute path of the product install folder. When this property is omitted, only the standard folder of the assembler is searched. The reference point of the path is the project folder. This corresponds to the -I option of the assembler. The specified include path is displayed as the subproperty.	
	Default	Additional include paths[*number of defined items*]
	How to change	Edit by the Path Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.
	Restriction	Up to 259 characters Up to 64 items can be specified.However, this also includes the number of paths used by linked tools.
System include paths	The include paths which the system set during assembling are displayed. The following macro names are available as embedded macros. %BuildModeName%: Replaces with the build mode name. %ProjectName%: Replaces with the project name. %MicomToolPath%: Replaces with the absolute path of the product install folder. The system include path is searched with lower priority than the additional include path. The reference point of the path is the project folder. This corresponds to the -i option of the assembler. The include path is displayed as the subproperty.	
	Default	System include paths[*number of defined items*]
	How to change	Edit by the System Include Path Order dialog box which appears when clicking the [...] button.
	Restriction	Changes not allowed (Only the specified order of the include paths can be changed.)
Macro definition	Specify the macro name to be defined. Specify in the format "*macro name=defined value*", with one macro name per line. The "=*defined value*" part can be omitted, and in this case, "1" is used as the defined value. This corresponds to the -D option of the assembler. The specified macro is displayed as the subproperty.	
	Default	Macro definition[*number of defined items*]
	How to change	Edit by the Text Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.
	Restriction	Up to 256 characters Up to 256 items can be specified.

(3) [Assemble List]

The detailed information on the assemble list are displayed and the configuration can be changed.

Output assemble list file	Select whether to output the assemble list file. This corresponds to the -a -l option of the assembler.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-a -l)	Outputs an assemble list file.
		No	Does not output an assemble list file.
Output folder for assemble list file	Specify the output destination folder of an assemble list file. The assemble list file is saved under the assembler source file name with the extension ".s" replaced by ".v". This corresponds to the -l option of the assembler. If a relative path is specified, the reference point of the path is the main project or subproject folder. If an absolute path is specified, the reference point of the path is the main project or subproject folder (unless the drives are different). The following macro name is available as an embedded macro. %BuildModeName%: Replaces with the build mode name. If this is blank, it is treated as if the project folder is specified. This property is displayed only when [Yes(-a -l)] in the [Output assemble list file] property is selected.		
	Default	%BuildModeName%	
	How to change	Directly enter to the text box or edit by the Browse For Folder dialog box which appears when clicking the [...] button.	
	Restriction	Up to 247 characters	

(4) [Message]

The detailed information on messages are displayed and the configuration can be changed.

Verbose mode	Select whether to display the execution status of the assembler to the Output panel during build. This corresponds to the -v option of the assembler.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-v)	Displays the execution status of the assembler during build.
		No	Does not display the execution status of the assembler during build.

Warn of using r0 register as destination register	Select whether to display warnings when the r0 register is specified as the destination register. This corresponds to the -wr0- and -wr0+ options of the assembler.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-wr0+)	Displays warnings when the r0 register is specified as the destination register. Specification by this property takes precedence over the [Display warning message] property.
		No(-wr0-)	Does not display warnings when the r0 register is specified as the destination register. Specification by this property takes precedence over the [Display warning message] property.
		No	This item is in accordance with the [Display warning message] property.
Warn of using r1 register	Select whether to display warnings when the r1 register is specified as the source register or destination register. This corresponds to the -wr1- and -wr1+ options of the assembler.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-wr1+)	Displays warnings when the r1 register is specified as the source register or destination register. Specification by this property takes precedence over the [Display warning message] property.
		No(-wr1-)	Does not display warnings when the r1 register is specified as the source register or destination register. Specification by this property takes precedence over the [Display warning message] property.
		No	This item is in accordance with the [Display warning message] property.
Display warning message	Select whether to display warnings when the r1 register is specified as the source register or destination register, when the r0 register is specified as the destination register, or when the r20 or r21 register is specified as the destination register while using the mask register function. This corresponds to the -w option of the assembler.		
	Default	Yes	
	How to change	Select from the drop-down list.	
	Restriction	Yes	Displays warnings when the r1 register is specified as the source register or destination register, when the r0 register is specified as the destination register, or when the r20 or r21 register is specified as the destination register while using the mask register function.
		No(-w)	Does not display warnings when the r1 register is specified as the source register or destination register, when the r0 register is specified as the destination register, or when the r20 or r21 register is specified as the destination register while using the mask register function.

(5) [Others]

Other detailed information on assembly are displayed and the configuration can be changed.

Size threshold of sdata/ sbss section allocation(Bytes)	Specify the upper limit of the data length allocated to the .sdata/.sbss sections. This corresponds to the -G option of the assembler. If this property is changed, the value of the [Size threshold of sdata/sbss section allocation(Bytes)] property in the [Output Code] category from the [Compile Options] tab will be changed accordingly.		
	Default	Blank	
	How to change	Directly enter to the text box.	
	Restriction	0 to 32767 (decimal number)	
Perform optimization	Select whether to perform optimization that rearranges instructions to avoid register/flag hazards. This corresponds to the -O option of the assembler.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-O)	Performs optimization that avoid register/flag hazards.
		No	Does not perform optimization that avoid register/flag hazards.
Use 32-bit branch instruction	Select whether to specify far jump for branch instructions (jarl, jr) where 22/32 is not described in the instruction. This corresponds to the -Xfar_jump option of the assembler. This property is displayed only when the V850E2 core device is specified as a device type.		
	Default	Yes(-Xfar_jump)	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-Xfar_jump)	Specifies far jump for branch instructions (jarl, jr) where 22/32 is not described in the instruction.
		No	The branch instructions (jarl, jr) where 22/32 is not described in the instruction is the ordinary branch instruction.
Commands executed before assemble processing	Specify the command to be executed before assemble processing. Use the call instruction to specify a batch file (example: call a.bat). The following macro names are available as embedded macros. %ProjectFolder%: Replaces with the absolute path of the project folder. %OutputFolder%: Replaces with the absolute path of the output folder. %OutputFile%: Replaces with the absolute path of the output file. %InputFile%: Replaces with the absolute path of the file to be assembled. %AssembledFile%: Replaces with the absolute path of the output file under assembling. The specified command is displayed as the subproperty.		
	Default	Commands executed before assemble processing[*number of defined items*]	
	How to change	Edit by the Text Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.	
	Restriction	Up to 1023 characters Up to 64 items can be specified.	

Commands executed after assemble processing	Specify the command to be executed after assemble processing. Use the call instruction to specify a batch file (example: call a.bat). The following macro names are available as embedded macros. %ProjectFolder%: Replaces with the absolute path of the project folder. %OutputFolder%: Replaces with the absolute path of the output folder. %OutputFile%: Replaces with the absolute path of the output file. %InputFile%: Replaces with the absolute path of the file to be assembled. %AssembledFile%: Replaces with the absolute path of the output file under assembling. The specified command is displayed as the subproperty.	
	Default	Commands executed after assemble processing[*number of defined items*]
	How to change	Edit by the Text Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.
	Restriction	Up to 1023 characters Up to 64 items can be specified.
Other additional options	Input the assemble options to be added additionally. The options set here are added at the end of the assemble options group.	
	Default	Blank
	How to change	Directly enter to the text box or edit by the Character String Input dialog box which appears when clicking the [...] button.
	Restriction	Up to 259 characters

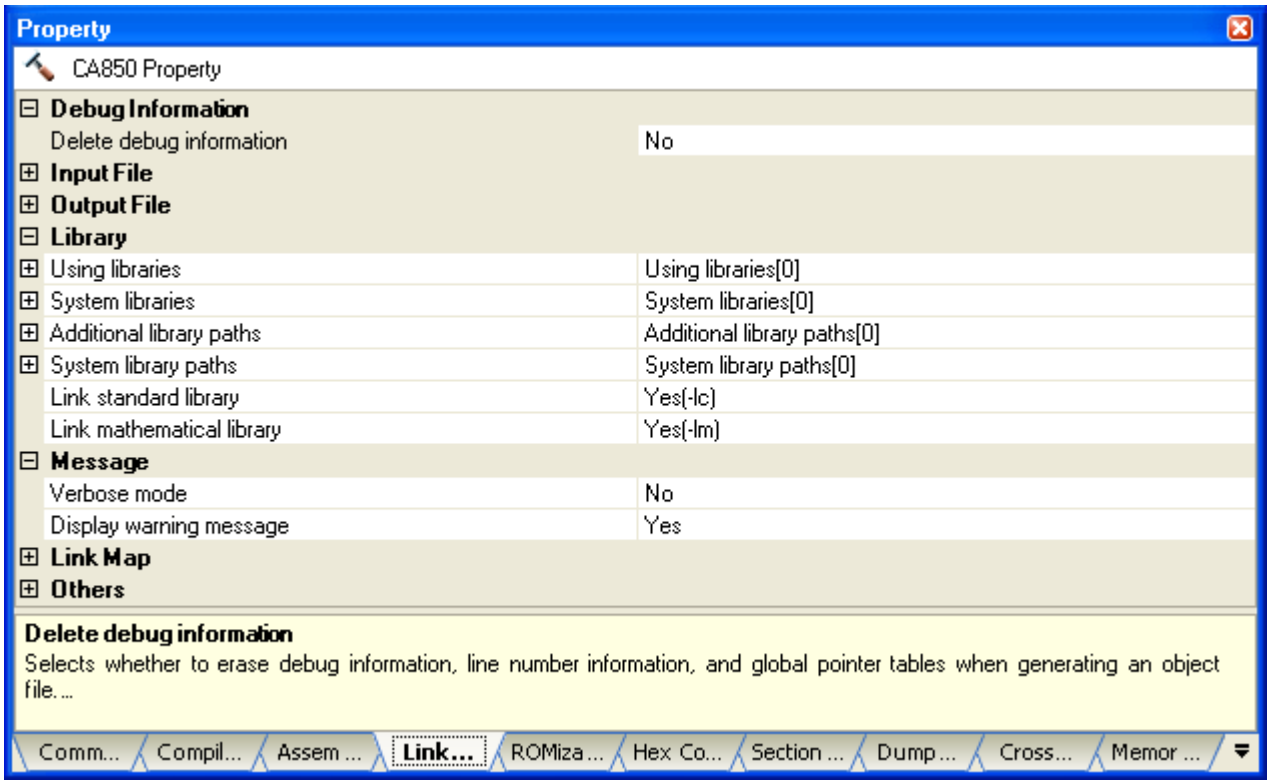
[Link Options] tab

This tab shows the detailed information on the linker categorized by the following and the configuration can be changed.

(1) [Debug Information]
(2) [Input File]
(3) [Output File]
(4) [Library]
(5) [Message]
(6) [Link Map]
(7) [Others]

Caution This tab is not displayed for library projects.

Figure A-7. Property Panel: [Link Options] Tab



[Description of each category]

(1) [Debug Information]

The detailed information on debug information is displayed and the configuration can be changed.

Delete debug information	Select whether to remove debug information, line number information, and global pointer tables when generating an object file. This corresponds to the -s option of the linker.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-s)	Removes debug information, line number information, and global pointer tables when generating an object file.
		No	Does not remove debug information, line number information, and global pointer tables when generating an object file.

(2) [Input File]

The detailed information on input files are displayed and the configuration can be changed.

Use standard startup routine	Select whether to link, during linking, the object module file provided with the compiler in which the standard startup routine is written. However, when any C source file is added to the project and when the build target file is added to the Startup node, the object module file provided with the compiler is not linked.		
	Default	Yes	
	How to change	Select from the drop-down list.	
	Restriction	Yes	Links the object module file provided with the compiler. The files that have been added to the Startup node will not be targeted.
		No	Does not link the object module file provided with the compiler.
Using link directive file	Display the link directive file to be used for linking. This corresponds to the -D option of the linker.		
	Default	*The name of the link directive file that is added to the project*	
	How to change	Changes not allowed	

(3) [Output File]

The detailed information on output files are displayed and the configuration can be changed.

Output folder	Specify the folder for saving the module file that is generated. If a relative path is specified, the reference point of the path is the main project or subproject folder. If an absolute path is specified, the reference point of the path is the main project or subproject folder (unless the drives are different). The following macro name is available as an embedded macro. %BuildModeName%: Replaces with the build mode name. If this is blank, it is treated as if the project folder is specified.		
	Default	%BuildModeName%	
	How to change	Directly enter to the text box or edit by the Browse For Folder dialog box which appears when clicking the [...] button.	
	Restriction	Up to 247 characters	
Output file name	Specify the load module file name to be generated. The extension other than ".out" cannot be specified. If the extension is omitted, ".out" is automatically added. This corresponds to the -o option of the linker. The following macro name is available as an embedded macro. %ProjectName%: Replaces with the project name. If this is blank, it is treated as if "%ProjectName%.out" is specified.		
	Default	%ProjectName%.out	
	How to change	Directly enter to the text box.	
	Restriction	Up to 259 characters	
Output relocatable object file	Select whether to generate a relocatable object file. This corresponds to the -r option of the linker.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-r)	Generates a relocatable object file.
		No	Does not generate a relocatable object file.

(4) [Library]

The detailed information on the library creation are displayed and the configuration can be changed.

Using libraries	Specify the library file name (lib*string*.a) to be used other than the standard libraries. Specify only the "*string*" part (example: if you specify "user", "libuser.a" is assumed to be specified). Add one file in one line. The library files are searched from the library path. This corresponds to the -l option of the linker. The specified library file name is displayed as the subproperty.	
	Default	Using libraries[*number of defined items*]
	How to change	Edit by the Text Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.
	Restriction	Up to 63 characters Up to 256 items can be specified.

System libraries	The name of the library file which the system uses is displayed. The system library file is searched with lower priority than the library file to be used. The library file name is displayed as the subproperty.		
	Default	System libraries[*number of defined items*]	
	How to change	Changes not allowed	
Additional library paths	Specify the search folder to be used other than the standard libraries. The following macro names are available as embedded macros. %BuildModeName%: Replaces with the build mode name. %ProjectName%: Replaces with the project name. %MicomToolPath%: Replaces with the absolute path of the product install folder. The library files are searched from the library path. If a relative path is specified, the reference point of the path is the project folder. This corresponds to the -L option of the linker. The specified library path name is displayed as the subproperty.		
	Default	Additional library paths[*number of defined items*]	
	How to change	Edit by the Path Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.	
	Restriction	Up to 259 characters Up to 256 items can be specified.	
System library paths	The folder to search the system library file is displayed. The following macro names are available as embedded macros. %BuildModeName%: Replaces with the build mode name. %ProjectName%: Replaces with the project name. %MicomToolPath%: Replaces with the absolute path of the product install folder. If a relative path is displayed, the reference point of the path is the project folder. This corresponds to the -L option of the linker. The library path name is displayed as the subproperty.		
	Default	System library paths[*number of defined items*]	
	How to change	Changes not allowed	
Link standard library	Select whether to link the standard library (libc.a). This corresponds to the -lc option of the linker.		
	Default	Yes(-lc)	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-lc)	Links the standard library.
		No	Does not link the standard library.
Link mathematical library	Select whether to link the mathematical library (libm.a). This corresponds to the -lm option of the linker. This property is displayed only when [Yes(-lc)] in the [Link standard library] property is selected.		
	Default	Yes(-lm)	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-lm)	Links the mathematical library.
		No	Does not link the mathematical library.

(5) [Message]

The detailed information on messages are displayed and the configuration can be changed.

Verbose mode	Select whether to display the execution status of the linker to the Output panel during build. This corresponds to the -v option of the linker.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-v)	Displays the execution status of the linker during build.
		No	Does not display the execution status of the linker during build.
Display warning message	Select whether to display the warning messages on the Output panel. This corresponds to the -w option of the linker.		
	Default	Yes	
	How to change	Select from the drop-down list.	
	Restriction	Yes	Displays warning messages.
		No(-w)	Does not display warning messages.

(6) [Link Map]

The detailed information on the link map are displayed and the configuration can be changed.

Output link map file	Select whether to output the link map file. This corresponds to the -m option of the linker.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-m)	Outputs a link map file.
		No	Does not output the link map file.
Output folder for link map file	Specify the output destination folder of a link map file. This corresponds to the -m option of the linker. If a relative path is specified, the reference point of the path is the main project or subproject folder. If an absolute path is specified, the reference point of the path is the main project or subproject folder (unless the drives are different). The following macro name is available as an embedded macro. %BuildModeName%: Replaces with the build mode name. If this is blank, it is treated as if the project folder is specified. This property is displayed only when [Yes(-m)] in the [Output link map file] property is selected.		
	Default	%BuildModeName%	
	How to change	Directly enter to the text box or edit by the Browse For Folder dialog box which appears when clicking the [...] button.	
	Restriction	Up to 247 characters	

Link map file name	Specify the name of a link map file. This corresponds to the -m option of the linker. Use the extension ".map". If the extension is omitted, ".map" is automatically added. The following macro name is available as an embedded macro. %ProjectName%: Replaces with the project name. If this is blank, it is treated as if "%ProjectName%.map" is specified. This property is displayed only when [Yes(-m)] in the [Output link map file] property is selected.	
	Default	%ProjectName%.map
	How to change	Directly enter to the text box.
	Restriction	Up to 259 characters

(7) [Others]

Other detailed information on linking are displayed and the configuration can be changed.

Entry symbol	Specify the symbol to be set as the entry point address of the object file. If this is blank, the entry point address is determined in the following sequence. (1) If symbol "__start" exists, it is used. (2) If the text attribute section exists, the start address of the text attribute section that is allocated to the lowest address area in the generated object file is used. (3) Address 0 This corresponds to the -e option of the linker.		
	Default	Blank	
	How to change	Directly enter to the text box or edit by the Character String Input dialog box which appears when clicking the [...] button.	
	Restriction	Up to 1022 characters	
Specify filling value of holes	Select whether to specify the filling value for align holes between sections of the generated object. This corresponds to the -f option of the linker. This property is displayed only when [Yes(-B)] in the [Link in 2-pass mode] property is selected.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-f)	Specifies the filling value of holes.
		No	Does not specify the filling value of holes.
Filling value of holes	Specify the filling value for align holes between sections of the generated object. This corresponds to the -f option of the linker. This property is displayed only when [Yes(-f)] in the [Specify filling value of holes] property is selected.		
	Default	0x0000	
	How to change	Directly enter to the text box.	
	Restriction	0x0000 to 0xffff (hexadecimal number)	

Display GP information	Select whether to display on the Output panel the information used as a yardstick in the value setting on [Size threshold of sdata/sbss section allocation(Bytes)] property in the [Others] category from the [Assemble Options] tab. This corresponds to the -A option of the linker.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-A)	Displays the information used as a yardstick in the value setting on [Size threshold of sdata/sbss section allocation(Bytes)] property.
		No	Does not display the information used as a yardstick in the value setting on [Size threshold of sdata/sbss section allocation(Bytes)] property.
Link in 2-pass mode	Select whether to perform linking in the 2-pass mode. The 2-pass mode is slower than the 1-pass mode, but it is able to process larger sized files. This corresponds to the -B option of the linker.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-B)	Performs linking in the 2-pass mode.
		No	Performs linking in the 1-pass mode.
Ignore illegal relocation	Select whether to continue linking outputting warning messages instead of errors if the following illegalities is found during relocation processing. - The result of address calculation of an unresolved external reference is illegal - The relationship with the section to be allocated is illegal This corresponds to the -E option of the linker.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-E)	Continues linking outputting warning messages if an illegalities is found during relocation processing.
		No	Stops linking outputting warning messages if an illegalities is found during relocation processing.
Check all multi-defined symbols	Select whether to output a message for all multi-defined external symbols and stop link processing. This corresponds to the -M option of the linker.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-M)	Outputs a message for all multi-defined external symbols and stops link processing.
		No	Outputs a message for the first multi-defined external symbol and stops link processing.

Check illegality of undefined external symbol	Select whether to check if the size and alignment conditions of an undefined external symbol are invalid when linking it. This corresponds to the -t option of the linker. This property is displayed only when [Yes] on the [Display warning message] property in the [Message] category is selected.		
	Default	Yes	
	How to change	Select from the drop-down list.	
	Restriction	Yes	Checks if the size and alignment conditions of an undefined external symbol are invalid when linking it.
		No(-t)	Does not check if the size and alignment conditions of an undefined external symbol are invalid when linking it.
Check illegality of external symbol	Select whether to check if the size and alignment conditions of an external symbol are invalid when linking it. This corresponds to the -T option of the linker. This property is displayed only when [Yes] on the [Display warning message] property in the [Message] category is selected.		
	Default	Yes	
	How to change	Select from the drop-down list.	
	Restriction	Yes	Checks if the size and alignment conditions of an external symbol are invalid when linking it.
		No(-T)	Does not check if the size and alignment conditions of an external symbol are invalid when linking it.
Check mask register function	Select whether to check if the file that uses the mask register function and the file that does not use that function are mixed when linking the object files generated from the C source files. This corresponds to the -mc option of the linker.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-mc)	Checks if the file that uses the mask register function and the file that does not use that function are mixed.
		No	Does not check if the file that uses the mask register function and the file that does not use that function are mixed.
Check register mode	Select whether to display detailed information when register modes are mixed for all input object files. This corresponds to the -rc option of the linker.		
	Default	Yes(-rc)	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-rc)	Displays detailed information when register modes are mixed for all input object files.
		No	Does not display detailed information when register modes are mixed for all input object files.

Rescan library files	Select whether to re-references the library file specified on the [Using libraries] and [System libraries] property in the [Library] category. When this property is specified, symbols that are unresolved through the link sequence of the library can be prevented. This corresponds to the -rescan option of the linker.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-rescan)	Re-references the library file to be used.
		No	Does not re-reference the library file to be used.
Check allocation for internal ROM area	Select whether to check for the allocation to the internal ROM area. Select [No(-rom_less)] when using the ROM-less mode. This corresponds to the -rom_less option of the linker.		
	Default	Yes	
	How to change	Select from the drop-down list.	
	Restriction	Yes	Checks for the allocation to the internal ROM area.
		No(-rom_less)	Does not check for the allocation to the internal ROM area.
Behavior on internal memory overflow	Select whether to continue the processing by displaying a warning message or stop the processing by displaying an error message if an overflow occurs during the allocation to the internal ROM/RAM area. This corresponds to the -Ximem_overflow=warning option of the linker.		
	Default	Error(None)	
	How to change	Select from the drop-down list.	
	Restriction	Error(None)	Stops the processing by displaying an error message if an overflow occurs during the allocation to the internal ROM/RAM area.
		Warning(-Ximem_overflow=warning)	Continues the processing by displaying a warning message if an overflow occurs during the allocation to the internal ROM/RAM area.
Commands executed before link processing	Specify the command to be executed before link processing. Use the call instruction to specify a batch file (example: call a.bat). The following macro names are available as embedded macros. %ProjectFolder%: Replaces with the absolute path of the project folder. %OutputFolder%: Replaces with the absolute path of the output folder. %OutputFile%: Replaces with the absolute path of the output file. %LinkedFile%: Replaces with the absolute path of the output file under link processing. The specified command is displayed as the subproperty.		
	Default	Commands executed before link processing[*number of defined items*]	
	How to change	Edit by the Text Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.	
	Restriction	Up to 1023 characters Up to 64 items can be specified.	

Commands executed after link processing	Specify the command to be executed after link processing. Use the call instruction to specify a batch file (example: call a.bat). The following macro names are available as embedded macros. %ProjectFolder%: Replaces with the absolute path of the project folder. %OutputFolder%: Replaces with the absolute path of the output folder. %OutputFile%: Replaces with the absolute path of the output file. %LinkedFile%: Replaces with the absolute path of the output file under link processing. The specified command is displayed as the subproperty.	
	Default	Commands executed after link processing[*number of defined items*]
	How to change	Edit by the Text Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.
	Restriction	Up to 1023 characters Up to 64 items can be specified.
Other additional options	Input the link options to be added additionally. The options set here are added at the end of the link options group.	
	Default	Blank
	How to change	Directly enter to the text box or edit by the Character String Input dialog box which appears when clicking the [...] button.
	Restriction	Up to 259 characters

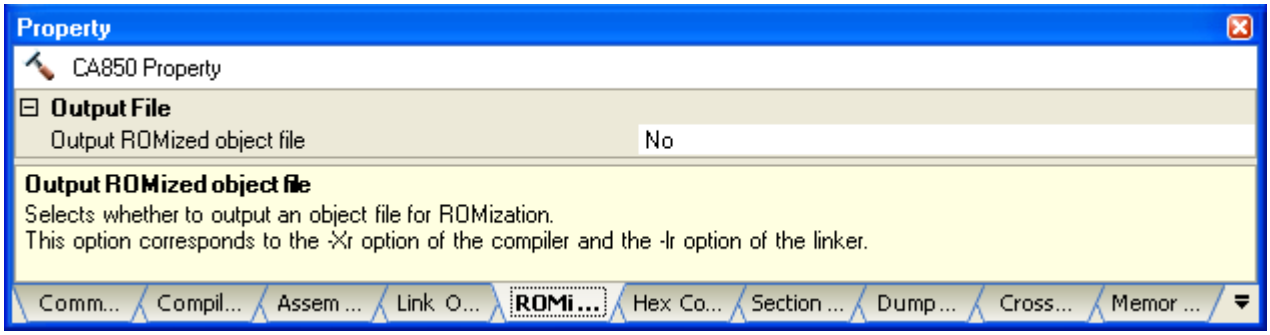
[ROMization Process Options] tab

This tab shows the detailed information on the ROMization processor categorized by the following and the configuration can be changed.

(1) [Output File]
(2) [Input File]
(3) [Section List]
(4) [Memory Map]
(5) [Others]

Caution This tab is not displayed for library projects.

Figure A-8. Property Panel: [ROMization Process Options] Tab



[Description of each category]

(1) [Output File]

The detailed information on output files are displayed and the configuration can be changed.

Output ROMized object file	Select whether to output the ROMized object file. This corresponds to the -Xr option of the compiler and the -lr option of the linker.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-Xr -lr)	Outputs the ROMized object file.
		No	Does not output the ROMized object file.

Output folder for ROMized object file	Specify the folder for saving the ROMized object file. This corresponds to the -o option of the ROMization processor. If a relative path is specified, the reference point of the path is the main project or subproject folder. If an absolute path is specified, the reference point of the path is the main project or subproject folder (unless the drives are different). The following macro name is available as an embedded macro. %BuildModeName%: Replaces with the build mode name. If this is blank, it is treated as if the project folder is specified. This property is displayed only when [Yes(-Xr -lr)] in the [Output ROMized object file] property is selected.	
	Default	%BuildModeName%
	How to change	Directly enter to the text box or edit by the Browse For Folder dialog box which appears when clicking the [...] button.
	Restriction	Up to 247 characters
ROMized object file name	Specify the ROMized object file name. The extension other than ".out" cannot be specified. If the extension is omitted, ".out" is automatically added. This corresponds to the -o option of the ROMization processor. This property is displayed only when [Yes(-Xr -lr)] in the [Output ROMized object file] property is selected.	
	Default	romp.out
	How to change	Directly enter to the text box.
	Restriction	Up to 259 characters

(2) [Input File]

The detailed information on input files are displayed and the configuration can be changed.

This category is not displayed when [No] in the [Output ROMized object file] property in the [Output File] category is selected.

Use standard ROMization area reservation code file	Select whether to use the standard ROMization area reservation code file (rompcrt.o) that conforms to the register mode selected on the [Select register mode] property in the [Register Mode] category from the [Common Options] tab.		
	Default	Yes	
	How to change	Select from the drop-down list.	
	Restriction	Yes	Uses the standard ROMization area reservation code file.
		No	Does not use the standard ROMization area reservation code file. Make the ROMization area reservation code file, and specify the file for the [ROMization area reservation code file name] property.

ROMization area reservation code file name	Specify the name of the ROMization area reservation code file. If a relative path is specified, the reference point of the path is the main project or subproject folder. If an absolute path is specified, the reference point of the path is the main project or subproject folder (unless the drives are different). If this field is blank, a link error occurs. Be sure to specify the boot area load module file name. This property is displayed only when [No] in the [Use standard ROMization area reservation code file] property is selected.	
	Default	Blank
	How to change	Directly enter to the text box or edit by the Specify ROMization Area Reservation Code File dialog box which appears when clicking the [...] button.
	Restriction	Up to 259 characters

(3) [Section List]

The detailed information on the section list are displayed and the configuration can be changed.

This category is not displayed when [No] in the [Output ROMized object file] property in the [Output File] category is selected.

Order of storing to the rompsec section	Specify the section name to be ROMized and the order of storing to the rompsec section. Specify in the format of "*section name option attribute*", with one section name per line. If [Yes] is selected in the [Output ROMization section file] property, a ROMization section file is output when editing this property is finalized. Formats of the option attribute are as described below. - -p Specify this property when the section to be added has the data attribute or sdata attribute. If this property attribute is omitted, all sections that have the data attribute or sdata attribute and sections allocated to the internal instruction RAM are assumed to be specified. - -t Specify this property when the section to be added has the text attribute or const attribute. If this property attribute is omitted, sections allocated to the internal instruction RAM are assumed to be specified. If this property attribute specifies a particular section of an input file linked specifying a device file with internal instruction RAM, sections allocated to unspecified internal instruction RAM will not be stored in the rompsec section, and will also be deleted from the output file. This corresponds to the -t and -p options of the ROMization processor. The specified section name is displayed as the subproperty.		
	Default	Order of storing to the rompsec section[*number of set items*]	
	How to change	Edit by the Text Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.	
	Restriction	Up to 1022 characters Up to 1024 items can be specified.	
Output ROMization section file	Select whether to output the ROMized section file.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes	Outputs a ROMization section file when editing the [Order of storing to the rompsec section] property is finalized.
		No	Does not output the ROMized section file.

Output folder for ROMized section file	Specify the folder for saving the ROMized section file. If a relative path is specified, the reference point of the path is the main project or subproject folder. If an absolute path is specified, the reference point of the path is the main project or subproject folder (unless the drives are different). The following macro name is available as an embedded macro. %BuildModeName%: Replaces with the build mode name. If this is blank, it is treated as if the project folder is specified. This property is displayed only when [Yes] in the [Output ROMization section file] property is selected.	
	Default	%BuildModeName%
	How to change	Directly enter to the text box or edit by the Browse For Folder dialog box which appears when clicking the [...] button.
	Restriction	Up to 247 characters
ROMized section file name	Specify the ROMized section file name. The extension can be freely specified. This property is displayed only when [Yes] in the [Output ROMization section file] property is selected.	
	Default	Blank
	How to change	Directly enter to the text box.
	Restriction	Up to 259 characters

(4) [Memory Map]

The detailed information on memory map are displayed and the configuration can be changed.

This category is not displayed when [No] in the [Output ROMized object file] property in the [Output File] category is selected.

Output memory map file	Select whether to output the memory map file. This corresponds to the -m option of the ROMization processor.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-m)	Outputs a memory map file.
		No	Does not output a memory map file.

Output folder for memory map file	Specify the folder for saving a memory map file. This corresponds to the -m option of the ROMization processor. If a relative path is specified, the reference point of the path is the main project or subproject folder. If an absolute path is specified, the reference point of the path is the main project or subproject folder (unless the drives are different). The following macro name is available as an embedded macro. %BuildModeName%: Replaces with the build mode name. If this is blank, it is treated as if the project folder is specified. This property is displayed only when [Yes(-m)] in the [Output memory map file] property is selected.	
	Default	%BuildModeName%
	How to change	Directly enter to the text box or edit by the Browse For Folder dialog box which appears when clicking the [...] button.
	Restriction	Up to 247 characters
Memory map file name	Specify the memory map file name. The extension other than ".map" cannot be specified. If the extension is omitted, ".map" is automatically added. This corresponds to the -m option of the ROMization processor. The following macro name is available as an embedded macro. %ProjectName%: Replaces with the project name. If this is blank, it is treated as if "romp.map" is specified. This property is displayed only when [Yes(-m)] in the [Output memory map file] property is selected.	
	Default	romp.map
	How to change	Directly enter to the text box.
	Restriction	Up to 259 characters

(5) [Others]

Other detailed information on ROMization process are displayed and the configuration can be changed.

This category is not displayed when [No] in the [Output ROMized object file] property in the [Output File] category is selected.

Entry label	Specify the entry label to be used as the start address of the rompsec section to be generated. This corresponds to the -b option of the ROMization processor. If this is blank, it is treated as if "__S_romp" is specified.	
	Default	__S_romp
	How to change	Directly enter to the text box or edit by the Character String Input dialog box which appears when clicking the [...] button.
	Restriction	Up to 1022 characters

Include a text attribute section into the ROMization object file	Select whether to include a text attribute section into the ROMization object file to be generated. This corresponds to the -d option of the ROMization processor.		
	Default	Yes	
	How to change	Select from the drop-down list.	
	Restriction	Yes	Includes a text attribute section into the ROMization object file.
		No(-d)	Does not include a text attribute section into the ROMization object file.
Check address duplication	Select whether to check for the duplicate address of the input file (executable object file) and output file (ROMization object file). This corresponds to the -i option of the ROMization processor.		
	Default	Yes	
	How to change	Select from the drop-down list.	
	Restriction	Yes	Checks for the duplicate address of the input file (executable object file) and output file (ROMization object file).
		No(-i)	Does not check for the duplicate addresses of the input file and output file.
Check allocation for internal ROM area	Select whether to check for the allocation to the internal ROM area. Select [No(-rom_less)] when using the ROM-less mode. This corresponds to the -rom_less option of the ROMization processor.		
	Default	Yes	
	How to change	Select from the drop-down list.	
	Restriction	Yes	Checks for the allocation to the internal ROM area.
		No(-rom_less)	Does not check for the allocation to the internal ROM area.
Behavior on internal memory overflow	Select whether to continue the processing by displaying a warning message or stop the processing by displaying an error message if an overflow occurs during the allocation to the internal ROM/RAM area.		
	Default	Error(None)	
	How to change	Select from the drop-down list.	
	Restriction	Error(None)	Stops the processing by displaying an error message if an overflow occurs during the allocation to the internal ROM/RAM area.
		Warning(-Ximem_overflow=warning)	Continues the processing by displaying a warning message if an overflow occurs during the allocation to the internal ROM/RAM area.

Commands executed before ROMization processing	Specify the command to be executed before ROMization processing. Use the call instruction to specify a batch file (example: call a.bat). The following macro names are available as embedded macros. %ProjectFolder%: Replaces with the absolute path of the project folder. %OutputFolder%: Replaces with the absolute path of the output folder. %OutputFile%: Replaces with the absolute path of the output file. %RomizedFile%: Replaces with the absolute path of the output file under ROMization processing. The specified command is displayed as the subproperty.	
	Default	Commands executed before ROMization processing[*number of defined items*]
	How to change	Edit by the Text Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.
	Restriction	Up to 1023 characters Up to 64 items can be specified.
Commands executed after ROMization processing	Specify the command to be executed after ROMization processing. Use the call instruction to specify a batch file (example: call a.bat). The following macro names are available as embedded macros. %ProjectFolder%: Replaces with the absolute path of the project folder. %OutputFolder%: Replaces with the absolute path of the output folder. %OutputFile%: Replaces with the absolute path of the output file. %RomizedFile%: Replaces with the absolute path of the output file under ROMization processing. The specified command is displayed as the subproperty.	
	Default	Commands executed after ROMization processing[*number of defined items*]
	How to change	Edit by the Text Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.
	Restriction	Up to 1023 characters Up to 64 items can be specified.
Other additional options	Input the ROMization process options to be added additionally. The options set here are added at the end of the ROMization process options group.	
	Default	Blank
	How to change	Directly enter to the text box or edit by the Character String Input dialog box which appears when clicking the [...] button.
	Restriction	Up to 259 characters

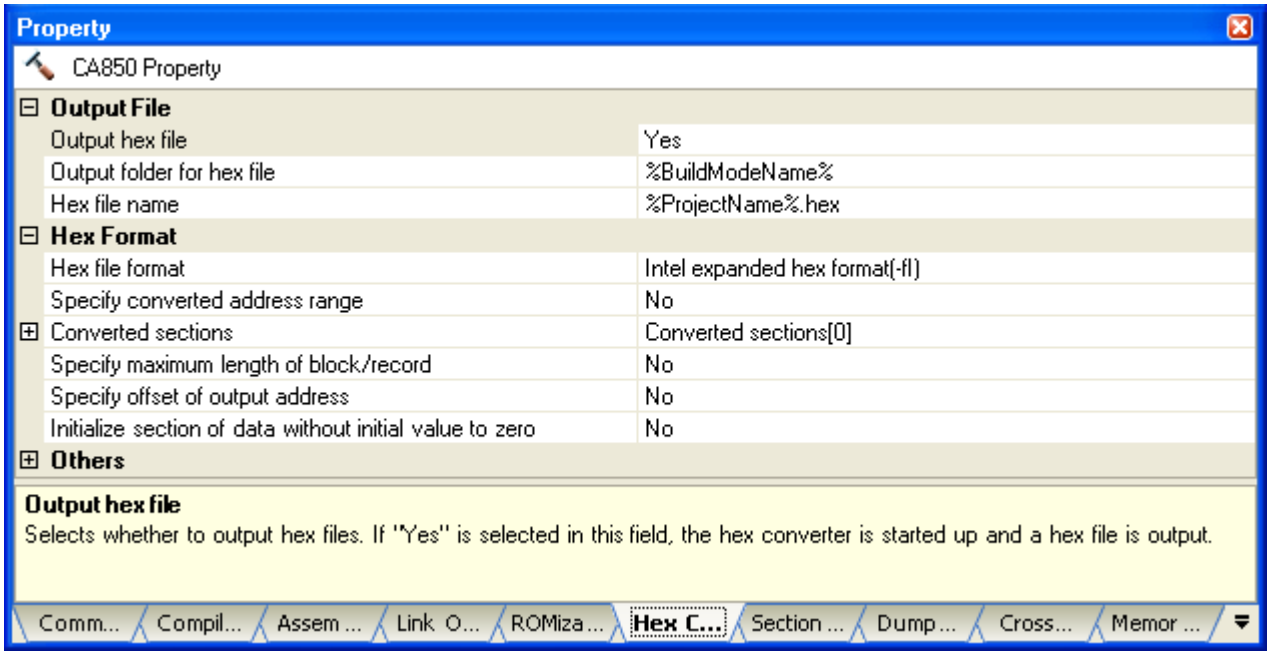
[Hex Convert Options] tab

This tab shows the detailed information on the hex converter categorized by the following and the configuration can be changed.

(1) [Output File]
(2) [Hex Format]
(3) [Symbol Table]
(4) [Others]

Caution This tab is not displayed for library projects.

Figure A-9. Property Panel: [Hex Convert Options] Tab



[Description of each category]

(1) [Output File]

The detailed information on output files are displayed and the configuration can be changed.

Output hex file	Select whether to output the hex file.		
	Default	Yes	
	How to change	Select from the drop-down list.	
	Restriction	Yes	Outputs the hex file.
		No	Does not output the hex file.

Output folder for hex file	Specify the folder for saving the hex file. This corresponds to the -o option of the hex converter. If a relative path is specified, the reference point of the path is the main project or subproject folder. If an absolute path is specified, the reference point of the path is the main project or subproject folder (unless the drives are different). The following macro name is available as an embedded macro. %BuildModeName%: Replaces with the build mode name. If this is blank, it is treated as if the project folder is specified. This property is displayed only when [Yes] in the [Output hex file] property is selected.	
	Default	%BuildModeName%
	How to change	Directly enter to the text box or edit by the Browse For Folder dialog box which appears when clicking the [...] button.
	Restriction	Up to 247 characters
Hex file name	Specify the hex file name. This corresponds to the -o option of the hex converter. The extension can be freely specified. The following macro name is available as an embedded macro. %ProjectName%: Replaces with the project name. This property is displayed only when [Yes] in the [Output hex file] property is selected.	
	Default	%ProjectName%.hex
	How to change	Directly enter to the text box.
	Restriction	Up to 259 characters

(2) [Hex Format]

The detailed information on the hex format are displayed and the configuration can be changed.

This category is not displayed when [No] in the [Output hex file] property in the [Output File] category is selected.

Hex file format	Select the format of the hex file to be generated. This corresponds to the -f option of the hex converter.		
	Default	Intel expanded hex format(-fI)	
	How to change	Select from the drop-down list.	
	Restriction	Intel expanded hex format(-fI)	Specifies the Intel expanded hex format as the format of the hex file to be generated.
		Motorola S type format(standard address)(-fS)	Specifies the Motorola S type format (standard address) as the format of the hex file to be generated.
		Motorola S type format(32-bit address)(-fs)	Specifies the Motorola S type format (32-bit address) as the format of the hex file to be generated.
		Expanded Tektronix hex format(-fT)	Specifies the expanded Tektronix hex format as the format of the hex file to be generated.

Specify converted address range	Select whether to specify the address range to be converted to a hex file. This corresponds to the -U option of the hex converter. This property is not displayed when [Expanded Tektronix hex format(-fT)] in the [Hex file format] property is selected.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-U)	Specifies the address range to be converted to a hex file.
		No	Does not specify the address range to be converted to a hex file.
Filling value	Specify the filling value of the unused areas under the case of converting to a hex file. This corresponds to the -U option of the hex converter. This property is displayed only when [Yes(-U)] in the [Specify converted address range] property is selected.		
	Default	0xFF	
	How to change	Directly enter to the text box.	
	Restriction	0x0000 to 0xFFFF (2- or 4-digit hexadecimal number)	
Start address	Specify the start address of the area to be converted to a hex file. This corresponds to the -U option of the hex converter. This property is displayed only when [Yes(-U)] in the [Specify converted address range] property is selected.		
	Default	Blank	
	How to change	Directly enter to the text box.	
	Restriction	0x0 to *the maximum value of the address that can be handled by the device* (hexadecimal)	
Size	Specify the size of the area to be converted to a hex file. This corresponds to the -U option of the hex converter. This property is displayed only when [Yes(-U)] in the [Specify converted address range] property is selected.		
	Default	Blank	
	How to change	Directly enter to the text box.	
	Restriction	0x1 to *the maximum value of the address that can be handled by the device* (hexadecimal)	
Converted sections	Specify the section to be converted to a hex file. Add one section in one line. When this property is omitted, all the sections with the section type other than NOBITS and section attribute A are converted to hex files. This corresponds to the -H option of the hex converter. The specified section name is displayed as the subproperty. This property is displayed only when [No] in the [Specify converted address range] property is selected.		
	Default	Converted sections[*number of set items*]	
	How to change	Edit by the Text Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.	
	Restriction	Up to 1022 characters Up to 1024 items can be specified.	

<table>
<tr><td rowspan="5">Specify maximum length of block/record</td><td colspan="3">Select whether to specify the maximum length of block/record of a hex file.
This corresponds to the -b option of the hex converter.</td></tr>
<tr><td>Default</td><td colspan="2">No</td></tr>
<tr><td>How to change</td><td colspan="2">Select from the drop-down list.</td></tr>
<tr><td rowspan="2">Restriction</td><td>Yes(-b)</td><td>Specifies the maximum length of block/record.</td></tr>
<tr><td>No</td><td>Does not specify the maximum length of block/record.</td></tr>
<tr><td rowspan="5">Maximum length of block/record</td><td colspan="3">Specify the maximum length of block/record of a hex file.
This corresponds to the -b option of the hex converter.
Note that if a change to the [Hex file format] property causes the value set in this property to be outside the specifiable range, then it is set to the default value of the format.
This property is displayed only when [Yes(-b)] in the [Specify maximum length of block/record] property is selected.</td></tr>
<tr><td>Default</td><td colspan="2">- When [Intel expanded hex format(-fI)] on the [Hex file format] property is selected and [Reset to Default] from the context menu of this property
31
- When [Motorola S type format(standard address)(-fS)] on the [Hex file format] property is selected and [Reset to Default] from the context menu of this property
80
- When [Motorola S type format(32-bit address)(-fs)] on the [Hex file format] property is selected and [Reset to Default] from the context menu of this property
80
- When [Expanded Tektronix hex format(-fT)] on the [Hex file format] property is selected and [Reset to Default] from the context menu of this property
255</td></tr>
<tr><td>How to change</td><td colspan="2">Directly enter to the text box.</td></tr>
<tr><td>Restriction</td><td colspan="2">- When [Intel expanded hex format(-fI)] on the [Hex file format] property is selected
1 to 255 (decimal number), or 0x01 to 0xff (hexadecimal number)
- When [Motorola S type format(standard address)(-fS)] on the [Hex file format] property is selected
1 to 251 (decimal number), or 0x01 to 0xfb (hexadecimal number)
- When [Motorola S type format(32-bit address)(-fs)] on the [Hex file format] property is selected
1 to 250 (decimal number), or 0x01 to 0xfa (hexadecimal number)
- When [Expanded Tektronix hex format(-fT)] on the [Hex file format] property is selected
16 to 255 (decimal number), or 0x10 to 0xff (hexadecimal number)</td></tr>
<tr><td rowspan="5">Specify offset of output address</td><td colspan="3">Select whether to specify the offset of an output address when converting to a hex file.
This corresponds to the -d option of the hex converter.</td></tr>
<tr><td>Default</td><td colspan="2">No</td></tr>
<tr><td>How to change</td><td colspan="2">Select from the drop-down list.</td></tr>
<tr><td rowspan="2">Restriction</td><td>Yes(-d)</td><td>Specifies the offset of an output address.</td></tr>
<tr><td>No</td><td>Does not specify the offset of an output address.</td></tr>
</table>

Offset of output address	Specify the offset of an output address when converting to a hex file. This corresponds to the -d option of the hex converter. This property is displayed only when [Yes(-d)] in the [Specify offset of output address] property is selected.		
	Default	0x0	
	How to change	Directly enter to the text box.	
	Restriction	0x0 to 0xfffffffe (hexadecimal number)	
Initialize section of data without initial value to zero	Select whether to initialize the section of the data without an initial value to zero during the conversion to a hex file. This corresponds to the -z option of the hex converter. This property is displayed only when [Yes(-U)] in the [Specify converted address range] property is selected.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-z)	Initializes the section of the data without initial value to zero.
		No	Does not initialize the section of the data without initial value to zero.

(3) [Symbol Table]

The detailed information on the symbol table is displayed and the configuration can be changed.

This category is not displayed when [No] in the [Output hex file] property in the [Output File] category is selected and [Expanded Tektronix hex format(-fT)] in the [Output hex file] property in the [Hex Format] category is selected.

Convert symbol table	Select whether to convert a symbol table during the conversion to a hex file. This corresponds to the -S -x option of the hex converter.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(Convert global and local symbols)(-S -x)	Converts global symbols and local symbols.
		Yes(Convert global symbols)(-S)	Converts global symbols.
		No	Does not convert a symbol table.

(4) [Others]

Other detailed information on hex conversion are displayed and the configuration can be changed.

This category is not displayed when [No] in the [Output hex file] property in the [Output File] category is selected.

<table>
<tr><td rowspan="4">Warn internal ROM overflow</td><td colspan="3">Select whether to display a warning message when the area to be converted to a hex file overflows from the internal ROM area.
This corresponds to the -rom_less option of the hex converter.</td></tr>
<tr><td>Default</td><td colspan="2">Yes</td></tr>
<tr><td>How to change</td><td colspan="2">Select from the drop-down list.</td></tr>
<tr><td>Restriction</td><td>Yes</td><td>Displays a warning message when the area to be converted to a hex file overflows from the internal ROM area.</td></tr>
<tr><td></td><td>No(-rom_less)</td><td>Does not display a warning message when the area to be converted to a hex file overflows from the internal ROM area.</td></tr>
<tr><td rowspan="4">Commands executed before hex convert processing</td><td colspan="3">Specify the command to be executed before hex convert processing.
Use the call instruction to specify a batch file (example: call a.bat).
The following macro names are available as embedded macros.
%ProjectFolder%: Replaces with the absolute path of the project folder.
%OutputFolder%: Replaces with the absolute path of the output folder.
%OutputFile%: Replaces with the absolute path of the output file.
%InputFile%: Replaces with the absolute path of the output file under hex convert processing.
%HexConvertedFile%: Replaces with the absolute path of the output file under hex convert processing.
The specified command is displayed as the subproperty.</td></tr>
<tr><td>Default</td><td colspan="2">Commands executed before hex convert processing[number of defined items]</td></tr>
<tr><td>How to change</td><td colspan="2">Edit by the Text Edit dialog box which appears when clicking the [...] button.
For the subproperty, you can use the text box directly enter the text.</td></tr>
<tr><td>Restriction</td><td colspan="2">Up to 1023 characters
Up to 64 items can be specified.</td></tr>
<tr><td rowspan="4">Commands executed after hex convert processing</td><td colspan="3">Specify the command to be executed after hex convert processing.
Use the call instruction to specify a batch file (example: call a.bat).
The following macro names are available as embedded macros.
%ProjectFolder%: Replaces with the absolute path of the project folder.
%OutputFolder%: Replaces with the absolute path of the output folder.
%OutputFile%: Replaces with the absolute path of the output file.
%InputFile%: Replaces with the absolute path of the output file under hex convert processing.
%HexConvertedFile%: Replaces with the absolute path of the output file under hex convert processing.
The specified command is displayed as the subproperty.</td></tr>
<tr><td>Default</td><td colspan="2">Commands executed after hex convert processing[number of defined items]</td></tr>
<tr><td>How to change</td><td colspan="2">Edit by the Text Edit dialog box which appears when clicking the [...] button.
For the subproperty, you can use the text box directly enter the text.</td></tr>
<tr><td>Restriction</td><td colspan="2">Up to 1023 characters
Up to 64 items can be specified.</td></tr>
</table>

Other additional options	Input the hex convert options to be added additionally. The options set here are added at the end of the hex convert options group.	
	Default	Blank
	How to change	Directly enter to the text box or edit by the Character String Input dialog box which appears when clicking the [...] button.
	Restriction	Up to 259 characters

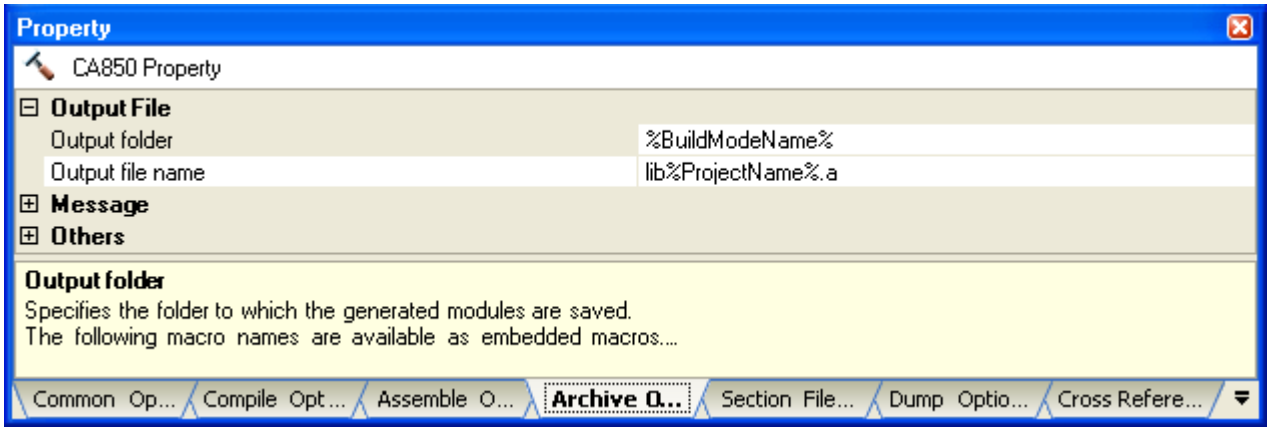
[Archive Options] tab

This tab shows the detailed information on the archiver categorized by the following and the configuration can be changed.

(1) [Output File]
(2) [Message]
(3) [Others]

Caution This tab is displayed only for library projects.

Figure A-10. Property Panel: [Archive Options] Tab



[Description of each category]

(1) [Output File]

The detailed information on output files are displayed and the configuration can be changed.

Output folder	Specify the folder for saving the archive file that is generated. This corresponds to the -q key of the archiver. If a relative path is specified, the reference point of the path is the main project or subproject folder. If an absolute path is specified, the reference point of the path is the main project or subproject folder (unless the drives are different). The following macro name is available as an embedded macro. %BuildModeName%: Replaces with the build mode name. If this is blank, it is treated as if the project folder is specified.	
	Default	%BuildModeName%
	How to change	Directly enter to the text box or edit by the Browse For Folder dialog box which appears when clicking the [...] button.
	Restriction	Up to 247 characters

Output file name	Specify the archive file name to be generated. This corresponds to the -q key of the archiver. The extension other than ".a" cannot be specified. If the extension is omitted, ".a" is automatically added. The following macro name is available as an embedded macro. %ProjectName%: Replaces with the project name.	
	Default	lib%ProjectName%.a
	How to change	Directly enter to the text box.
	Restriction	Up to 259 characters

(2) [Message]

The detailed information on messages is displayed and the configuration can be changed.

Verbose mode	Select whether to display the execution status of the archiver[Note] to the Output panel during build. This corresponds to the v option of the archiver.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(v)	Displays the execution status of the archiver during build.
		No	Does not display the execution status of the archiver during build.

Note The meanings of the output of execution status are shown below.

Output Format	Meaning
`q - file-name`	Create a new archive file, or add a member

(3) [Others]

Other detailed information on archiving are displayed and the configuration can be changed.

Commands executed before archive processing	Specify the command to be executed before archive processing. Use the call instruction to specify a batch file (example: call a.bat). The following macro names are available as embedded macros. %ProjectFolder%: Replaces with the absolute path of the project folder. %OutputFolder%: Replaces with the absolute path of the output folder. %OutputFile%: Replaces with the absolute path of the output file. %ArchivedFile%: Replaces with the absolute path of the output file under archive processing. The specified command is displayed as the subproperty.	
	Default	Commands executed before archive processing[*number of defined items*]
	How to change	Edit by the Text Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.
	Restriction	Up to 1023 characters Up to 64 items can be specified.

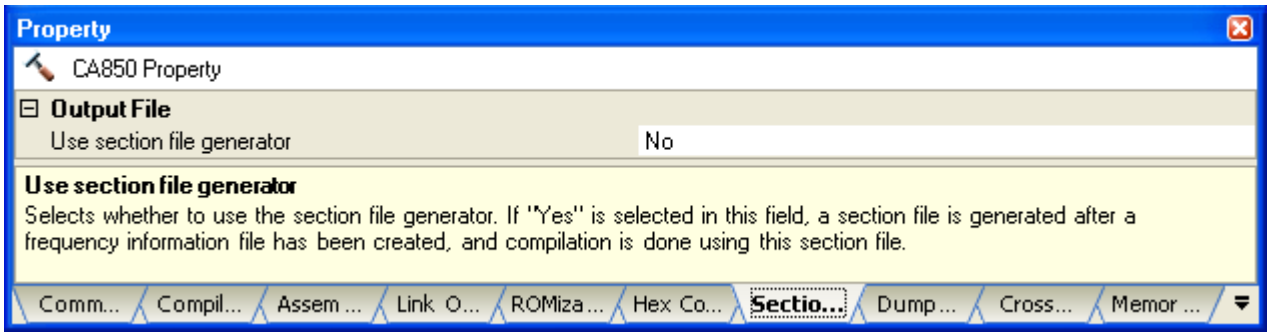
Commands executed after archive processing	Specify the command to be executed after archive processing. Use the call instruction to specify a batch file (example: call a.bat). The following macro names are available as embedded macros. %ProjectFolder%: Replaces with the absolute path of the project folder. %OutputFolder%: Replaces with the absolute path of the output folder. %OutputFile%: Replaces with the absolute path of the output file. %ArchivedFile%: Replaces with the absolute path of the output file under archive processing. The specified command is displayed as the subproperty.	
	Default	Commands executed after archive processing[*number of defined items*]
	How to change	Edit by the Text Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.
	Restriction	Up to 1023 characters Up to 64 items can be specified.
Other additional options	Input the archive options to be added additionally. The options set here are added at the end of the archive options group.	
	Default	Blank
	How to change	Directly enter to the text box or edit by the Character String Input dialog box which appears when clicking the [...] button.
	Restriction	Up to 259 characters

[Section File Generate Options] tab

This tab shows the detailed information on the section file generator categorized by the following and the configuration can be changed.

(1) [Output File]
(2) [Message]
(3) [Allocation of Variables]
(4) [Others]

Figure A-11. Property Panel: [Section File Generate Options] Tab



[Description of each category]

(1) [Output File]

The detailed information on output files are displayed and the configuration can be changed.

Use section file generator	Select whether to use the section file generator during build.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes	Generates a section file after a frequency information file has been created, and performs compilation using that section file. The section information file will be removed from the rapid build target.
		No	Does not create a frequency information file and use the section file generator during build.

Output folder for section file	Specify the folder for saving the section file. This corresponds to the -o option of the section file generator. If a relative path is specified, the reference point of the path is the main project or subproject folder. If an absolute path is specified, the reference point of the path is the main project or subproject folder (unless the drives are different). The following macro name is available as an embedded macro. %BuildModeName%: Replaces with the build mode name. If this is blank, it is treated as if the project folder is specified. This property is displayed only when [Yes] in the [Use section file generator] property is selected.	
	Default	%BuildModeName%
	How to change	Directly enter to the text box or edit by the Browse For Folder dialog box which appears when clicking the [...] button.
	Restriction	Up to 247 characters
Section file name	Specify the section file name. The extension other than ".sf" cannot be specified. If the extension is omitted, ".sf" is automatically added. This corresponds to the -o option of the section file generator. The following macro name is available as an embedded macro. %ProjectName%: Replaces with the project name. If this is blank, it is treated as if "%ProjectName%.sf" is specified. This property is displayed only when [Yes] in the [Use section file generator] property is selected.	
	Default	%ProjectName%.sf
	How to change	Directly enter to the text box.
	Restriction	Up to 259 characters

(2) [Message]

The detailed information on messages is displayed and the configuration can be changed.

This category is not displayed when [No] in the [Use section file generator] property in the [Output File] category is selected.

Verbose mode	Select whether to display the execution status of the section file generator to the Output panel during build. This corresponds to the -v option of the section file generator.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-v)	Displays the execution status of the section file generator during build.
		No	Does not display the execution status of the section file generator during build.

(3) [Allocation of Variables]

The detailed information on the allocation of variables are displayed and the configuration can be changed.

This category is not displayed when [No] in the [Use section file generator] property in the [Output File] category is selected.

Sort key of variables	Select the sort key of the variables to be output into the section file. This corresponds to the -ns, -sname, -ssection, -ssize, -O, and -O2 options of the section file generator.		
	Default	Frequency of use(None)	
	How to change	Select from the drop-down list.	
	Restriction	Do not sort(-ns)	Does not sort variables to be output to the section file.
		Frequency of use(None)	Sorts variables to be output to the section file in decreasing order of frequency in which they are used.
		Variable name(-sname)	Sorts variables to be output to the section file according to the dictionary order of variable names.
		Section name(-ssection)	Sorts variables to be output to the section file according to the dictionary order of section names.
		Variable size(-ssize)	Sorts variables to be output to the section file in increasing order of their size.
		Optimized location(-O)	Sorts variables to be output to the section file in decreasing order of frequency in which they are used and outputs only a part of them which are possible to be allocated to the .tidata section.
		All section optimized location(-O2)	Selects variables to the section file for each variable size that can be allocated to .tidata, sidata, .sedata, and .sdata sections in the order starting from highest use frequency and determines that only the number of variables that can be allocated will be selected and outputs.
Specification of sections excluded in optimization	Select the section not subject to optimization during the section file generation. This corresponds to the -Xcs option of the section file generator. This property is displayed only when [Optimized location(-O)] or [All section optimized location(-O2)] in the [Sort key of variables] property is selected.		
	Default	Optimize all sections(None)	
	How to change	Select from the drop-down list.	
	Restriction	Optimize all sections(None)	Includes all sections in optimization during the section file generation.
		Exclude all sections in optimization(-Xcs)	Excludes all sections from optimization during the section file generation.
		Specify sections excluded in optimization(-Xcs)	Specifies the section not subject to optimization during the section file generation.

<table>
<tr><td rowspan="4">Sections excluded in optimization</td><td colspan="3">Specify the section not subject to optimization during the section file generation.
Add one section in one line.
When this property is omitted, any sections are not subjected to optimization.
This corresponds to the -Xcs option of the section file generator.
The specified section name is displayed as the subproperty.
This property is displayed only when [Specify sections excluded in optimization(-Xcs)] in the [Specification of sections excluded in optimization] property is selected.</td></tr>
<tr><td>Default</td><td colspan="2">Sections excluded in optimization[number of set items]</td></tr>
<tr><td>How to change</td><td colspan="2">Edit by the Text Edit dialog box which appears when clicking the [...] button.
For the subproperty, you can use the text box directly enter the text.</td></tr>
<tr><td>Restriction</td><td colspan="2">Up to 1022 characters
Up to 1024 items can be specified.</td></tr>
<tr><td rowspan="4">Specify allocatable size of tidata section</td><td colspan="3">Select whether to specify the allocatable size for the tidata.word/tidata.byte sections.
This corresponds to the -size_tidata option of the section file generator.
This property is displayed only when [Optimized location(-O)] or [All section optimized location(-O2)] in the [Sort key of variables] property is selected.</td></tr>
<tr><td>Default</td><td colspan="2">No</td></tr>
<tr><td>How to change</td><td colspan="2">Select from the drop-down list.</td></tr>
<tr><td>Restriction</td><td>Yes(-size_tidata)</td><td>Specifies the allocatable size for the tidata.word/tidata.byte sections.</td></tr>
<tr><td></td><td>No</td><td>Does not specify the allocatable size for the tidata.word/tidata.byte sections.</td></tr>
<tr><td rowspan="4">Allocatable size of tidata section</td><td colspan="3">Specify the allocatable size for the tidata.word/tidata.byte sections.
This corresponds to the -size_tidata option of the section file generator.
This property is not displayed when [No] in the [Specify allocatable size of tidata section] property is selected.</td></tr>
<tr><td>Default</td><td colspan="2">256</td></tr>
<tr><td>How to change</td><td colspan="2">Directly enter to the text box.</td></tr>
<tr><td>Restriction</td><td colspan="2">0 to 256 (decimal number)</td></tr>
<tr><td rowspan="4">Specify allocatable size of tidata.byte section</td><td colspan="3">Select whether to specify the allocatable size for the tidata.byte section.
This corresponds to the -size_tidata_byte option of the section file generator.
This property is displayed only when [Optimized location(-O)] or [All section optimized location(-O2)] in the [Sort key of variables] property is selected.</td></tr>
<tr><td>Default</td><td colspan="2">No</td></tr>
<tr><td>How to change</td><td colspan="2">Select from the drop-down list.</td></tr>
<tr><td>Restriction</td><td>Yes(-size_tidata_byte)</td><td>Specifies the allocatable size for the tidata.byte section.</td></tr>
<tr><td></td><td>No</td><td>Does not specify the allocatable size for the tidata.byte section.</td></tr>
</table>

Allocatable size of tidata.byte section	Specify the allocatable size for the tidata.byte section. This corresponds to the -size_tidata_byte option of the section file generator. This property is not displayed when [No] in the [Specify allocatable size of tidata.byte section] property is selected.		
	Default	128	
	How to change	Directly enter to the text box.	
	Restriction	0 to 128 (decimal number)	
Specify allocatable size of sidata section	Select whether to specify the allocatable size for the sidata section. This corresponds to the -size_sidata option of the section file generator. This property is displayed only when [All section optimized location(-O2)] in the [Sort key of variables] property is selected.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-size_sidata)	Specifies the allocatable size for the sidata section.
		No	Does not specify the allocatable size for the sidata section.
Allocatable size of sidata section	Specify the allocatable size for the sidata section. This corresponds to the -size_sidata option of the section file generator. This property is not displayed when [No] in the [Specify allocatable size of sidata section] property is selected.		
	Default	32768	
	How to change	Directly enter to the text box.	
	Restriction	0 to 32768 (decimal number)	
Specify allocatable size of sedata section	Select whether to specify the allocatable size for the sedata section. This corresponds to the -size_sedata option of the section file generator. This property is displayed only when [All section optimized location(-O2)] in the [Sort key of variables] property is selected.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-size_sedata)	Specifies the allocatable size for the sedata section.
		No	Does not specify the allocatable size for the sedata section.
Allocatable size of sedata section	Specify the allocatable size for the sedata section. This corresponds to the -size_sedata option of the section file generator. This property is not displayed when [No] in the [Specify allocatable size of sedata section] property is selected.		
	Default	32768	
	How to change	Directly enter to the text box.	
	Restriction	0 to 32768 (decimal number)	

Specify allocatable size of sdata section	Select whether to specify the allocatable size for the sdata section. This corresponds to the -size_sdata option of the section file generator. This property is displayed only when [All section optimized location(-O2)] in the [Sort key of variables] property is selected.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-size_sdata)	Specifies the allocatable size for the sdata section.
		No	Does not specify the allocatable size for the sdata section.
Allocatable size of sdata section	Specify the allocatable size for the sdata section. This corresponds to the -size_sdata option of the section file generator. This property is not displayed when [No] in the [Specify allocatable size of sdata section] property is selected.		
	Default	65536	
	How to change	Directly enter to the text box.	
	Restriction	0 to 65536 (decimal number)	
Variables excluded in optimization	Specify the variable not subject to optimization during the section file generation. Add one variable in one line. This corresponds to the -Xcv option of the section file generator. The specified variable name is displayed as the subproperty. This property is displayed only when [Optimized location(-O)] or [All section optimized location(-O2)] in the [Sort key of variables] property is selected.		
	Default	Variables excluded in optimization[*number of set items*]	
	How to change	Edit by the Text Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.	
	Restriction	Up to 1022 characters Up to 1024 items can be specified.	

(4) [Others]

Other detailed information on section file generation are displayed and the configuration can be changed.
This category is not displayed when [No] in the [Use section file generator] property in the [Output File] category is selected.

Comment level	Select the level of the comments to be output into the section file. This corresponds to the -cl option of the section file generator.		
	Default	Level 1(None)	
	How to change	Select from the drop-down list.	
	Restriction	No Output(-cl 0)	Does not output comments into the section file.
		Level 1(None)	Outputs a comment (file generation information such as time and date, variable information and the description) into the section file. Variable information consists of a section name, size and frequency of usage.
		Level 2(-cl 2)	Outputs a format guide in addition to level 1.

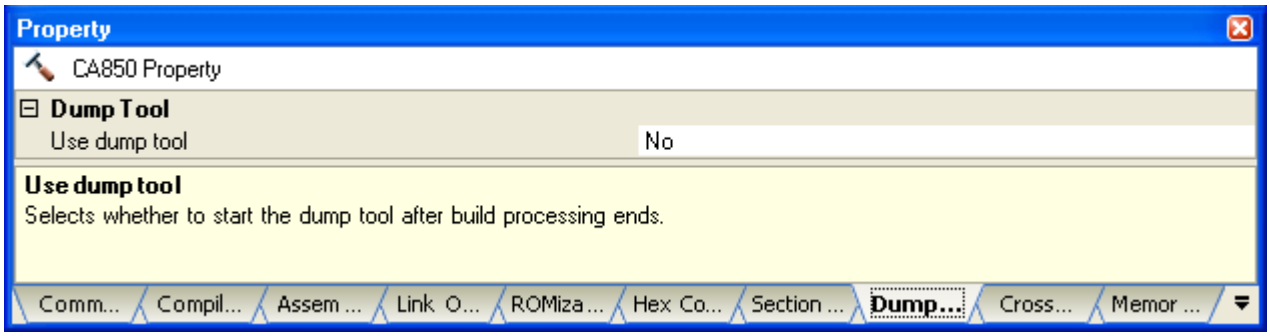
Other additional options	Input the section file generate options to be added additionally. The options set here are added at the end of the section file generator options group.	
	Default	Blank
	How to change	Directly enter to the text box or edit by the Character String Input dialog box which appears when clicking the [...] button.
	Restriction	Up to 259 characters

[Dump Options] tab

This tab shows the detailed information on the dump tool categorized by the following and the configuration can be changed.

(1) [Dump Tool]

Figure A-12. Property Panel: [Dump Options] Tab



[Description of each category]

(1) [Dump Tool]

The detailed information on the dump tool are displayed and the configuration can be changed.

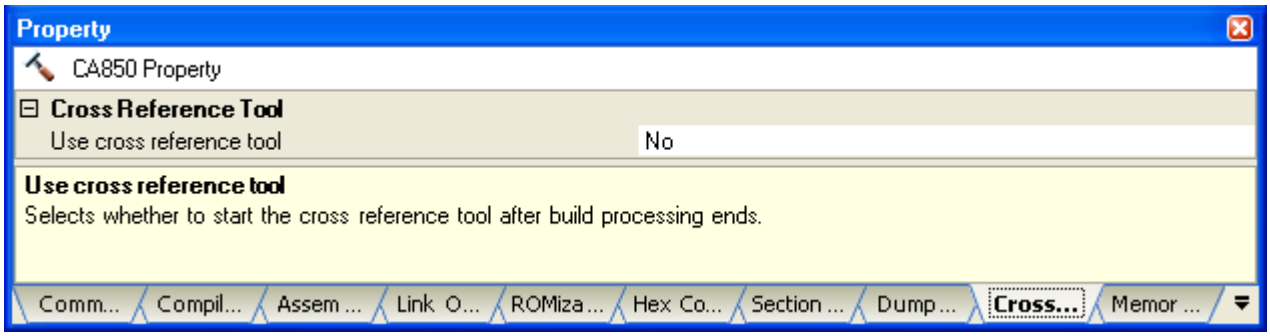
Use dump tool	Select whether to start the dump tool after build processing ends.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes	Starts the dump tool for the load module file after build processing ends.
		No	Does not start the dump tool after build processing ends.
Additional options for dump tool	Input the dump tool options to be added. The options set here are added at the end of the dump options group. This property is displayed only when [Yes] in the [Use dump tool] property is selected.		
	Default	Blank	
	How to change	Directly enter to the text box or edit by the Character String Input dialog box which appears when clicking the [...] button.	
	Restriction	Up to 259 characters	

[Cross Reference Options] tab

This tab shows the detailed information on the cross reference tool categorized by the following and the configuration can be changed.

(1) [Cross Reference Tool]

Figure A-13. Property Panel: [Cross Reference Options] Tab



[Description of each category]

(1) [Cross Reference Tool]

The detailed information on the cross reference tool are displayed and the configuration can be changed.

Use cross reference tool	Select whether to start the cross reference tool after build processing ends. If the cross reference tool is started, all the C source files registered to the project are taken as an input and all information (cross reference information, tag jump information, call tree, function metrics and call database) is output to the files in text format and CSV format.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes	Starts the cross reference tool after build processing ends.
		No	Does not start the cross reference tool after build processing ends.
Additional options for cross reference tool	Input the cross reference tool options to be added. The options set here are added at the end of the cross reference options group.		
	Default	Blank	
	How to change	Directly enter to the text box or edit by the Character String Input dialog box which appears when clicking the [...] button.	
	Restriction	Up to 259 characters	

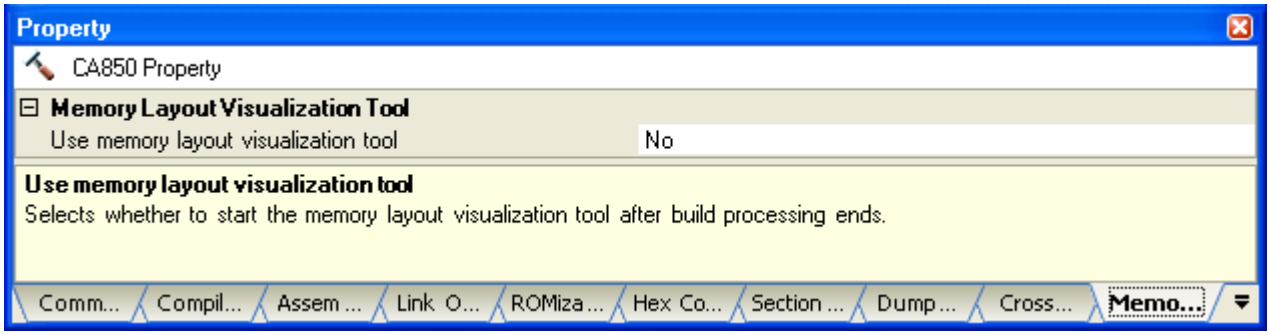
[Memory Layout Visualization Options] tab

This tab shows the detailed information on the memory layout visualization tool categorized by the following and the configuration can be changed.

(1) [Memory Layout Visualization Tool]

Caution This tab is not displayed for library projects.

Figure A-14. Property Panel: [Memory Layout Visualization Options] Tab



[Description of each category]

(1) [Memory Layout Visualization Tool]

The detailed information on the memory layout visualization tool are displayed and the configuration can be changed.

Use memory layout visualization tool	Select whether to start the memory layout visualization tool after build processing ends. If the memory layout visualization is started, an object file (*.out) is taken as an input and a memory map table is output to the files in text format and CSV format. The object file (*.out) output by the linker is taken as an input.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes	Starts the memory layout visualization tool after build processing ends.
		No	Does not start the memory layout visualization tool after build processing ends.
Additional options for memory layout visualization tool	Input the memory layout visualization tool options to be added. The options set here are added at the end of the memory layout visualization options group.		
	Default	Blank	
	How to change	Directly enter to the text box or edit by the Character String Input dialog box which appears when clicking the [...] button.	
	Restriction	Up to 259 characters	

[Build Settings] tab

This tab shows the detailed information on each C source file, assembler source file, link directive file, section file, object file, and archive file categorized by the following and the configuration can be changed.

(1) [Build]

Figure A-15. Property Panel: [Build Settings] Tab (When Selecting C Source File)

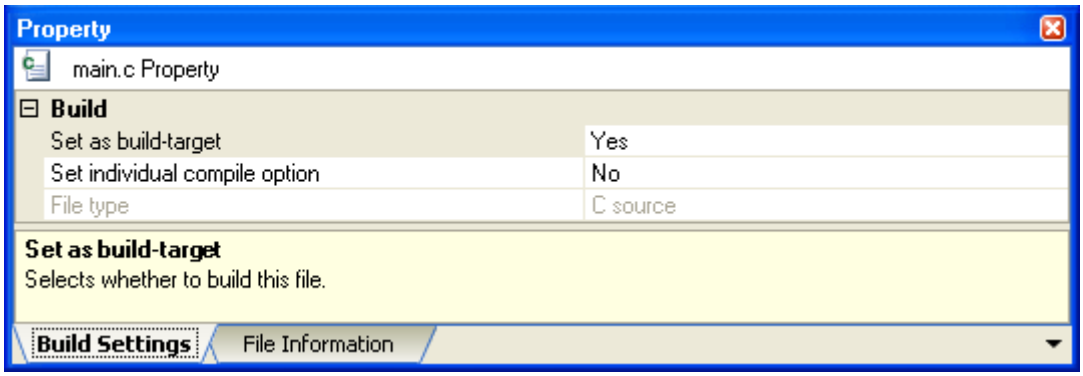


Figure A-16. Property Panel: [Build Settings] Tab (When Selecting Assembler Source File)

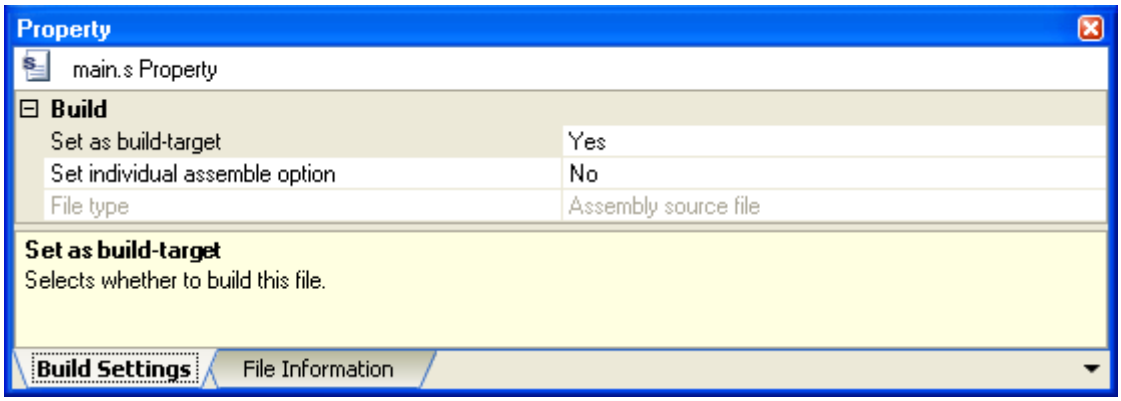


Figure A-17. Property Panel: [Build Settings] Tab (When Selecting Link Directive File)

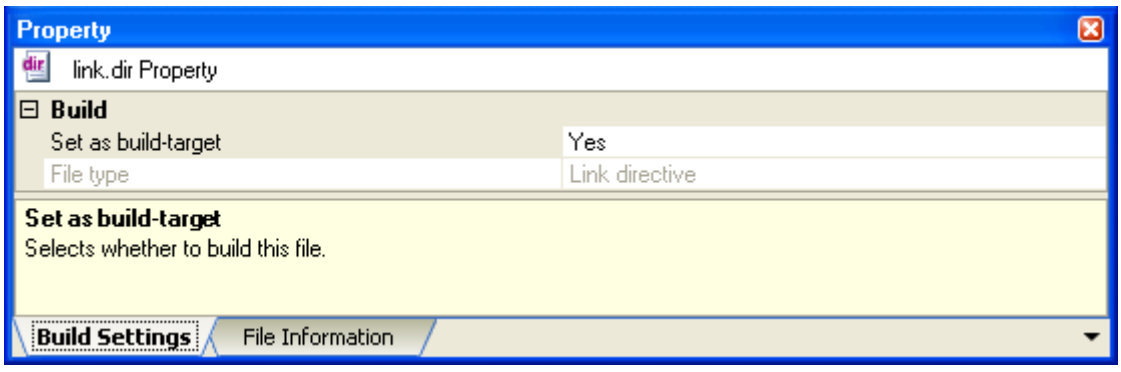


Figure A-18. Property Panel: [Build Settings] Tab (When Selecting Section File)

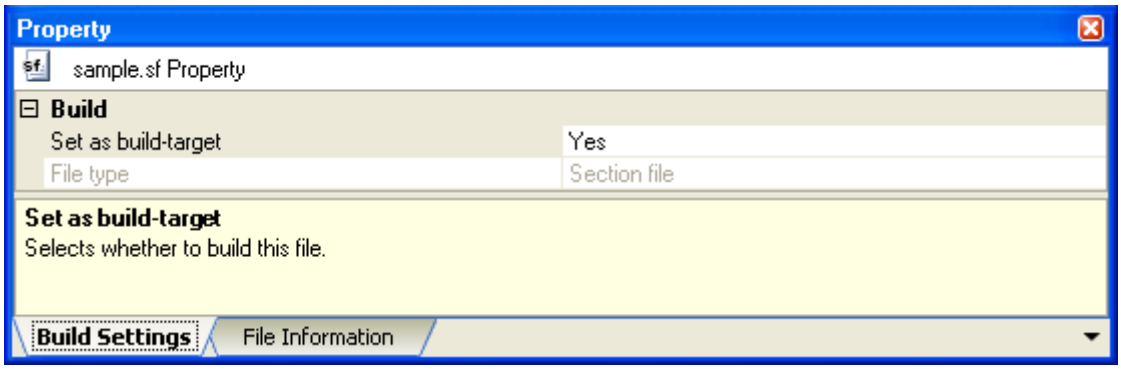


Figure A-19. Property Panel: [Build Settings] Tab (When Selecting Object File)

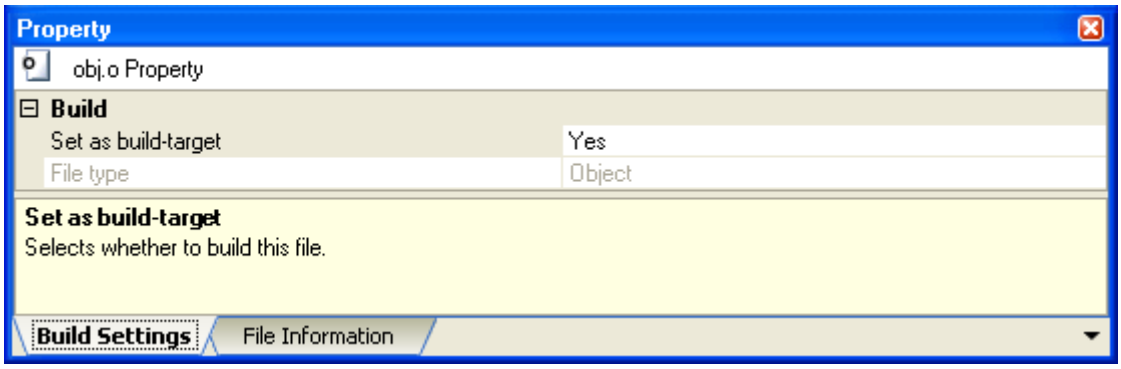
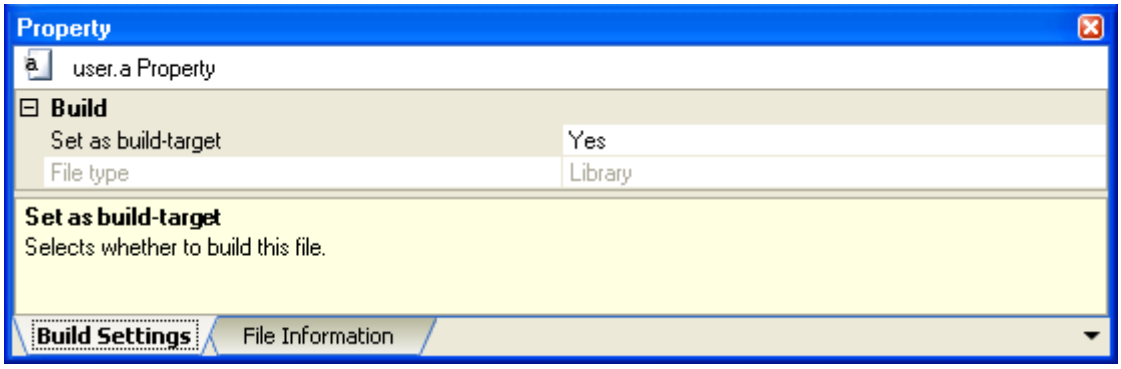


Figure A-20. Property Panel: [Build Settings] Tab (When Selecting Archive File)



[Description of each category]

(1) [Build]

The detailed information on the build are displayed and the configuration can be changed.

Set as build-target	Select whether to build the selected file.		
	Default	Yes	
	How to change	Select from the drop-down list.	
	Restriction	Yes	Builds the selected file.
		No	Does not build the selected file.
Set individual compile option	Select whether to set a compile option that differs from the project settings to the selected C source file. This property is displayed only when a C source file is selected on the Project Tree panel and [Yes] is selected in the [Set as build-target] property.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes	Sets a compile option that differs from the project settings to the selected C source file.
		No	Does not set a compile option that differs from the project settings to the selected C source file.
Set individual assemble option	Select whether to set an assemble option that differs from the project settings to the selected assembler source file. This property is displayed only when an assembler source file is selected on the Project Tree panel and [Yes] is selected in the [Set as build-target] property.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes	Sets a compile option that differs from the project settings to the selected assembler source file.
		No	Does not set a compile option that differs from the project settings to the selected assembler source file.
File type	Display the type of the selected file.		
	Default	C source (when C source file is selected) Assembly source (when assembler source file is selected) Link directive (when link directive file is selected) Section file (when section file is selected) Object (when object file is selected) Library (when archive file is selected)	
	How to change	Changes not allowed	

[Individual Compile Options] tab

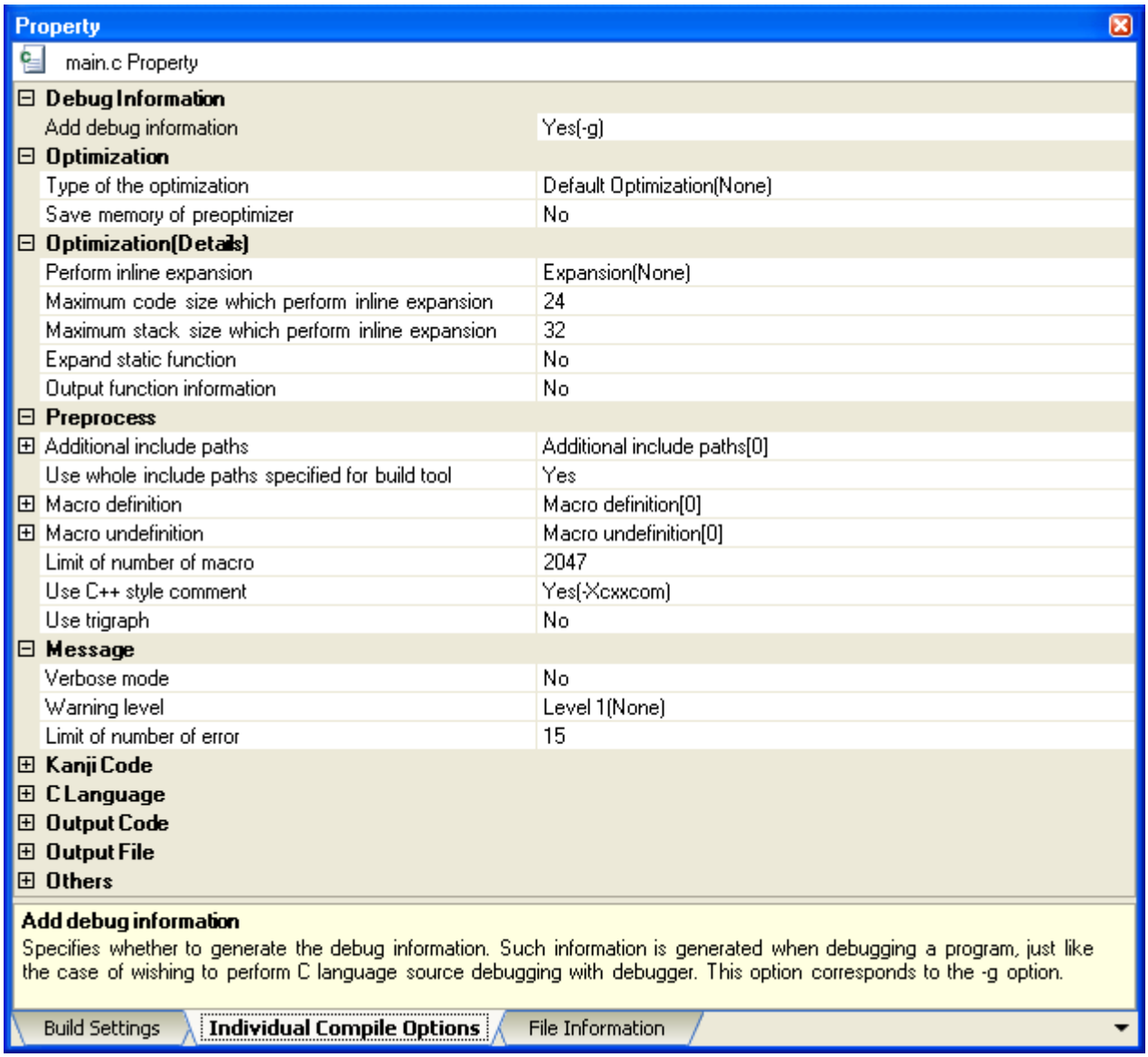
This tab shows the detailed information on a C source file categorized by the following and the configuration can be changed.

Note that this tab takes over the settings of the [Compile Options] tab. If the settings are changed from the [Compile Options] tab, the properties are displayed in boldface.

(1) [Debug Information]
(2) [Optimization]
(3) [Optimization(Details)]
(4) [Preprocess]
(5) [Message]
(6) [Kanji Code]
(7) [C Language]
(8) [Output Code]
(9) [Output File]
(10) [Others]

Remark This tab is displayed only when [Yes] in the [Set individual compile option] property in the [Build] category from the [Build Settings] tab is selected.

Figure A-21. Property Panel: [Individual Compile Options] Tab



[Description of each category]

(1) [Debug Information]

The detailed information on debug information is displayed and the configuration can be changed.

Add debug information	Select whether to enable source level debugging by outputting symbol information for the source debugger. This corresponds to the -g option of the compiler.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-g)	Outputs symbol information for the source debugger.
		No	Does not output symbol information for the source debugger.

(2) [Optimization]

The detailed information on the optimization are displayed and the configuration can be changed.

<table>
<tr><td rowspan="9">Type of the optimization</td><td colspan="3">Select the type of the optimization for compiling.
This corresponds to the -O* option of the compiler.</td></tr>
<tr><td>Default</td><td colspan="2">Configuration of the general option</td></tr>
<tr><td>How to change</td><td colspan="2">Select from the drop-down list.</td></tr>
<tr><td rowspan="5">Restriction</td><td>Optimize for Debugging(-Od)</td><td>Performs optimization with the debug precedence.
Generates codes emphasizing source debugging, without putting stress on the ROM capacity and execution speed.</td></tr>
<tr><td>Default Optimization(None)</td><td>Generates codes emphasizing source debugging.
Performs optimization within a range where source debugging is not affected.</td></tr>
<tr><td>Standard Optimization(-Og)</td><td>Performs appropriate optimization.
Performs optimization that allows debugging of the C source in most cases.</td></tr>
<tr><td>Level 1 Advanced Optimization(-O)</td><td>Performs advanced optimization.
Performs optimization emphasizing the ROM capacity.</td></tr>
<tr><td>Level 2 Advanced Opt.(Code size precedence)(-Os)</td><td>Performs more advanced optimization (object size precedence).
Performs the maximum optimization placing the utmost emphasis on the ROM capacity.</td></tr>
<tr><td>Level 2 Advanced Opt.(Speed precedence)(-Ot)</td><td>Performs more advanced optimization (execution speed precedence).
Performs the maximum optimization placing the utmost emphasis on the execution speed.</td></tr>
<tr><td rowspan="5">Save memory of machine-dependent optimization module</td><td colspan="3">Select whether to save the memory usage amount of the machine-dependent optimization module during compiling.
Specify this property when the memory of the machine is insufficient and compile processing cannot be completed normally.
This corresponds to the -Wi,-D option of the compiler.
This property is not displayed when any of [Optimize for Debugging(-Od)], [Default Optimization(None)], or [Standard Optimization(-Og)] in the [Type of the optimization] property is selected.</td></tr>
<tr><td>Default</td><td colspan="2">Configuration of the general option</td></tr>
<tr><td>How to change</td><td colspan="2">Select from the drop-down list.</td></tr>
<tr><td rowspan="2">Restriction</td><td>Yes(-Wi,-D)</td><td>Saves the memory usage amount of the machine-dependent optimization module during compiling.
However, the compiling speed decreases.</td></tr>
<tr><td>No</td><td>Does not specify saving the memory usage amount of the machine-dependent optimization module during compiling.</td></tr>
</table>

Save memory of preoptimizer	Select whether to save the memory usage amount of the preoptimizer during compiling. Specify this property when the memory of the machine is insufficient and compile processing cannot be completed normally. This corresponds to the -Wp,-D option of the compiler.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-Wp,-D)	Saves the memory usage amount of the preoptimizer during compiling. However, the compiling speed decreases.
		No	Does not specify saving the memory usage amount of the preoptimizer during compiling.

(3) [Optimization(Details)]

The detailed information on the optimization are displayed and the configuration can be changed.

Perform inline expansion	Select whether to perform inline expansion. This corresponds to the -Wp,-N option of the compiler.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	Expansion(None)	Performs inline expansion.
		Expansion only 'inline' function(-Wp,-inline)	Performs inline expansion of only a function for which #pragma inline is specified.
		No Expansion(-Wp,-no_inline)	Does not specify inline expansion of all functions, including the function for which #pragma inline is specified.
Maximum code size for performing inline expansion	Specify the maximum size in the intermediate language of the function for performing inline expansion. For the function greater than the specified size, inline expansion is not performed. This corresponds to the -Wp,-N option of the compiler. As to a yardstick for the size, see the function information file output by specifying the [Output function information] property. This property is not displayed when [No Expansion(-Wp,-no_inline)] in the [Perform inline expansion] property is selected.		
	Default	*Configuration of the general option*	
	How to change	Directly enter to the text box.	
	Restriction	0 to 9999 (decimal number)	

<table>
<tr><td rowspan="4">Maximum stack size for performing inline expansion</td><td colspan="3">Specify the maximum value (bytes) of the stack size in the intermediate language of the function for performing inline expansion.
For the function greater than the specified size, inline expansion is not performed.
This corresponds to the -Wp,-G option of the compiler.
As to a yardstick for the size, see the function information file output by specifying the [Output function information] property.
This property is not displayed when [No Expansion(-Wp,-no_inline)] in the [Perform inline expansion] property is selected.</td></tr>
<tr><td>Default</td><td colspan="2">Configuration of the general option</td></tr>
<tr><td>How to change</td><td colspan="2">Directly enter to the text box.</td></tr>
<tr><td>Restriction</td><td colspan="2">0 to 9999 (decimal number)</td></tr>
<tr><td rowspan="5">Expand static function</td><td colspan="3">Specify whether to perform inline expansion against the static function that has been referenced only once.
This corresponds to the -Wp,-S option of the compiler.
This property is not displayed when [No Expansion(-Wp,-no_inline)] in the [Perform inline expansion] property is selected.</td></tr>
<tr><td>Default</td><td colspan="2">Configuration of the general option</td></tr>
<tr><td>How to change</td><td colspan="2">Select from the drop-down list.</td></tr>
<tr><td rowspan="2">Restriction</td><td>Yes(-Wp,-S)</td><td>Performs inline expansion against the static function that has been referenced only once.</td></tr>
<tr><td>No</td><td>Does not specify inline expansion against the static function that has been referenced only once.</td></tr>
<tr><td rowspan="5">Output function information</td><td colspan="3">Specify whether to output the code size and stack size in the intermediate language of each function to a file.
Information that is output will serve as a yardstick when specifying values in the [Maximum code size for performing inline expansion] property and [Maximum stack size for performing inline expansion] property.
This corresponds to the -Wp,-I option of the compiler.
This property is not displayed when [No Expansion(-Wp,-no_inline)] in the [Perform inline expansion] property is selected.</td></tr>
<tr><td>Default</td><td colspan="2">Configuration of the general option</td></tr>
<tr><td>How to change</td><td colspan="2">Select from the drop-down list.</td></tr>
<tr><td rowspan="2">Restriction</td><td>Yes(-Wp,-I)</td><td>Outputs the code size and stack size in the intermediate language of each function to a file.</td></tr>
<tr><td>No</td><td>Does not specify the output of the code size and stack size in the intermediate language of each function to a file.</td></tr>
</table>

<table>
<tr><td rowspan="4">Function information file name</td><td colspan="3">Specify the file name for outputting the code size and stack size in the intermediate language of each function.
This corresponds to the -Wp,-I option of the compiler.
If a relative path is specified, the reference point of the path is the main project or subproject folder.
If an absolute path is specified, the reference point of the path is the main project or subproject folder (unless the drives are different).
The following macro name is available as an embedded macro.
%BuildModeName%: Replaces with the build mode name.
If this is blank, it is treated as if the configuration of the general option is specified.
This property is not displayed when [No] in the [Output function information] property is selected.</td></tr>
<tr><td>Default</td><td colspan="2">Configuration of the general option</td></tr>
<tr><td>How to change</td><td colspan="2">Directly enter to the text box or edit by the Specify Function Information File dialog box which appears when clicking the [...] button.</td></tr>
<tr><td>Restriction</td><td colspan="2">Up to 259 characters</td></tr>
<tr><td rowspan="5">Loop expansion</td><td colspan="3">Specify whether to expand the loops such as "for" and "while".
This corresponds to the -Wo,-Ol,-Xlo option of the compiler.
This property is displayed only when [Level 2 Advanced Opt.(Speed precedence)(-Ot)] in the [Type of the optimization] property is selected.</td></tr>
<tr><td>Default</td><td colspan="2">Configuration of the general option</td></tr>
<tr><td>How to change</td><td colspan="2">Select from the drop-down list.</td></tr>
<tr><td rowspan="3">Restriction</td><td>Yes(Adjust automatically unrolling number)(-Wo,-Ol)</td><td>Performs loop expansions so that the code size is minimized while keeping the number of times to expand below the value specified in the [Maximum number of loop expansions] property.</td></tr>
<tr><td>Yes(Constant unrolling number)(-Wo,-Ol,-Xlo)</td><td>Performs loop expansions for a number of times specified in the [Maximum number of loop expansions] property.</td></tr>
<tr><td>No(-Wo,-Ol0)</td><td>Does not specify loop expansion.</td></tr>
<tr><td rowspan="4">Maximum number of loop expansions</td><td colspan="3">Specify the maximum number of times to expand the loops such as "for" and "while".
This corresponds to the -Wo,-Ol option of the compiler.
This property is not displayed when [No(-Wo,-Ol0)] in the [Loop expansion] property is selected.</td></tr>
<tr><td>Default</td><td colspan="2">Configuration of the general option</td></tr>
<tr><td>How to change</td><td colspan="2">Directly enter to the text box.</td></tr>
<tr><td>Restriction</td><td colspan="2">0 to 999 (decimal number)</td></tr>
</table>

<table>
<tr><td rowspan="5">Output branch instructions with code size priority</td><td colspan="3">Select whether to arrange and output branch instructions, giving precedence to the code size.
This corresponds to the -Wo,-XFo option of the compiler.
This property is not displayed when [Optimize for Debugging(-Od)] or [Default Optimization(None)] in the [Type of the optimization] property is selected.</td></tr>
<tr><td>Default</td><td colspan="2">Configuration of the general option</td></tr>
<tr><td>How to change</td><td colspan="2">Select from the drop-down list.</td></tr>
<tr><td rowspan="2">Restriction</td><td>Yes(-Wo,-XFo)</td><td>Arranges and outputs branch instructions, giving precedence to the code size.</td></tr>
<tr><td>No</td><td>Outputs a code that the debug information is given priority for branch instructions.</td></tr>
<tr><td rowspan="5">Pack alignment</td><td colspan="3">Specify whether to inhibit the optimization that aligns branch destination labels.
This property is displayed only when [Level 1 Advanced Optimization(-O)], [Level 2 Advanced Opt.(Code size precedence)(-Os)], or [Level 2 Advanced Opt.(Speed precedence)(-Ot)] in the [Type of the optimization] property is selected.
However, when [Level 1 Advanced Optimization(-O)] or [Level 2 Advanced Opt.(Code size precedence)(-Os)] is selected, this function is included. Therefore, [Yes(-Wi,-P)] is always selected.
This corresponds to the -Wi,-P option of the compiler.</td></tr>
<tr><td>Default</td><td colspan="2">Configuration of the general option</td></tr>
<tr><td>How to change</td><td colspan="2">Select from the drop-down list.</td></tr>
<tr><td rowspan="2">Restriction</td><td>Yes(-Wi,-P)</td><td>Prevents optimization that allows branch destination labels to be aligned.
The size of the execution code can be reduced.</td></tr>
<tr><td>No</td><td>Does not specify the inhibition of the optimization that aligns branch destination labels.</td></tr>
<tr><td rowspan="5">Perform advanced optimization</td><td colspan="3">Specify whether to execute the strongest optimization through strict data flow analysis.
Specify this property to perform the stronger optimization when performing the advanced optimization.
This property is displayed only when [Level 1 Advanced Optimization(-O)], [Level 2 Advanced Opt.(Code size precedence)(-Os)], or [Level 2 Advanced Opt.(Speed precedence)(-Ot)] in the [Type of the optimization] property is selected.
This corresponds to the -Wi,-O4 option of the compiler.</td></tr>
<tr><td>Default</td><td colspan="2">Configuration of the general option</td></tr>
<tr><td>How to change</td><td colspan="2">Select from the drop-down list.</td></tr>
<tr><td rowspan="2">Restriction</td><td>Yes(-Wi,-O4)</td><td>Executes the strongest optimization through strict data flow analysis.
However, the compiling speed significantly decreases.</td></tr>
<tr><td>No</td><td>Does not specify advanced optimization.</td></tr>
</table>

(4) [Preprocess]

The detailed information on the preprocess are displayed and the configuration can be changed.

<table>
<tr><td>Additional include paths</td><td colspan="3">Specify the additional include paths during compiling.
The following macro names are available as embedded macros.
%BuildModeName%: Replaces with the build mode name.
%ProjectName%: Replaces with the project name.
%MicomToolPath%: Replaces with the absolute path of the product install folder.
When this property is omitted, only the standard folder of the compiler is searched. The reference point of the path is the project folder.
This corresponds to the -I option of the compiler.
The specified include path is displayed as the subproperty.</td></tr>
<tr><td></td><td>Default</td><td colspan="2">Additional include paths[number of defined items]</td></tr>
<tr><td></td><td>How to change</td><td colspan="2">Edit by the Path Edit dialog box which appears when clicking the [...] button.
For the subproperty, you can use the text box directly enter the text.</td></tr>
<tr><td></td><td>Restriction</td><td colspan="2">Up to 259 characters
Up to 64 items can be specified.</td></tr>
<tr><td>Use whole include paths specified for build tool</td><td colspan="3">Select whether to compile using the include path specified in the [Additional include paths] property in the [Preprocess] category from the [Compile Options] tab of the build tool to be used.
This corresponds to the -I option of the compiler.
The paths are added to the -i option according to the following sequence.
- Paths specified in the [Additional include paths] property
- Paths specified in the [Additional include paths] in the [Preprocess] category from the [Compile Options] tab
- Paths specified in the [System include paths] in the [Preprocess] category from the [Compile Options] tab</td></tr>
<tr><td></td><td>Default</td><td colspan="2">Yes</td></tr>
<tr><td></td><td>How to change</td><td colspan="2">Select from the drop-down list.</td></tr>
<tr><td></td><td rowspan="2">Restriction</td><td>Yes</td><td>Compiles using the include path specified in the property of the build tool to be used.</td></tr>
<tr><td></td><td>No</td><td>Does not use the include path specified in the property of the build tool to be used.</td></tr>
<tr><td>Macro definition</td><td colspan="3">Specify the macro name to be defined.
Specify in the format of "macro name=defined value", with one macro name per line. The "=defined value" part can be omitted, and in this case, "1" is used as the defined value.
This corresponds to the -D option of the compiler.
The specified macro is displayed as the subproperty.</td></tr>
<tr><td></td><td>Default</td><td colspan="2">Configuration of the general option</td></tr>
<tr><td></td><td>How to change</td><td colspan="2">Edit by the Text Edit dialog box which appears when clicking the [...] button.
For the subproperty, you can use the text box directly enter the text.</td></tr>
<tr><td></td><td>Restriction</td><td colspan="2">Up to 256 characters
Up to 256 items can be specified.</td></tr>
</table>

Macro undefinition	Specify the macro name to be undefined. Specify in the format of "*macro name*", with one macro name per line. This corresponds to the -U option of the compiler. The specified macro is displayed as the subproperty.		
	Default	*Configuration of the general option*	
	How to change	Edit by the Text Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.	
	Restriction	Up to 256 characters Up to 256 items can be specified.	
Limit of number of macro	Specify the upper limit for the number of macro identifiers. This corresponds to the -Xm option of the compiler.		
	Default	*Configuration of the general option*	
	How to change	Directly enter to the text box.	
	Restriction	1 to 999999 (decimal number)	
Use C++ style comment	Specify whether to enable C++ comment style (from "//" to the end of the line), in addition to regular comments. This corresponds to the -Xcxxcom option of the compiler.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-Xcxxcom)	Enables C++ comment style (from "//" to the end of the line), in addition to regular comments.
		No	Disables C++ comment style (from "//" to the end of the line).
Include comments in preprocessor output file	Specify whether to include the comments of the source program in the output of the C language source program's preprocessing. This corresponds to the -C option of the compiler. This property is not displayed when [No] in the [Output preprocessed source file] property in the [Output File] category is selected.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-C)	Includes the comments of the source program in the output of the C language source program's preprocessing.
		No	Does not include the comments of the source program in the output of the C language source program's preprocessing.
Use trigraph	Specify whether to replace trigraph sequences. A trigraph is a sequence of 3 characters replaced with a single character, defined in the ANSI standard. This corresponds to the -t option of the compiler.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-t)	Replaces trigraph sequences.
		No	Does not replace trigraph sequences.

(5) [Message]

The detailed information on messages are displayed and the configuration can be changed.

Verbose mode	Select whether to display the execution status of the compiler to the Output panel during build. This corresponds to the -v option of the compiler.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-v)	Displays the execution status of the compiler during build.
		No	Does not display the execution status of the compiler during build.
Warning level	Select the warning display level under compiling. This corresponds to the -w option of the compiler.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	No Output(-w)	Does not output warning messages.
		Level 1(None)	Outputs normal warning messages.
		Level 2(-w2)	Outputs detailed warning messages.
Limit of number of error	Specify the maximum number of error messages to be output. This corresponds to the -err_limit option of the compiler.		
	Default	*Configuration of the general option*	
	How to change	Directly enter to the text box.	
	Restriction	15 to 50 (decimal number)	

(6) [Kanji Code]

The detailed information on kanji codes are displayed and the configuration can be changed.

Kanji character code of source	Specify the kanji code to be used for Japanese comments and character strings in the input file. This corresponds to the -Xk option of the compiler.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	Shift_JIS(None)	Interprets the kanji code of the source as Shift_JIS.
		None(-Xk=none)	Interprets the source as not containing kanji codes. The code is not guaranteed.
		EUC-JP(-Xk=euc)	Interprets the kanji code of the source as EUC-JP.

Kanji character code for target	Specify the kanji code to be converted into for Japanese character strings. Set this property if you want to change the kanji code used during application development in the target. This corresponds to the -Xkt option of the compiler.		
	Default	None(None)	
	How to change	Select from the drop-down list.	
	Restriction	None(None)	Does not convert the kanji code of the target. The code is not guaranteed.
		Shift_JIS(-Xkt=sjis)	Converts the kanji code of the target into Shift_JIS.
		EUC-JP(-Xkt=euc)	Converts the kanji code of the target into EUC-JP.

(7) [C Language]

The detailed information on C language are displayed and the configuration can be changed.

Sign of bit field	Select whether int type bit fields without a type specifier (signed or unsigned) are handled as signed or unsigned. This corresponds to the -Xbitfield option of the compiler.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	signed	Handles int type bit fields without a type specifier as signed.
		unsigned(-Xbit-field=unsigned)	Handles int type bit fields without a type specifier as unsigned.
Sign of char	Select whether char type bit fields without a type specifier (signed or unsigned) are handled as signed or unsigned. This corresponds to the -Xchar option of the compiler.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	signed	Handles char type without a type specifier as signed.
		unsigned(-Xchar=unsigned)	Handles char type without a type specifier as unsigned.
Enumeration type	Specify which integer type matches with the enumeration type. This corresponds to the -Xenum_type option of the compiler.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	int(None)	Matches int type with the enumeration type.
		signed char(-Xenum_type=char)	Matches signed char type with the enumeration type.
		unsigned char(-Xenum_type=uchar)	Matches unsigned char type with the enumeration type.
		short(-Xenum_type=short)	Matches short type with the enumeration type.
		unsigned short(-Xenum_type=ushort)	Matches unsigned short type with the enumeration type.

Compile strictly according to ANSI standards	Specify whether to apply the ANSI standard to the compiler processing strictly and display error and warning messages for descriptions that violate the standard. This corresponds to the -ansi option of the compiler.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-ansi)	Applies the ANSI standard to the compiler processing strictly and displays error and warning messages for descriptions that violate the standard.
		No	Confers compatibility with the conventional C language specifications and continues the compiler processing after warning message is output.
Use expansion of CC78K	Select whether to enable the expansion functions compatible with the 78K microcontrollers C compiler CC78K. This corresponds to the -cc78k option of the compiler.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-cc78k)	Enables the expansion functions compatible with the CC78K.
		No	Disables the expansion functions compatible with the CC78K.
Perform strictly integer operation	Specify whether to use runtime libraries ___mul/___mulu, ___div/___divu or mul, mulu, div, divu instructions without using the mulh and divh instructions, for integers of 16-bit data or less, in order to execute multiply and divide instructions strictly according to the ANSI standard. This corresponds to the -Xe option of the compiler.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-Xe)	Uses runtime libraries ___mul/___mulu or ___div/___divu for integers of 16-bit data or less.
		No	Uses runtime libraries mulh or divh instructions for integers of 16-bit data or less.

(8) [Output Code]

The detailed information on output codes are displayed and the configuration can be changed.

<table>
<tr><td rowspan="5">Use prologue/epilogue library</td><td colspan="3">Specify whether to perform prologue/epilogue processing of functions through runtime library calls.
This corresponds to the -Xpro_epi_runtime option of the compiler.</td></tr>
<tr><td>Default</td><td colspan="2">Configuration of the general option</td></tr>
<tr><td>How to change</td><td colspan="2">Select from the drop-down list.</td></tr>
<tr><td rowspan="3">Restriction</td><td>Auto(None)</td><td>In the [Type of the optimization] property in the [Optimization] category, corresponds to [No(-Xpro_epi_runtime=off)] when [Level 2 Advanced Opt.(Speed precedence)(-Ot)] is selected, [Yes(-Xpro_epi_runtime=on)] when any of other items is selected.</td></tr>
<tr><td>No(-Xpro_epi_runtime=off)</td><td>Does not perform prologue/epilogue processing of functions through runtime library calls.</td></tr>
<tr><td>Yes(-Xpro_epi_runtime=on)</td><td>Performs prologue/epilogue processing of functions through runtime library calls.</td></tr>
<tr><td rowspan="6">Output code of switch statement</td><td colspan="3">Specify the code output mode for switch statements in programs.
This corresponds to the -Xcase option of the compiler.</td></tr>
<tr><td>Default</td><td colspan="2">Configuration of the general option</td></tr>
<tr><td>How to change</td><td colspan="2">Select from the drop-down list.</td></tr>
<tr><td rowspan="4">Restriction</td><td>Auto(None)</td><td>Automatically judges the format considered optimum by the compiler.</td></tr>
<tr><td>if-else(-Xcase=ifelse)</td><td>Outputs the code in the same format as the if-else statement along a string of case statements in programs.
Because the case statements are compared starting from the top, unnecessary comparison can be reduced and the execution speed can be increased if the case statement that most often matches is written first or if the number of labels is few.</td></tr>
<tr><td>Binary search(-Xcase=binary)</td><td>Outputs the code in the binary search format for switch statements in programs.
Because a matching case statement is searched by using a binary search algorithm, when many labels are used, any case statement can be found at almost the same speed.</td></tr>
<tr><td>Table jump(-Xcase=table)</td><td>Outputs the code in the table jump format for switch statements in programs.
References a table indexed on the values in the case statements, and selects and processes case labels from the switch statement values. Code will branch to all the case statements with about the same speed. If case values are not used in succession, an unnecessary area is created.</td></tr>
</table>

Label size of switch table	Specify the size per label of the branch table for the case labels in switch statements. This corresponds to the -Xword_switch option of the compiler.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	2 bytes(None)	Generates one 2-byte branch table per case label in a switch statement.
		4 bytes(-Xword_switch)	Generates one 4-byte branch table per case label in a switch statement. Select this item when a compile error occurs because the switch statement is long.
Structure packing	Selects the value of the structure packing. The specified alignment can be used without aligning structure members according to the type of each member. The data size can be reduced but the code size increases. This corresponds to the -Xpack option of the compiler.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	1 byte(-Xpack=1)	Aligns structure members on a 1-byte boundary.
		2 bytes(-Xpack=2)	Aligns structure members on a 2-byte boundary.
		4 bytes(-Xpack=4)	Aligns structure members on a 4-byte boundary.
		8 bytes(None)	Aligns structure members on a 8-byte boundary.
Perform inline expansion of strcpy/strcmp	Selsect whether to perform inline expansion of strcpy() or strcmp() function calls, with regarding the alignment conditions of the array (including character strings) and the structure as 4 bytes. This improves the execution speed of the object but it also increases the code size. This corresponds to the -Xi option of the compiler. This property is displayed only when [8 bytes(None)] in the [Structure packing] property is selected.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-Xi)	Performs inline expansion of strcpy() or strcmp() function calls, with regarding the alignment conditions of the array (including character strings) and the structure as 4 bytes.
		No	Does not perform inline expansion of strcpy() or strcmp() function calls.
Perform pointer byte access	Select whether to perform an indirect address access of structure in byte units. Use this property if a limit is exceeded when the structure packing function is used. This corresponds to the -Xbyte option of the compiler.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-Xbyte)	Specifies indirect address access to a structure in byte units.
		No	Does not perform an indirect address access of structure in byte units.

Output comment to assembly language source file	Select whether to output a C source program as a comment to the assembler source file to be output. This corresponds to the -Xc option of the compiler. This property is not displayed when [Yes(-Fs)] in the [Output assemble file] property or [Yes(-Fv)] in the [Output an assemble list] property is selected in the [Output File] category.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-Xc)	Outputs a C source program as a comment to the assembler source file.
		No	Does not output a C source program as a comment to the assembler source file.
Use jmp instruction for branch instruction of interruption	Select whether to use the jmp instruction for interrupt functions defined in C language. This corresponds to the -Xj option of the compiler.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-Xj)	Uses the jmp instruction for interrupt functions defined in C language.
		No	Uses the jr instruction for interrupt functions defined in C language.
Prohibit the operation that replaces word with bit instructions	Select whether to prohibit replacing the ld.w/ld.h and st.w/st.h instructions with 1-bit manipulation instructions (set1, clr1, tst1, and not1). This corresponds to the -Xno_word_bitop option of the compiler.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-Xno_word_bitop)	Prohibits replacing the ld.w/ld.h and st.w/st.h instructions with 1-bit manipulation instructions (set1, clr1, tst1, and not1).
		No	Replaces the ld.w/ld.h and st.w/st.h instructions with 1-bit manipulation instructions (set1, clr1, tst1, and not1).

(9) [Output File]

The detailed information on output files are displayed and the configuration can be changed.

Object file name	Specify the name of the object file generated after compilation. The extension other than ".o" cannot be specified. If the extension is omitted, ".o" is automatically added. If this field is blank, the file is saved under the file name with extension .c replaced by .o. This corresponds to the -o option of the compiler.	
	Default	Blank
	How to change	Directly enter to the text box.
	Restriction	Up to 259 characters

<table>
<tr><td rowspan="5">Output assemble file</td><td colspan="3">Select whether to output the assembler source file of the compile result for a C source.
This corresponds to the -Fs option of the compiler.</td></tr>
<tr><td>Default</td><td colspan="2">Configuration of the general option</td></tr>
<tr><td>How to change</td><td colspan="2">Select from the drop-down list.</td></tr>
<tr><td rowspan="2">Restriction</td><td>Yes(-Fs)</td><td>Outputs the assembler source file.</td></tr>
<tr><td>No</td><td>Does not output the assembler source file.</td></tr>
<tr><td rowspan="5">Output folder for assembly file</td><td colspan="3">Specify the output destination folder of an assembler source file.
The assembler source file is saved under the source file name with the extension replaced by ".s".
This corresponds to the -Fs option of the compiler.
If a relative path is specified, the reference point of the path is the main project or subproject folder.
If an absolute path is specified, the reference point of the path is the main project or subproject folder (unless the drives are different).
The following macro name is available as an embedded macro.
%BuildModeName%: Replaces with the build mode name.
If this is blank, it is treated as if the project folder is specified.
This property is displayed only when [Yes(-Fs)] in the [Output assemble file] property is selected.</td></tr>
<tr><td>Default</td><td colspan="2">Configuration of the general option</td></tr>
<tr><td>How to change</td><td colspan="2">Directly enter to the text box or edit by the Browse For Folder dialog box which appears when clicking the [...] button.</td></tr>
<tr><td>Restriction</td><td colspan="2">Up to 247 characters</td></tr>
<tr><td rowspan="4">Output assemble list file</td><td colspan="3">Select whether to output the assemble list of the compile result for a C source.
This corresponds to the -Fv option of the compiler.</td></tr>
<tr><td>Default</td><td colspan="2">Configuration of the general option</td></tr>
<tr><td>How to change</td><td colspan="2">Select from the drop-down list.</td></tr>
<tr><td rowspan="2">Restriction</td><td>Yes(-Fv)</td><td>Outputs an assemble list.</td></tr>
<tr><td>No</td><td>Does not output an assemble list.</td></tr>
<tr><td rowspan="5">Output folder for assemble list file</td><td colspan="3">Specify the output destination folder of an assemble list.
The assemble list is saved under the source file name with the extension replaced by ".v".
This corresponds to the -Fv option of the compiler.
If a relative path is specified, the reference point of the path is the main project or subproject folder.
If an absolute path is specified, the reference point of the path is the main project or subproject folder (unless the drives are different).
The following macro name is available as an embedded macro.
%BuildModeName%: Replaces with the build mode name.
If this is blank, it is treated as if the project folder is specified.
This property is displayed only when [Yes(-Fv)] in the [Output assemble list file] property is selected.</td></tr>
<tr><td>Default</td><td colspan="2">Configuration of the general option</td></tr>
<tr><td>How to change</td><td colspan="2">Directly enter to the text box or edit by the Browse For Folder dialog box which appears when clicking the [...] button.</td></tr>
<tr><td>Restriction</td><td colspan="2">Up to 247 characters</td></tr>
</table>

Output frequency information file	Select whether to output the frequency information file for the variables used by the section file generator. This corresponds to the -Xcre_sec_data option of the compiler.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-Xcre_sec_data)	Outputs the frequency information file for the variables.
		No	Does not output the frequency information file for the variables.
Output folder for frequency information file	Specify the output destination folder of the frequency information file. The frequency information file is saved under the source file name with the extension replaced by ".sec". This corresponds to the -Xcre_sec_data option of the compiler. If a relative path is specified, the reference point of the path is the main project or subproject folder. If an absolute path is specified, the reference point of the path is the main project or subproject folder (unless the drives are different). The following macro name is available as an embedded macro. %BuildModeName%: Replaces with the build mode name. If this is blank, it is treated as if the project folder is specified. This property is not displayed when [No] in the [Output frequency information file] property is selected.		
	Default	Blank	
	How to change	Directly enter to the text box or edit by the Browse For Folder dialog box which appears when clicking the [...] button.	
	Restriction	Up to 247 characters	
Output preprocessed source file	Select whether to execute the command that execute only preprocessing (preprocess processing) for a C source program prior to compile processing. The result is output under the source file name with the extension replaced by ".i". The line numbers and file name of the source program are not output.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-P)	Executes only preprocessing for a C source program and outputs the result.
		No	Does not execute only preprocessing for a C source program and does not output the result.

(10) [Others]

Other detailed information on compilation are displayed and the configuration can be changed.

Commands executed before compile processing	Specify the command to be executed before compile processing. Use the call instruction to specify a batch file (example: call a.bat). The following macro names are available as embedded macros. %ProjectFolder%: Replaces with the absolute path of the project folder. %OutputFolder%: Replaces with the absolute path of the output folder. %OutputFile%: Replaces with the absolute path of the output file. %InputFile%: Replaces with the absolute path of the file to be compiled. %CompiledFile%: Replaces with the absolute path of the output file under compiling. The specified command is displayed as the subproperty.	
	Default	Commands executed before compile processing[*number of defined items*]
	How to change	Edit by the Text Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.
	Restriction	Up to 1023 characters Up to 64 items can be specified.
Commands executed after compile processing	Specify the command to be executed after compile processing. Use the call instruction to specify a batch file (example: call a.bat). The following macro names are available as embedded macros. %ProjectFolder%: Replaces with the absolute path of the project folder. %OutputFolder%: Replaces with the absolute path of the output folder. %OutputFile%: Replaces with the absolute path of the output file. %InputFile%: Replaces with the absolute path of the file to be compiled. %CompiledFile%: Replaces with the absolute path of the output file under compiling. The specified command is displayed as the subproperty.	
	Default	Commands executed after compile processing[*number of defined items*]
	How to change	Edit by the Text Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.
	Restriction	Up to 1023 characters Up to 64 items can be specified.
Other additional options	Input the compile options to be added additionally. The options set here are added at the end of the compile options group.	
	Default	*Configuration of the general option*
	How to change	Directly enter to the text box or edit by the Character String Input dialog box which appears when clicking the [...] button.
	Restriction	Up to 259 characters

[Individual Assemble Options] tab

This tab shows the detailed information on an assemble source file categorized by the following and the configuration can be changed.

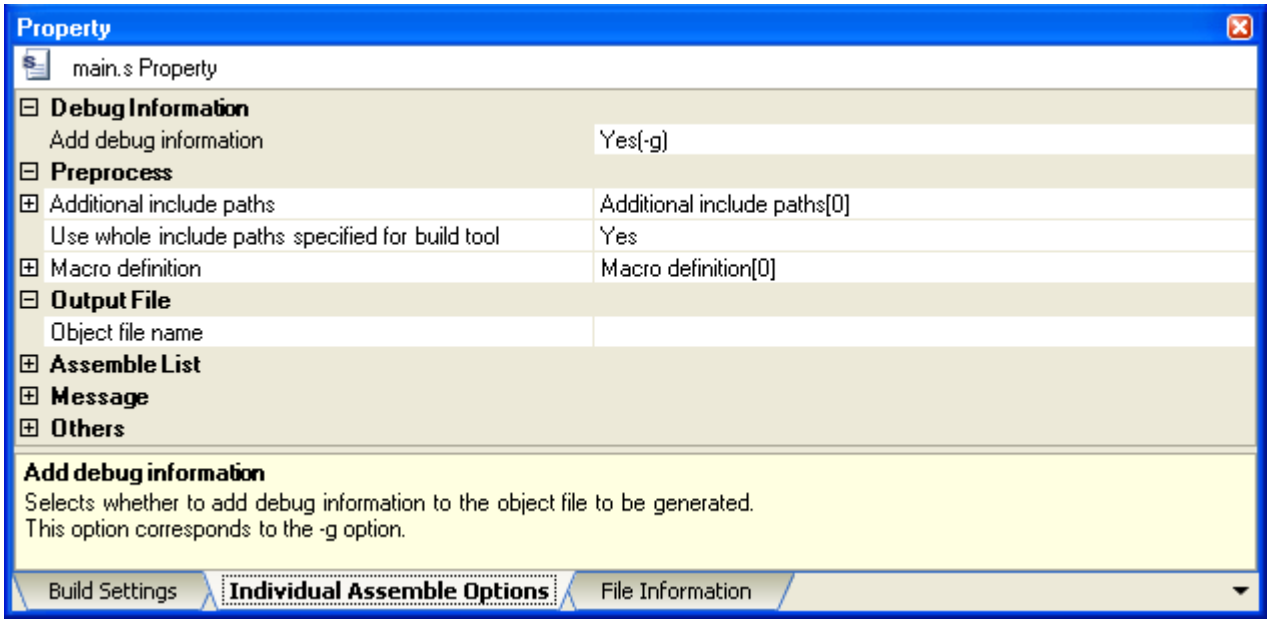
Note that this tab takes over the settings of the [Assemble Options] tab. If the settings are changed from the [Assemble Options] tab, the properties are displayed in boldface.

(1) [Debug Information]
(2) [Preprocess]
(3) [Output File]
(4) [Assemble List]
(5) [Message]
(6) [Others]

Remarks 1. This tab is displayed when [Yes] in the [Set individual assemble option] property in the [Build] category from the [Build Settings] tab is selected.

2. This tab is also displayed when a C source file is selected and [Yes(-Fs)] is selected in the [Output assemble file] property in the [Output File] category from the [Individual Compile Options] tab.

Figure A-22. Property Panel: [Individual Assemble Options] Tab



[Description of each category]

(1) [Debug Information]

The detailed information on debug information is displayed and the configuration can be changed.

Add debug information	Select whether to enable source level debugging by adding debug information to the object file being generated. This corresponds to the -g option of the assembler.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-g)	Adds debug information to the object file being generated.
		No	Does not add debug information to the object file being generated.

(2) [Preprocess]

The detailed information on the preprocess are displayed and the configuration can be changed.

Additional include paths	Specify the additional include paths during assembling. The following macro names are available as embedded macros. %BuildModeName%: Replaces with the build mode name. %ProjectName%: Replaces with the project name. %MicomToolPath%: Replaces with the absolute path of the product install folder. When this property is omitted, only the standard folder of the assembler is searched. The reference point of the path is the project folder. This corresponds to the -I option of the assembler. The specified include path is displayed as the subproperty.	
	Default	Additional include paths[*number of defined items*]
	How to change	Edit by the Path Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.
	Restriction	Up to 259 characters Up to 64 items can be specified.However, this also includes the number of paths used by linked tools.
Use whole include paths specified for build tool	Select whether to assemble using the include path specified in the [Additional include paths] property in the [Preprocess] category from the [Assemble Options] tab of the build tool to be used. This corresponds to the -I option of the assembler. The paths are added to the -i option according to the following sequence. - Paths specified in the [Additional include paths] property in the [Preprocess] category - Paths specified in the [Additional include paths] property in the [Preprocess] category from the [Assemble Options] tab - Paths specified in the [System include paths] property in the [Preprocess] category from the [Assemble Options] tab	
	Default	Yes
	How to change	Select from the drop-down list.

Macro definition	Specify the macro name to be defined. Specify in the format "*macro name=defined value*", with one macro name per line. The "=*defined value*" part can be omitted, and in this case, "1" is used as the defined value. This corresponds to the -D option of the assembler. The specified macro is displayed as the subproperty.	
	Default	Macro definition[*number of defined items*]
	How to change	Edit by the Text Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.
	Restriction	Up to 256 characters Up to 256 items can be specified.

(3) [Output File]

The detailed information on output files are displayed and the configuration can be changed.

Object file name	Specify the name of the object file generated after assembling. The extension other than ".o" cannot be specified. If the extension is omitted, ".o" is automatically added. If this field is blank, the file is saved under the file name with extension .s replaced by .o. This corresponds to the -o option of the assembler. This property is not displayed when a C source file is selected and [Yes(-Fs)] is selected in the [Output assemble file] property in the [Output File] category from the [Individual Compile Options] tab.	
	Default	Blank
	How to change	Directly enter to the text box.
	Restriction	Up to 259 characters

(4) [Assemble List]

The detailed information on the assemble list are displayed and the configuration can be changed.

Output assemble list file	Select whether to output the assemble list file. This corresponds to the -a -l option of the assembler.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-a -l)	Outputs an assemble list file.
		No	Does not output an assemble list file.

Output folder for assemble list file	Specify the output destination folder of an assemble list file. The assemble list file is saved under the assembler source file name with the extension ".s" replaced by ".v". This corresponds to the -l option of the assembler. If a relative path is specified, the reference point of the path is the main project or subproject folder. If an absolute path is specified, the reference point of the path is the main project or subproject folder (unless the drives are different). If this is blank, it is treated as if the project folder is specified. This property is displayed only when [Yes(-a -l)] in the [Output assemble list file] property is selected.		
	Default	*Configuration of the general option*	
	How to change	Directly enter to the text box or edit by the Browse For Folder dialog box which appears when clicking the [...] button.	
	Restriction	Up to 247 characters	

(5) [Message]

The detailed information on messages are displayed and the configuration can be changed.

Verbose mode	Select whether to display the execution status of the assembler to the Output panel during build. This corresponds to the -v option of the assembler.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-v)	Displays the execution status of the assembler during build.
		No	Does not display the execution status of the assembler during build.
Warn of using r0 register as destination register	Select whether to display warnings when the r0 register is specified as the destination register. This corresponds to the -wr0- and -wr0+ options of the assembler.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-wr0+)	Displays warnings when the r0 register is specified as the destination register.
		No(-wr0-)	Does not display warnings when the r0 register is specified as the destination register.
		No	Displays warnings regardless of the destination register specification of the r0 register.

Warn of using r1 register	Select whether to display warnings when the r1 register is specified as the source register or destination register. This corresponds to the -wr1- and -wr1+ options of the assembler.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-wr1+)	Displays warnings when the r1 register is specified as the source register or destination register.
		No(-wr1-)	Does not display warnings when the r1 register is specified as the source register or destination register.
		No	Displays warnings regardless of the source register or destination register specification of the r1 register.
Display warning message	Select whether to display warnings when the r1 register is specified as the source register or destination register, when the r0 register is specified as the destination register, or when the r20 or r21 register is specified as the destination register while using the mask register function. This corresponds to the -w option of the assembler.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	Yes	Displays warnings when the r1 register is specified as the source register or destination register, when the r0 register is specified as the destination register, or when the r20 or r21 register is specified as the destination register while using the mask register function.
		No(-w)	Does not display warnings when the r1 register is specified as the source register or destination register, when the r0 register is specified as the destination register, or when the r20 or r21 register is specified as the destination register while using the mask register function.

(6) [Others]

Other detailed information on assembly are displayed and the configuration can be changed.

Perform optimization	Select whether to perform optimization that rearranges instructions to avoid register/flag hazards. This corresponds to the -O option of the assembler.		
	Default	*Configuration of the general option*	
	How to change	Select from the drop-down list.	
	Restriction	Yes(-O)	Performs optimization that avoid register/flag hazards.
		No	Does not perform optimization that avoid register/flag hazards.

<table>
<tr><td rowspan="5">Use 32-bit branch instruction</td><td colspan="3">Select whether to specify far jump for branch instructions (jarl, jr) where 22/32 is not described in the instruction.
This corresponds to the -Xfar_jump option of the assembler.
This property is displayed only when the V850E2 core device is specified as a device type.</td></tr>
<tr><td>Default</td><td colspan="2">Configuration of the general option</td></tr>
<tr><td>How to change</td><td colspan="2">Select from the drop-down list.</td></tr>
<tr><td rowspan="2">Restriction</td><td>Yes(-Xfar_jump)</td><td>Specifies far jump for branch instructions (jarl, jr) where 22/32 is not described in the instruction.</td></tr>
<tr><td>No</td><td>The branch instructions (jarl, jr) where 22/32 is not described in the instruction is the ordinary branch instruction.</td></tr>
<tr><td rowspan="4">Commands executed before assemble processing</td><td colspan="3">Specify the command to be executed before assemble processing.
Use the call instruction to specify a batch file (example: call a.bat).
The following macro name is available as an embedded macro.
%ProjectFolder%: Replaces with the absolute path of the project folder.
%OutputFolder%: Replaces with the absolute path of the output folder.
%OutputFile%: Replaces with the absolute path of the output file.
%InputFile%: Replaces with the absolute path of the file to be assembled.
%AssembledFile%: Replaces with the absolute path of the output file under assembling.
This property is not displayed when a C source file is selected and [Yes(-Fs)] is selected in the [Output assemble file] property in the [Output File] category from the [Individual Compile Options] tab.</td></tr>
<tr><td>Default</td><td colspan="2">Commands executed before assemble processing[number of defined items]</td></tr>
<tr><td>How to change</td><td colspan="2">Edit by the Text Edit dialog box which appears when clicking the [...] button.
For the subproperty, you can use the text box directly enter the text.</td></tr>
<tr><td>Restriction</td><td colspan="2">Up to 1023 characters
Up to 64 items can be specified.</td></tr>
<tr><td rowspan="4">Commands executed after assemble processing</td><td colspan="3">Specify the command to be executed after assemble processing.
Use the call instruction to specify a batch file (example: call a.bat).
The following macro names are available as embedded macros.
%ProjectFolder%: Replaces with the absolute path of the project folder.
%OutputFolder%: Replaces with the absolute path of the output folder.
%OutputFile%: Replaces with the absolute path of the output file.
%InputFile%: Replaces with the absolute path of the file to be assembled.
%AssembledFile%: Replaces with the absolute path of the output file under assembling.
This property is not displayed when a C source file is selected and [Yes(-Fs)] is selected in the [Output assemble file] property in the [Output File] category from the [Individual Compile Options] tab.</td></tr>
<tr><td>Default</td><td colspan="2">Commands executed after assemble processing[number of defined items]</td></tr>
<tr><td>How to change</td><td colspan="2">Edit by the Text Edit dialog box which appears when clicking the [...] button.
For the subproperty, you can use the text box directly enter the text.</td></tr>
<tr><td>Restriction</td><td colspan="2">Up to 1023 characters
Up to 64 items can be specified.</td></tr>
</table>

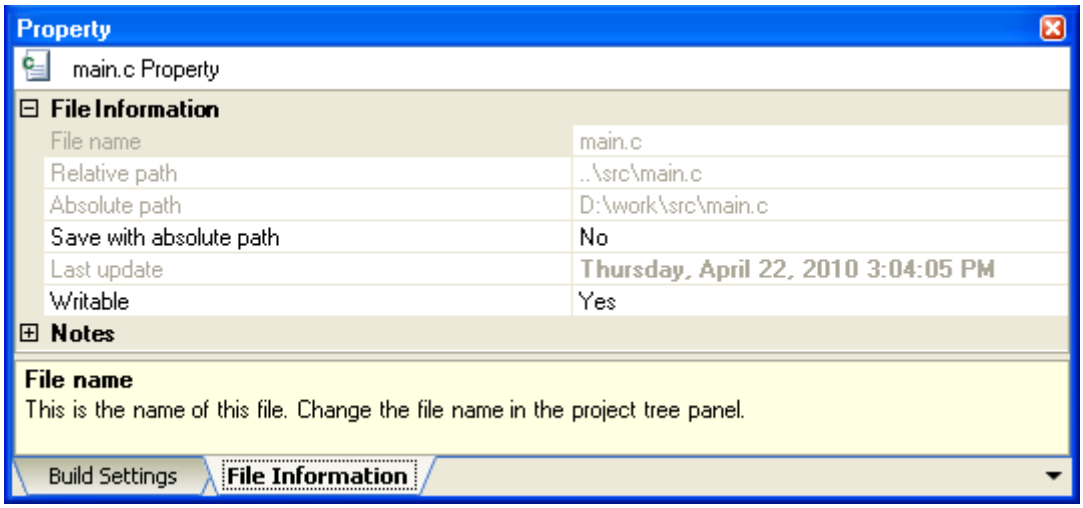
Other additional options	Input the assemble options to be added additionally. The options set here are added at the end of the assemble options group.	
	Default	*Configuration of the general option*
	How to change	Directly enter to the text box or edit by the Character String Input dialog box which appears when clicking the [...] button.
	Restriction	Up to 259 characters

[File Information] tab

This tab shows the detailed information on each file categorized by the following and the configuration can be changed.

(1) [File Information]
(2) [Notes]

Figure A-23. Property Panel: [File Information] Tab



[Description of each category]

(1) [File Information]

The detailed information on the file are displayed and the configuration can be changed.

File name	Display the file name. Change the file name on the Project Tree panel.		
	Default	*File name*	
	How to change	Changes not allowed	
Relative path	Display the relative path of the file from the project folder.		
	Default	*The relative path of the file from the project folder*	
	How to change	Changes not allowed	
Absolute path	Display the absolute path of the file.		
	Default	*The absolute path of the file*	
	How to change	Changes not allowed	
Save with absolute path	Select whether to save the file location with the absolute path.		
	Default	No	
	How to change	Select from the drop-down list.	
	Restriction	Yes	Saves the file location with the absolute path.
		No	Saves the file location with the relative path.

Last update	Display the time and date on which this file was changed last.		
	Default	*File updated time and date*	
	How to change	Changes not allowed	
Writable	Select whether to enable writing to the file.		
	Default	Yes (when the file is write enabled) No (when the file is not write enabled)	
	How to change	Select from the drop-down list.	
	Restriction	Yes	Enables the file to write.
		No	Does not enable the file to write.

(2) [Notes]

The detailed information on notes is displayed and the configuration can be changed.

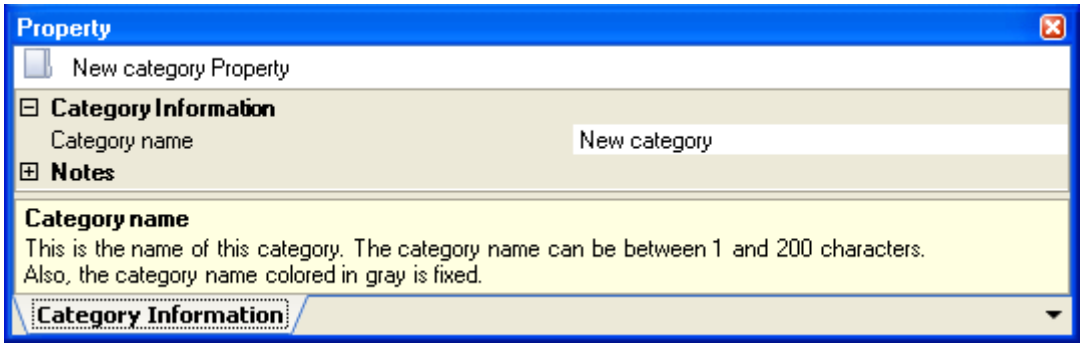
Memo	Add memos to the file. Add one item in one line. The added memos are displayed as the subproperty.	
	Default	Memo[*number-of-items*]
	How to change	Edit by the Text Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.
	Restriction	Up to 256 characters Up to 256 memos can be specified.

[Category Information] tab

This tab shows the detailed information on the category that the user added, File node, Build tool generated files node, and Startup node categorized by the following and the configuration can be changed.

(1) [Category Information]
(2) [Notes]

Figure A-24. Property Panel: [Category Information] Tab



[Description of each category]

(1) [Category Information]

The detailed information on the category is displayed and the configuration can be changed.

Category name	Specify the category name to categorize files. This property of the File node, Build tool generated files node, and Startup node is displayed in gray and you cannot change the attribute.	
	Default	*Category name of files*
	How to change	Directly enter to the text box.
	Restriction	1 to 200 characters

(2) [Notes]

The detailed information on notes is displayed and the configuration can be changed.
This category of the File node, Build tool generated files node, and Startup node is not displayed.

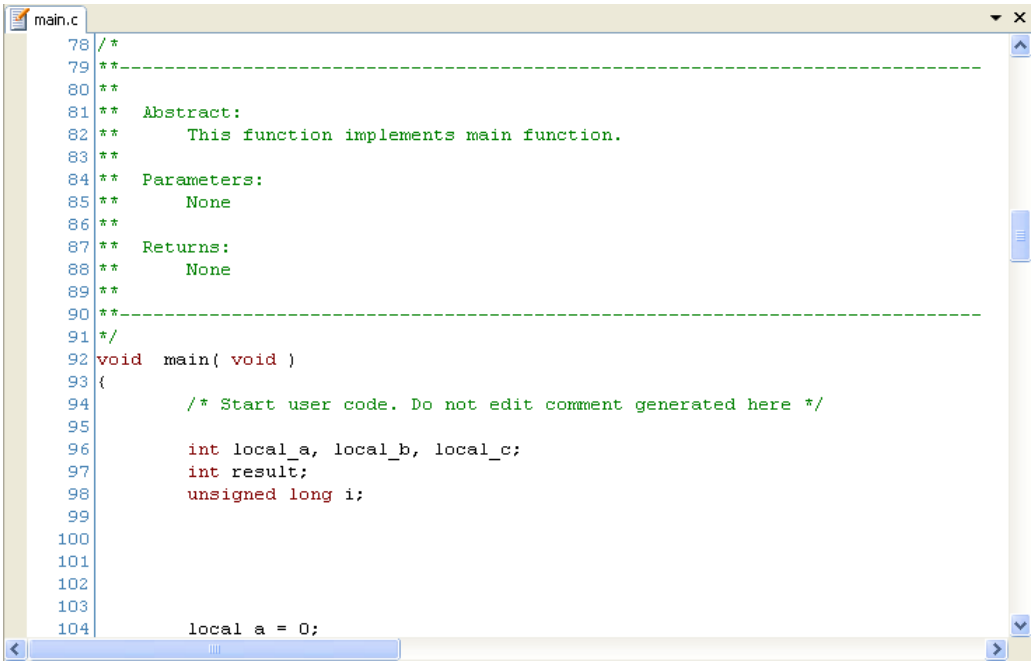
Memo	Add memos to the category of files. Add one item in one line. The added memos are displayed as the subproperty.	
	Default	Memo[*number-of-items*]
	How to change	Edit by the Text Edit dialog box which appears when clicking the [...] button. For the subproperty, you can use the text box directly enter the text.
	Restriction	Up to 256 characters Up to 256 memos can be specified.

Editor panel

This panel is used to display/edit text files/source files.

See "CubeSuite+ V850 Coding" for details about this panel.

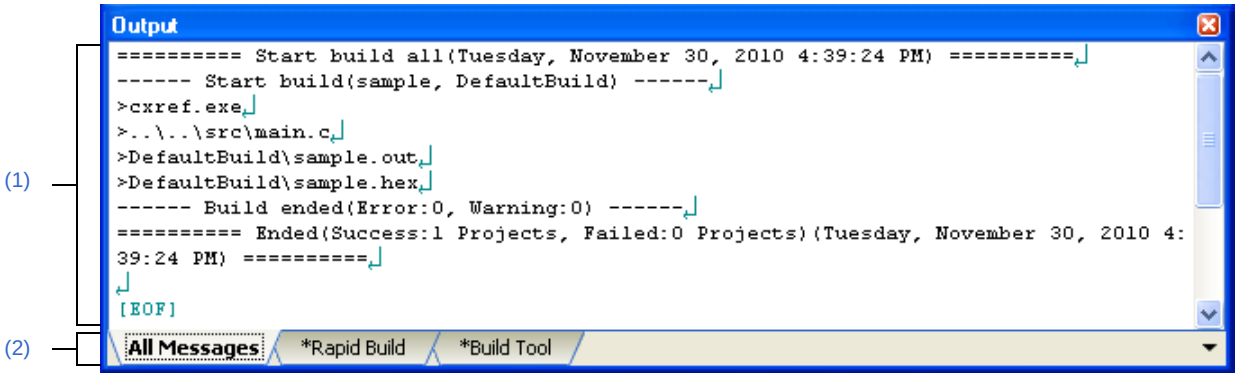
Figure A-25. Editor Panel



Output panel

This panel is used to display the message that is output from the build tool.
Messages are shown individually on the tab categorized by the output tool.

Figure A-26. Output Panel



The following items are explained here.

- [How to open]
- [Description of each area]
- [[File] menu (only available for the Output panel)]
- [[Edit] menu (only available for the Output panel)]
- [Context menu]

[How to open]

- From the [View] menu, select [Output].

[Description of each area]

(1) Message area

Display messages and the search results output from each tool.
In build result/search result (batch search) display, a new message is displayed deleting the previous message every time build/search is done (but not the [All Messages] tab).

Remark Up to 500000 lines of messages can be displayed. If 500001 lines or more of messages are output, then the excess lines are deleted, oldest first.

The message colors differ as follows depends on the type of the output message (the character color/background color is set in [General - Font and Color] category in the Option dialog box).

Message Type	Example (Default)			Description
Normal message	AaBbCc	Character color	Black	Information on something.
		Background color	White	
Warning	AaBbCc	Character color	Blue	Warning for the operation.
		Background color	Normal color	

Message Type	Example (Default)			Description
Error message	AaBbCc	Character color	Red	Fatal error or operation disabled because of an error in operation.
		Background color	Light gray	

This area has the following functions.

(a) Tag jump

When the output message is double-clicked, or the [Enter] key is pressed with the caret over the message, the Editor panel appears and the destination line number of the file is displayed.
You can jump to the line of the source file that generated the error from the error message output when building.

(b) Display help

help with regard to the message in the line is shown by selecting [Help for Message] in the context menu or pressing the [F1] key while the caret is in the line where the warning message or the error message is displayed.

(c) Save log

The contents displayed on the currently selected tab can be saved in a text file (*.txt) by selecting [Save Output - *tab name* As...] from the [File] menu and opens the Save As dialog box (messages on the tab that is not selected will not be saved).

(2) Tab selection area

Select tabs that messages are output from.
Tabs that are displayed are as follows.

Tab Name	Description
All Messages	Shows all the messages by order of output. (Except while executing a rapid build)
Rapid Build	Shows the message output from the build tool by running a rapid build.
Build Tool	Shows the message output from the build tool by running build/rebuild/clean.

Caution Tab is not automatically switched when a new message is output on the non-selected tab. If this is the case, is added to the tab informing a new message is output.

[[File] menu (only available for the Output panel)]

The following items are exclusive for the [File] menu in the Output panel (other items are common to all the panels).

Save Output - *tab name*	Saves the contents on the currently selecting tab in the previously saved text file (*.txt) (see "(c) Save log"). When this item is selected for the first time after launching the program, the operation is equivalent to when selecting [Save Output - *tab name* As...].
Save Output - *tab name* As...	Opens the Save As dialog box to save the contents on the currently selecting tab in the designated text file (*.txt) (see "(c) Save log").

[[Edit] menu (only available for the Output panel)]

The following items are exclusive to the [Edit] menu in the Output panel (other items are all invalid).

Copy	Copies the selected characters to the clipboard.
Select All	Selects all the messages displayed on this panel.
Find...	Opens the Find and Replace dialog box with the [Quick Find] tab target.
Replace...	Opens the Find and Replace dialog box with the [Replace in Files] tab target.

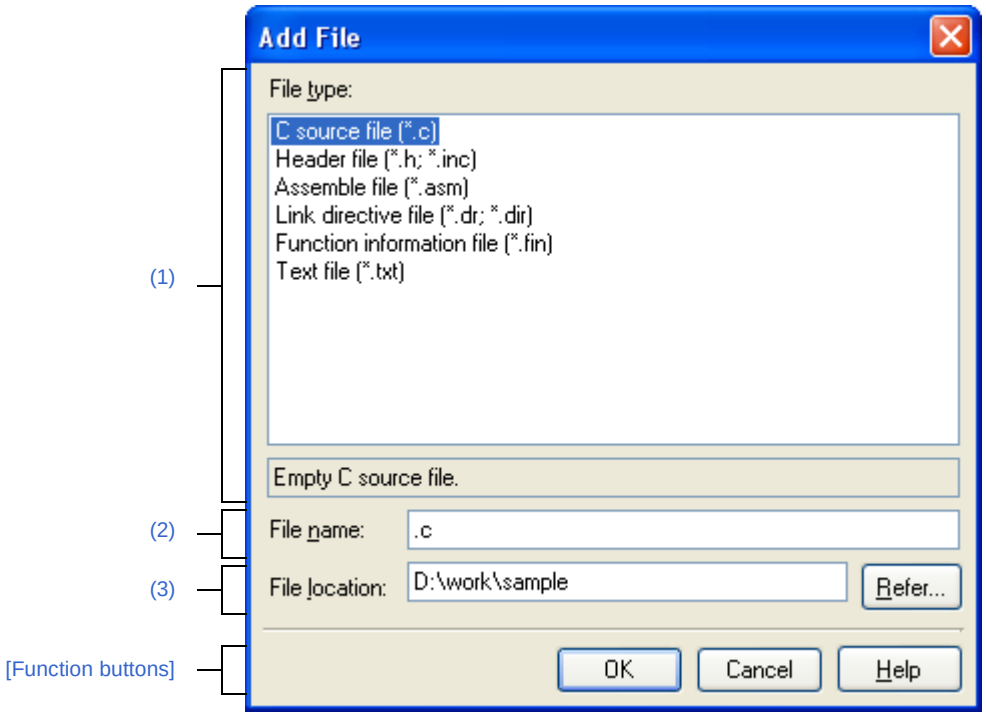
[Context menu]

copy	Copies the selected characters to the clipboard.
Select All	Selects all the messages displayed on this panel.
Clear	Deletes all the messages displayed on this panel.
Tag Jump	Jumps to the caret line in the editor indicated by the message (file, line, and column).
Help for Message	Shows the help with regard to the message at the current caret. Note that the help is only for warning/error messages.

Add File dialog box

This dialog box is used to create a new file and add it to the project.

Figure A-27. Add File Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- From the [File] menu, select [Add] >> [Add New File...].
- On the Project Tree panel, select either one of the Project node, Subproject node, File node, or category node, and then select [Add] >> [Add New File...] from the context menu.

[Description of each area]

(1) [File type] area

Select file types to create.

The description is shown at the lower box when a file type is selected.

File types to be shown are as follows.

- C source file (*.c)
- Header file (*.h; *.inc)
- Assemble file (*.s)
- Link directive file (*.dir; *.dr)
- Section file (*.sf)
- Text file (*.txt)

(2) [File name] area

Directly enter the name of the file to create.
The default file extension is "txt".

Remark If extensions are not designated, the one selected in the [File type] area are is added. Also that if extensions different from the one selected in the [File type] area are designated, the one selected in the [File type] area is added as an extension (for example, if you designate "aaa.txt" as a file name and select "C source file (*.c)" as file type, the file is named as "aaa.txt.c").

(3) [File location] area

Designate the location to create a file by directly entering its path or selecting from [Refer...] button.
The default file location is the project folder path.

(a) Button

Refer...	Opens the Browse For Folder dialog box. When a folder is selected, a path is added in the text box.

Remarks 1. When the text box is left blank, the project folder is regarded to be designated.
2. When the relative path is used, the path is regarded to be from the project folder.

Remark The number of characters that can be entered in the [File name] area and the [File location] area is up to 259 both for the path name and file name together. When the input violates any restriction, the following messages are shown in the tooltip in the [File name] area.

Message	Description
The file name including the path is too long. Make it within 259 characters.	The file name with the path is more than 259 characters.
The specified path contains a folder that does not exist.	The path includes the folder that does not exist.
The file name or path name is invalid. The following characters cannot be used: \, /, :, *, ?, ", <, >, |	The file name with the invalid path is designated. The characters, \, /, :, *, ", <, >, |, cannot be used for the file name and folder name.

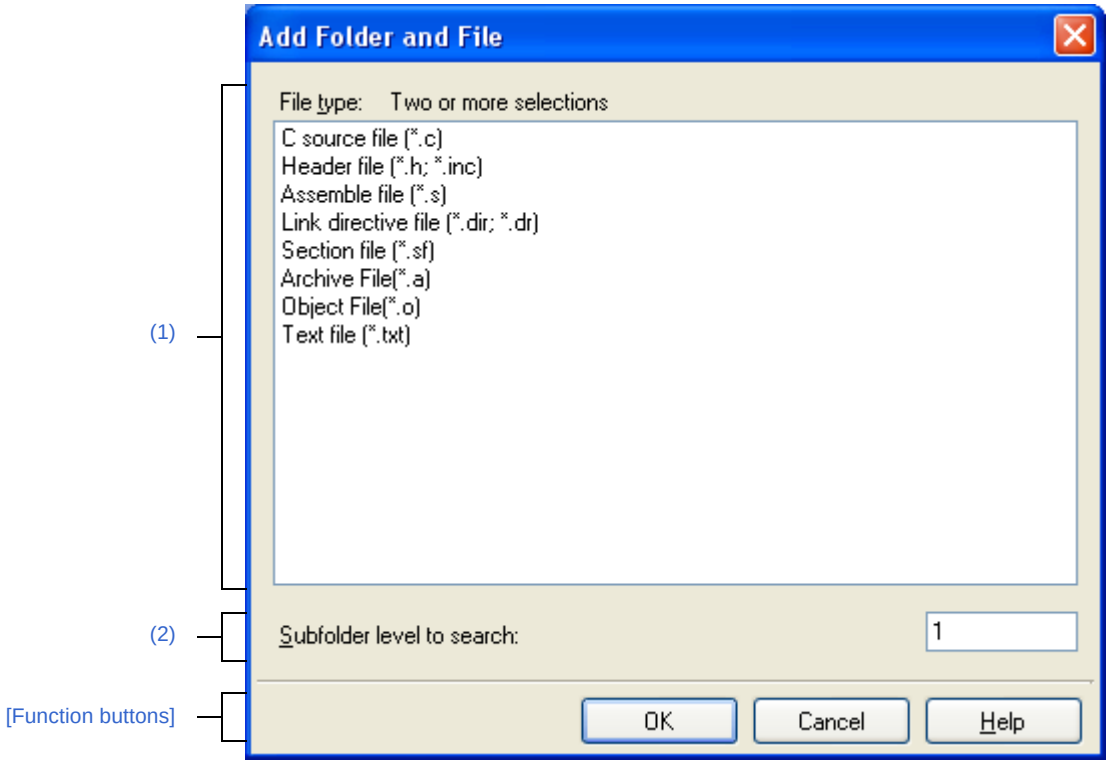
[Function buttons]

Button	Function
OK	Creates the file with the entered file name, adds it to the project, and opens with the Editor panel. Then closes this dialog box.
Cancel	Does not create a file and closes this dialog box.
Help	Displays the help of this dialog box.

Add Folder and File dialog box

This dialog box is used to add existing files and folder hierarchies to the project.
The folder is added as a category.

Figure A-28. Add Folder and File Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- Drag the folder from Explorer or the like, and drop it on the Project Tree panel.

[Description of each area]

(1) [File type] area

Select the file types to add to the project.
You can select multiple types by left clicking while holding down the [Ctrl] or [Shift] key.
If nothing is selected, it is assumed that all types are selected.
The file types displayed are shown below.

- C source file (*.c)
- Header file (*.h; *.inc)
- Assemble file (*.s)
- Link directive file (*.dir; *.dr)
- Section file (*.sf)

- Archive file (*.a)
- Object file (*.o)
- Text file (*.txt)

(2) [Subfolder level to search] area

Directly enter the number of subfolder levels to add to the project.
The default number is "1".

Remark Decimal numbers of up to 10 are allowed. When the input violates any restriction, the following messages are shown in the tooltip.

Message	Description
Fewer than 0 or more than 10 values cannot be specified.	More than 10 subfolder levels have been specified.
Specify in decimal.	A number in other than base-10 format or a string has been specified.

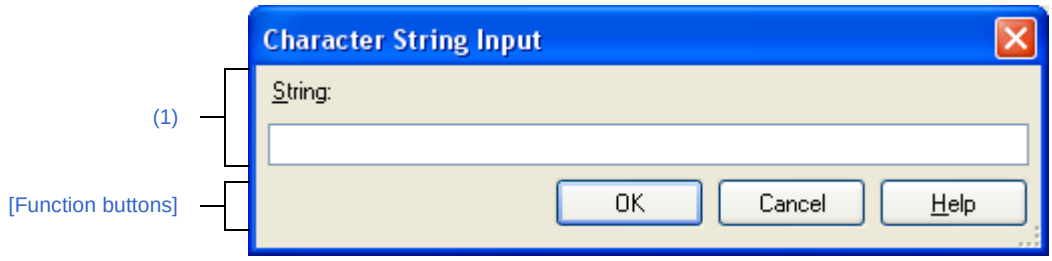
[Function buttons]

Button	Function
OK	The folder that was dragged and dropped and the files in that folder are added to the project.And then close the dialog box.
Cancel	Do not add a folder and files, and then closes this dialog box.
Help	Displays the help of this dialog box.

Character String Input dialog box

This dialog box is used to input and edit characters in one line.

Figure A-29. Character String Input Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- On the Property panel, select the following properties, and then click the [...] button.
  - From the [Common Options] tab, [Format of build option list] in the [Others] category.
  - From the [Compile Options] tab, [Displayed warning message] and [undisplayed warning message] in the [Message] category, [Other additional options] in the [Others] category.
  - From the [Assemble Options] tab, [Other additional options] in the [Others]category.
  - From the [Link Options] tab, [Entry symbol] and [Other additional options] in the [Others] category.
  - From the [ROMization Process Options] tab, [Entry label] and [Other additional options] in the [Others] category.
  - From the [Hex Convert Options] tab, [Other additional options] in the [Others] category.
  - From the [Archive Options] tab, [Other additional options] in the [Others] category.
  - From the [Section File Generate Options] tab, [Other additional options] in the [Others] category.
  - From the [Dump Options] tab, [Additional options for dump tool] in the [Dump Tool] category.
  - From the [Cross Reference Options] tab, [Additional options for cross reference tool] in the [Cross Reference Tool] category.
  - From the [Memory Layout Visualization Options] tab, [Additional options for memory layout visualization tool] in the [Memory Layout Visualization Tool] category.
  - From the [Individual Compile Options] tab, [Other additional options] in the [Others] category.
  - From the [Individual Assemble Options] tab, [Other additional options] in the [Others] category.
- In the Link Directive File Generation dialog box , select a segment or section in the [Segment / Section list] area, and then click the [...] button in the [Segment / Section detail] area.
- In the Link Directive File Generation dialog box, select a section in the [Segment / Section list] area, and then click the [...] button on [Input section name] in the [Segment / Section detail] area.
- In the Link Directive File Generation dialog box, select a symbol in the [Symbol list] area, and then click the [...] button on [Name] in the [Symbol detail] area.
- In the Link Directive File Generation dialog box, select a symbol in the [Symbol list] area, and then click the [...] button on [Base symbol name] in the [Symbol detail] area.
- In the [General - External Tools] category of the Option dialog box, check [Require options at start-up] in the New registration area. Then the dialog box automatically opens when an external tool is launched from [Tool] menu.

[Description of each area]

(1) [String] area

Input characters in one line.

By default, this dialog box opens with its edit box reflecting the current value of the property selected to call the dialog box.

Line break is not allowed.

Remark Up to 32767 characters can be entered. When the input violates any restriction, the following messages are shown in the toolchip.

Message	Description
More than *maximum number of restriction in the property that called this dialog box* characters cannot be specified.	The characters exceeds the maximum number of restriction in the property that called this dialog box.

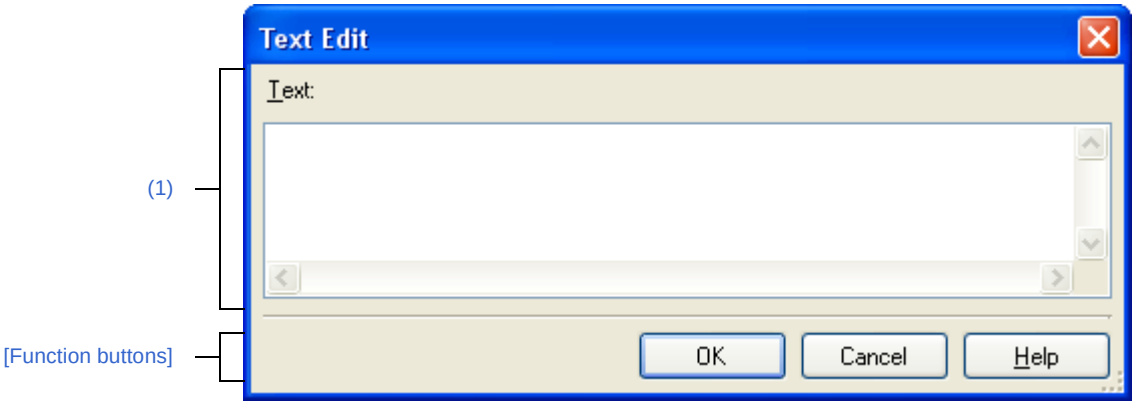
[Function buttons]

Button	Function
OK	Reflects the entered characters to the property that called this dialog box then closes the dialog box.
Cancel	Does not reflect the entered characters to the property that called this dialog box then closes the dialog box.
Help	Displays the help of this dialog box.

Text Edit dialog box

This dialog box is used to input and edit texts in multiple lines.

Figure A-30. Text Edit Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- On the Property panel, select the following properties, and then click the [...] button.
  - From the [Common Options] tab, [Macro definition] in the [Frequently Used Options(for Compile)] category, [Macro definition] in the [Frequently Used Options(for Assemble)] category, [Using libraries] in the [Frequently Used Options(for Link)] category, [Memo] in the [Notes] category, and [Commands executed before build processing], [Commands executed after build processing] in the [Others] category.
  - From the [Compile Options] tab, [Macro definition] and [Macro undefinition] in the [Preprocess] category, [Commands executed before compile processing] and [Commands executed after compile processing] in the [Others] category.
  - From the [Assemble Options] tab, [[Macro definition] in the [Preprocess] category, [Commands executed before assemble processing] and [Commands executed after assemble processing] in the [Others] category.
  - From the [Link Options] tab, [Using libraries] in the [Library] category, [Commands executed before link processing] and [Commands executed after link processing] in the [Others] category.
  - From the [ROMization Process Options] tab, [Order of storing to the rompsec section] in the [Section List] category, [Commands executed before ROMization processing] and [Commands executed after ROMization processing] in the [Others] category.
  - From the [Hex Convert Options] tab, [Converted sections] in the [Hex Format] category, [Commands executed before hex convert processing] and [Commands executed after hex convert processing] in the [Others] category.
  - From the [Archive Options] tab, [Commands executed before archive processing] and [Commands executed after archive processing] in the [Others] category.
  - From the [Section File Generate Options] tab, [Sections excluded in optimization] and [Variables excluded in optimization] in the [Allocation of Variables] category.
  - From the [Individual Compile Options] tab, [Macro definition] and [Macro undefinition] in the [Preprocess] category, [Commands executed before compile processing] and [Commands executed after compile processing] in the [Others] category.

- From the [Individual Assemble Options] tab, [Macro definition] in the [Preprocess] category, [Commands executed before assemble processing] and [Commands executed after assemble processing] in the [Others] category.
- From the [File Information] tab, [Memo] in the [Notes] category
- From the [Category Information] tab, [Memo] in the [Notes] category

[Description of each area]

(1) [Text] area

Input and edit texts in multiple lines.

By default, this dialog box opens with its edit box reflecting the current value of the property selected to call the dialog box.

Remark Up to 65535 lines and 65535 characters are allowed. When the input violates any restriction, the following messages are shown in the tooltip.

Message	Description
More than *maximum number of restriction in the property that called this dialog box* characters cannot be specified. The current number of characters is displayed between brackets at the beginning of the line in excess of the limit.	The characters exceeds the maximum number of restriction in the property that called this dialog box.

[Function buttons]

Button	Function
OK	Reflects the entered text to the text box that opened this dialog box and closed the dialog box.
Cancel	Does not reflect the entered text to the text box that opened this dialog box and closed the dialog box.
Help	Displays the help of this dialog box.

Path Edit dialog box

This dialog box is used to edit or add the path or the file name including path.

Figure A-31. Path Edit Dialog Box (When Editing Path)

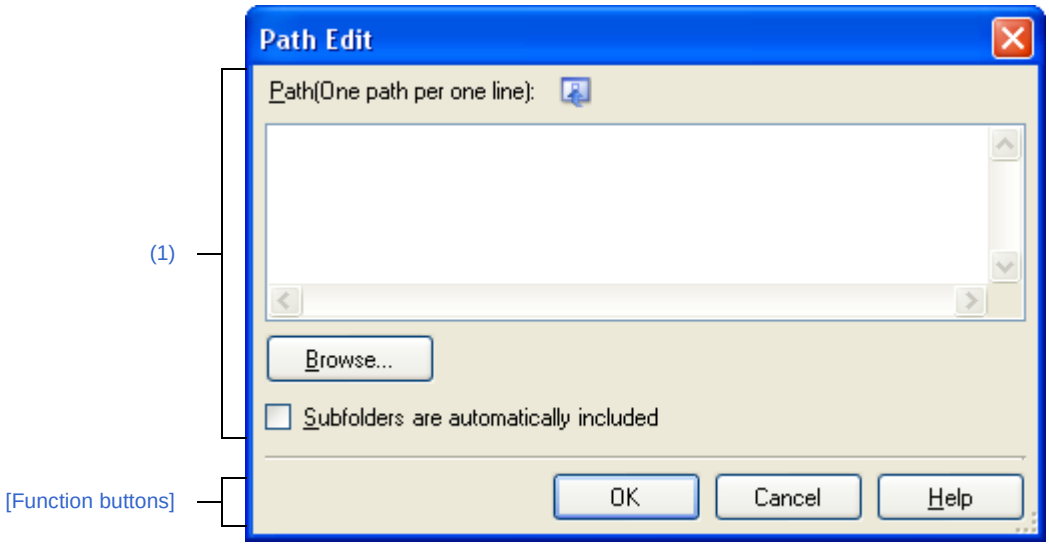
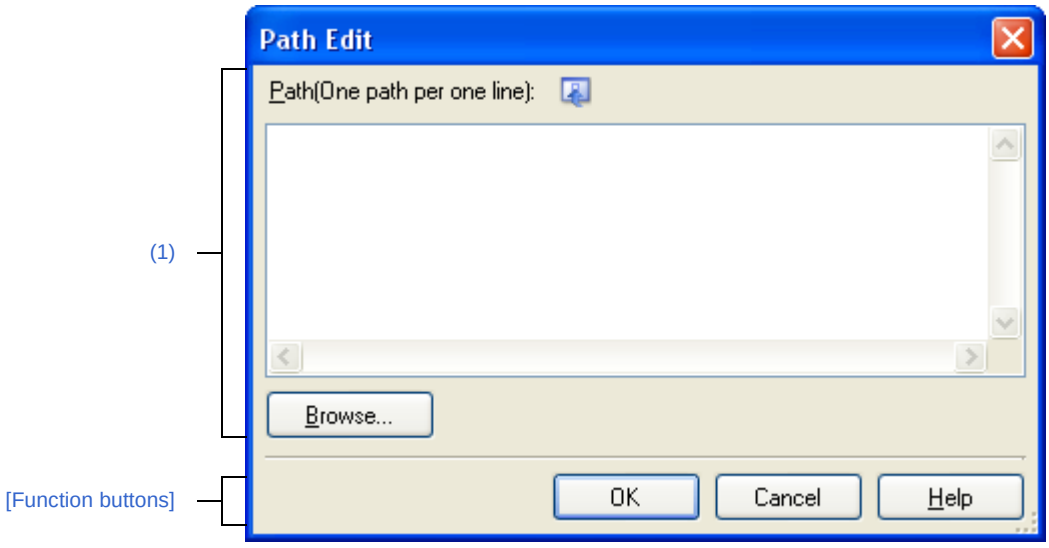


Figure A-32. Path Edit Dialog Box (When Editing File Name Including Path)



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- On the Property panel, select the following properties, and then click the [...] button.

- From the [Common Options] tab, [Additional include paths] in the [Frequently Used Options(for Compile)] category, [Additional include paths] in the [Frequently Used Options(for Assemble)] category, and [Additional library paths] in the [Frequently Used Options(for Link)] category.
- From [Compile Options] tab, [Additional include paths] in the [Preprocess] category, [Far jump file names] in the [Input File] category.
- From [Assemble Options] tab, [Additional include paths] in the [Preprocess] category.
- From [Link Options] tab, [Additional library paths] in the [Library] category.
- From [Individual Compile Options] tab, [Additional include paths] in the [Preprocess] category.
- From [Individual Assemble Options] tab, [Additional include paths] in the [Preprocess] category.

[Description of each area]

(1) Path edit area

Edit or add the path or the file name including path .

(a) [Path(One path per one line)]

Edit or adds the path or the file name including path by directly entering the path or the file name including path .

Path or the file name including path can be designated in multiple lines. Designate a path or the file name including path at a line.

By default, the contents of the text box that opened this dialog box are reflected in this area.

Path can be added by one of the following method.

- Click the [Browse...] button, and then select folders in the Browse For Folder dialog box.
- Drag and drop the folder using such as Explorer.

File names including path can be added by one of the following method.

- Select the file in the Specify Far Jump File dialog box which opens by clicking the [Browse...] button.
- Drag and drop the file using such as Explorer.

Caution **If an extremely long absolute path is specified as a relative path, an error could occur when clicking the [OK] button. In this case, designate the absolute path.**

Remark Up to 10000 lines are allowed. Up to the maximum characters that are limited by the Windows OS are allowed. When the input violates any restriction, the following messages are shown in the tooltip.

Message	Description
Specify a path.	The field is empty.
The path is too long. Specify a path with a number of characters equal to or fewer than *maximum number of restriction in the property that called this dialog box*.	The file name including the path is exceeding the character limit defined in the original path.
The specified path contains a folder that does not exist.	The path includes the folder that does not exist.
The file name or path name is invalid. The following characters cannot be used: \, /, :, *, ?, ", <, >, |	The file name with the invalid path is designated. The characters, \, /, :, *, ", <, >, |, cannot be used for the file name and folder name.
More than *maximum number of paths or files specified by the caller* lines cannot be specified.	The number of paths or files which have been input exceeds the maximum number of paths or files specified by the caller.

(b) Button

Browse...	- When adding the path Opens the Browse For Folder dialog box. When a folder is selected, the path is added to [Path(One path per one line)]. - When adding the file name including path Opens the Specify Far Jump File dialog box. When a file is selected, the file name is added to [Path(One path per one line)].

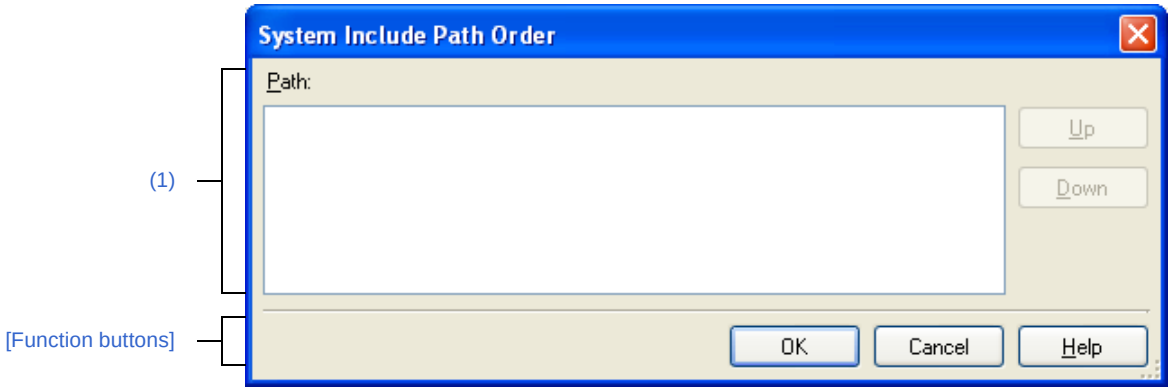
[Function buttons]

Button	Function
OK	Reflects the entered path to the property that called this dialog box then closes the dialog box.
Cancel	Does not reflect the entered path to the property that called this dialog box then closes the dialog box.
Help	Displays the help of this dialog box.

System Include Path Order dialog box

This dialog box is used to refer the system include paths specified for the compiler and set their specified sequence.

Figure A-33. System Include Path Order Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- On the Property panel, select the following properties, and then click the [...] button.
  - From the [Common Options] tab, [System include paths] in the [Frequently Used Options(for Compile)] category, and [System include paths] in the [Frequently Used Options(for Assemble)] category
  - From the [Compile Options] tab, [System include paths] in the [Preprocess] category
  - From the [Assemble Options] tab, [System include paths] in the [Preprocess] category

[Description of each area]

(1) Path list display area

This area displays the list of the system include paths specified for the compiler.

(a) [Path]

This area displays the list of the system include paths in the specified sequence for the compiler.
The default order is the order that the files are registered to the project.
By changing the display order of the paths, you can set the specified order of the paths to the compiler.
To change the display order, use the [Up] and [Down] buttons, or drag and drop the path names.

Remarks 1. Move the mouse cursor over a file name to display a tooltip with the absolute path of that file.

2. Newly added system include paths are added next to the last path of the list.

3. When the path names are dragged and dropped, the multiple path names which are next to each other can be selected together.

(b) Button

Up	Moves the selected path to up.

Down	Moves the selected path to down.

Remark Note that above buttons are disabled when any path is not selected.

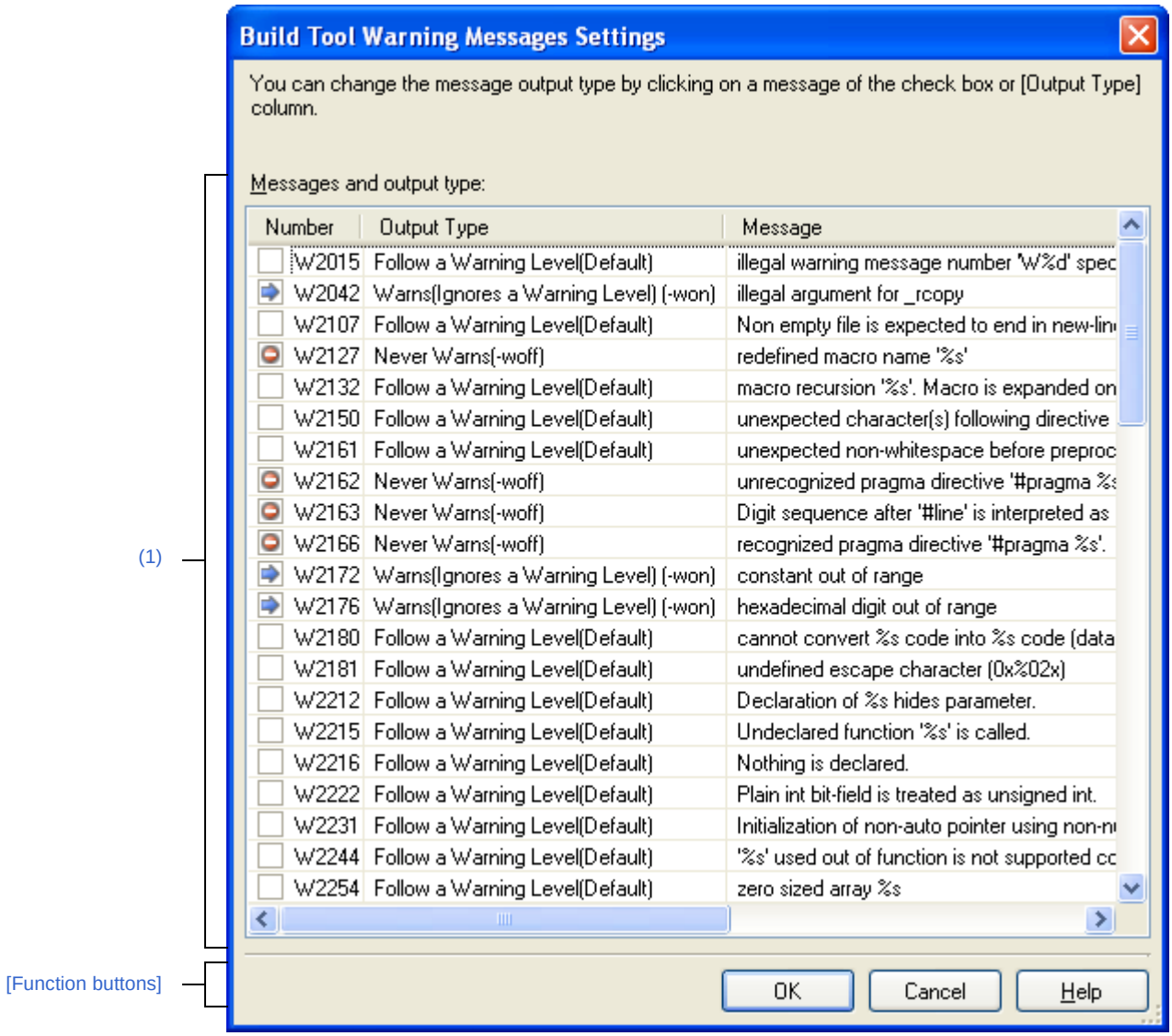
[Function buttons]

Button	Function
OK	Sets the specified order of the paths to the compiler as the display order in the Path list display area and closes this dialog box.
Cancel	Cancels the specified order of the paths and closes the dialog box.
Help	Displays the help of this dialog box.

Build Tool Warning Messages Settings dialog box

This dialog box is used to set the warning messages output by the build tool.

Figure A-34. Build Tool Warning Messages Settings dialog box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- On the Property panel, select the following properties, and then click the [...] button.
  - From the [Compile Options] tab, [Displayed warning message] and [Undisplayed warning message] in the [Message] category

[Description of each area]

(1) [Messages and output type] area

This area displays the list of the warning messages output by the build tool.

(a) [Number]

Show numbers of warning messages.

The icon corresponding to [Output Type] is shown on the check box.

Icon	[Output Type]
	Follow a Warning Level(Default)
	Warns(Ignore a Warning Level)(-won)
	Never Warns(-woff)

Remark By clicking check boxes, items of [Output Type] can be changed.

(b) [Output Type]

Set the output type of warning messages by selecting from the drop-down list.

Item	Description
Follow a Warning Level(Default)	Displays the warning message according to the setting of the [Warning level] property.
Warns(Ignore a Warning Level)(-won)	Displays the warning message regardless of the setting of the [Warning level] property.
Never Warns(-woff)	Does not display the warning message regardless of the setting of the [Warning level] property.

The contentes of the [Displayed warning message] property and [Undisplayed warning message] property are reflected by default.

However, if the same number is specified on the [Displayed warning message] property and [Undisplayed warning message] property, the number specified on the [Displayed warning message] property takes precedence.

(c) [Message]

Show warning messages.

Remarks 1. By clicking each header ([Number]/[Output Type]/[Message]), the list of warning messages can be sorted in order of the number, output type, or message in ascending/descending order.
Warning messages are sorted in descending order of the number by default.

2. You can select multiple warning messages by holding down the [Ctrl] or [Shift] key.
When multiple messages are selected, you can change the output type of selected all messages.
- Click the check box.
- Select from the drop-down list while holding down the [Ctrl] or [Shift] key.

[Function buttons]

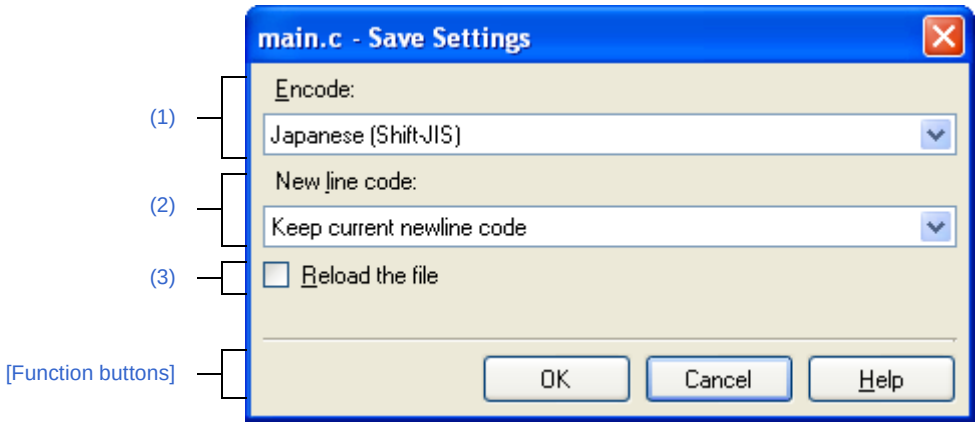
Button	Function
OK	Reflects the settings to the [Displayed warning message] property and [Undisplayed warning message] property and closes this dialog box.
Cancel	Does not reflect the settings to the [Displayed warning message] property and [Undisplayed warning message] property and closes this dialog box.
Help	Displays the help of this dialog box.

File Save Settings dialog box

This dialog box is used to set the encoding and newline code of the file that is being edited on the Editor panel.

Remark The target file name is displayed on the title bar.

Figure A-35. File Save Settings Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- Focus the Editor panel, and then select [*file name* Save Settings...] from the [File] menu.

[Description of each area]

(1) [Encode]

Select the encoding to be set from the drop-down list.

The items of the drop-down list are displayed according to the following sequence.

Note that the same encoding and encoding which are not supported by the current OS will not be displayed.

- *Encoding of the current file* (default)
- *Default encoding of the current OS*
- *Encoding of code page 932 (SJIS)*
- *Encoding of code page 50222 (JIS)*
- *Encoding of code page 51932 (EUC)*
- *Encoding of code page 65001 (UTF8)*
- *Encoding supported by the current OS other than those mentioned above*

(2) [Newline code]

Select the newline code to be set from the drop-down list.

You can select any of items below.

- Keep current newline code
- Windows (CR LF)
- Macintosh (CR)

- Unix (LF)

"Keep current newline code" is selected by default.
After the newline code is changed, the set newline code is selected by default.

(3) [Reload the file]

Use this check box to select whether to reload the file with the selected encoding and newline code when the [OK] button is clicked.
The check box is not selected by default.

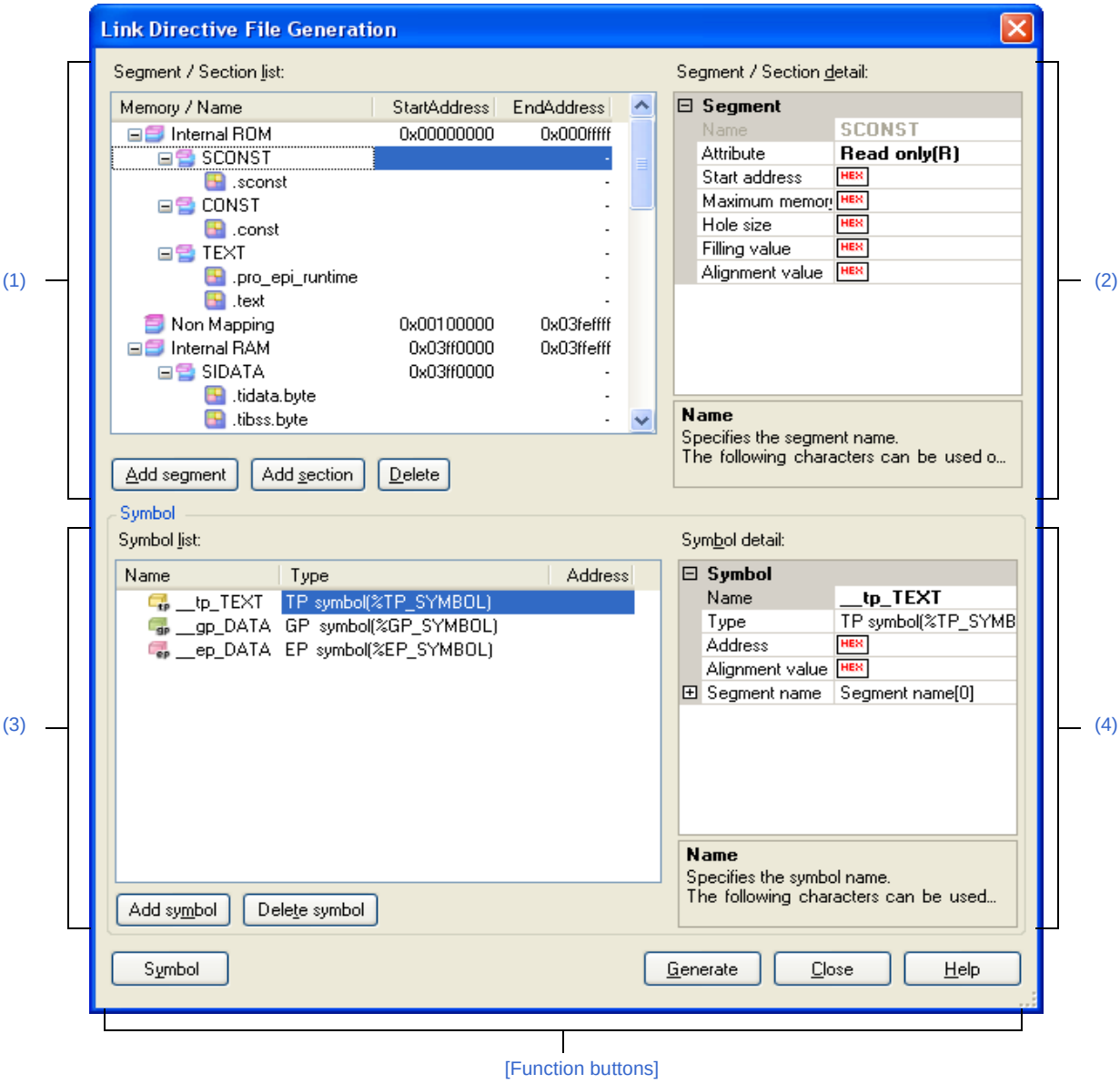
[Function buttons]

Button	Function
OK	Sets the selected encoding and newline code to the target file and closes this dialog box. If [Reload the file] is selected, sets the selected encoding and newline code to the target file and reloads the file.And then closes this dialog box.
Cancel	Cancels the settings of the encoding and newline code and closes the dialog box.
Help	Displays the help of this dialog box.

Link Directive File Generation dialog box

This dialog box is used to generate a link directive file based on the specified memory, segments, sections, and symbol allocation information.

Figure A-36. Link Directive File Generation Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- On the Project Tree panel, select the Build tool node, and then select [Create Link Directive File...] from the context menu.

[Description of each area]

(1) [Segment / Section list] area

Display the device memory allocation information, and a list of the currently configured segments and sections.

(a) [Memory / Name]

Display the names of the memory area, segments, and sections.

For the memory area, the name of the corresponding memory area as shown below is displayed.

- Internal ROM
- Non Mapping
- Internal RAM
- DataFlash

This item can be edited directly for the segments and sections.If a segment name and section name is changed, the value of [Name] in the [Segment / Section detail] area is also changed.

Caution Some segment and section names in reserved sections cannot be edited.See the remark of the [Segment / Section detail] area for details.

(b) [Start Address]

Display the start addresses of the memory area, segments, and sections.

This item can be edited directly for the segments and sections.If the start address is changed, the value of [Start Address] in the [Segment / Section detail] area is also changed.

(c) [End Address]

Display the end addresses of the memory area.

A dash (-) appears in segment and section rows.

(d) Button

Add segment	Adds a new segment directly below the row selected in the list. The segment name is "NewSegment_*XXX*" by default (*XXX*: 0 to 255 in decimal numbers). Make detailed segment settings in the [Segment / Section detail] area. This button is invalid when a section row is selected, or when 256 segments have been registered to the list.
Add section	Adds a new section directly below the row selected in the list. The section name is "NewSection_*XXX*" by default (*XXX*: 0 to 255 in decimal numbers). Make detailed section settings in the [Segment / Section detail] area. This button is invalid when 256 sections are registered in the list.
Delete	Deletes the segment or section that is selected in the list. If a segment is deleted, the section included in the segment is also deleted.

This area has the following functions.

- Expand/collapse a row view

  You can expand/collapse each low view by double clicking the row or clicking ⊞ or ⊟ at the beginning of the row.

- Move a segment or section row
  You can move segment or section rows by dragging and dropping them.

  Remark If a segment is moved, the section included in the segment is also moved.

- Copy a segment or section
  After selecting a segment or section, press the [Ctrl] + [C] key to copy it, then the [Ctrl] + [V] key to paste it.
  The copy of the row is pasted immediately below the row that is selected when the [Ctrl] + [V] key is pressed.
  "Copy_" is added to the head of the name of the copy of the segment or section.

  Remarks 1. If a segment is copied, the section included in the segment is also copied.
  2. The start address of the copy of the segment or section is blank.
  3. If the copy cannot be performed due to the attributes of the segment being copied to, an error will occur.

(2) [Segment / Section detail] area

Display and edit detailed information on the segment or section selected in the [Segment / Section list] area.

(a) Detailed information of segments

Name	Specify the segment name. The following characters can be used only: 0-9, A-Z, a-z, _, ., /, \.		
	Default	NewSegment_*XXX* (*XXX*: 0 to 255 in decimal numbers)	
	How to change	Directly enter to the text box or edit by the Character String Input dialog box which appears when clicking the [...] button.	
	Restriction	Up to 1022 characters	
Attribute	Select the attribute of the segment. If a segment contains a reserved section, then this is only available if the segment attributes can also be set according to the section attributes. In this case, the attributes that cannot be set are not appear in the drop-down list.		
	Default	- When adding the segment to the internal ROM area or non mapping area Executable(RX) - When adding the segment to the internal ROM Read/Write(RW) - When adding the segment to the DataFlash area Read only(R)	
	How to change	Select from the drop-down list.	
	Restriction	Executable(RX)	Makes the segment readable and executable.
		Read only(R)	Makes the segment readable.
		Read/Write(RW)	Makes the segment readable and writable.
		All enable (RWX)	Makes the segment readable, writable, and executable.

Start address	Specify the start address to allocate the segment. If this field is blank, the segment is allocated in the behind of the previous segment by the link function of the compiler.	
	Default	Blank
	How to change	Directly enter to the text box.
	Restriction	0x0 to 0xFFFFFFFF (hexadecimal number)
Maximum memory size	Specify the maximum memory size of the segment. If this field is blank, the size is considered as 0x100000 bytes by the link function of the compiler. An error occurs if the specified maximum memory size is exceeded.	
	Default	Blank
	How to change	Directly enter to the text box.
	Restriction	0x0 to 0xFFFFFFFF (hexadecimal number)
Hole size	Specify the hole size between segments. If this field is blank, the size is considered as 0x0 (byte) by the link function of the compiler.	
	Default	Blank
	How to change	Directly enter to the text box.
	Restriction	0x0 to 0xFFFFFFFF (hexadecimal number)
Filling value	Specify the filling value for a hole between segments. If this field is blank, the value is considered as 0x0000 by the link function of the compiler.	
	Default	Blank
	How to change	Directly enter to the text box.
	Restriction	0x0000 to 0xFFFF (hexadecimal number)
Alignment value	Specify the alignment conditions of the segment. When the odd number value is specified, it changes to the even number value by automatically adding one. If this field is blank, the value is considered as 0x8 by the link function of the compiler.	
	Default	Blank
	How to change	Directly enter to the text box.
	Restriction	0x0 to 0xFF (hexadecimal number)

(b) Detailed information of sections

Name	Specify the section name. The following characters can be used only: 0-9, A-Z, a-z, _, ., /, \.	
	Default	NewSection_*XXX* (*XXX*: 0 to 255 in decimal numbers)
	How to change	Directly enter to the text box or edit by the Character String Input dialog box which appears when clicking the [...] button.
	Restriction	Up to 1022 characters

Type	Select the type of the section. Select [Exist data(PROGBITS)] when a object file contains sections with actual values (.text, .data, etc.). Select [No data(NOBITS)] when a object file contains sections without actual values (.bss, .sbss, etc.).		
	Default	Exist data (PROGBITS)	
	How to change	Select from the drop-down list.	
	Restriction	Exist data (PROGBITS)	Sets the section with a default value.
		No data (NOBITS)	Sets the section without a default value.
Attribute	Select the attribute of the section.		
	Default	- When the attribute of the parent segment is [Executable(AX)] Executable(AX) - When the attribute of the parent segment is [Read only(A)] Read only(A) - When the attribute of the parent segment is [Read/Write(AW)] Read/Write(AW) - When the attribute of the parent segment is [All enable (AWX)] All enable (AWX)	
	How to change	Select from the drop-down list.	
	Restriction	Executable(AX)	Sets a section that occupies a memory and enables to execute. This item is not displayed when the attribute of the parent segment is [Read only(R)].
		Read only(A)	Sets a section that occupies a memory.
		Read/Write(AW)	Sets a section that occupies a memory and enables to write. This item is displayed only when the attribute of the parent segment is [Read/Write(RW)] or [All enable (RWX)].
		GP with 1 instruction(AWG)	Sets a section assigned within a memory range that enables it to occupy a memory, write to it, and reference it using a global pointer (gp) and 16-bit displacement. This item is displayed only when the attribute of the parent segment is [Read/Write(RW)] or [All enable (RWX)].
		All enable (AWX)	Sets a section that occupies a memory and enables to write and execute. This item is displayed only when the attribute of the parent segment is [All enable (RWX)].
Start address	Specify the start address to allocate the section. If this field is blank, the section is allocated in the behind of the previous section by the link function of the compiler.		
	Default	Blank	
	How to change	Directly enter to the text box.	
	Restriction	0x0 to 0xFFFFFFFF (hexadecimal number)	

Hole size	Specify the hole size between sections. If this field is blank, the size is considered as 0x0 (byte) by the link function of the compiler.	
	Default	Blank
	How to change	Directly enter to the text box.
	Restriction	0x0 to 0xFFFFFFFF (hexadecimal number)
Alignment value	Specify the alignment conditions of the section. When the odd number value is specified, it changes to the even number value by automatically adding one. If this field is blank, the value is considered as 0x4 by the link function of the compiler. However, if the section name is ".tidata.byte" or ".tibss.byte", the odd number value can be specified. If this field is blank, the value is considered as 0x1 by the link function of the compiler.	
	Default	Blank
	How to change	Directly enter to the text box.
	Restriction	0x0 to 0xFF (hexadecimal number)
Input section name	Specify the input section name. The following characters can be used only: 0-9, A-Z, a-z, _, ., /, \.	
	Default	Blank
	How to change	Directly enter to the text box or edit by the Character String Input dialog box which appears when clicking the [...] button.
	Restriction	Up to 1022 characters
Object file name	Specify the name of the object file including the input section. The specified object file name is displayed as the subproperty.	
	Default	Object file name[*number of set items*]
	How to change	Edit by the Object File Select dialog box which appears when clicking the [...] button.

Remark Reserved sections are handled as follows.

- If a section defined in the C compiler as a reserved section is specified by [Name] or [Input section name], then the [Types] and [Attribute] cannot be edited, and their values are set automatically.
  The combinations of reserved section names and values set automatically are shown below.

Reserved Section Name	Type	Attribute
.pro_epi_runtime	Exist data (PROGBITS)	Executable(AX)
.text	Exist data (PROGBITS)	Executable(AX)
.data	Exist data (PROGBITS)	Read/Write(AW)
.sedata	Exist data (PROGBITS)	Read/Write(AW)
.sidata	Exist data (PROGBITS)	Read/Write(AW)
.tidata	Exist data (PROGBITS)	Read/Write(AW)
.tidata.byte	Exist data (PROGBITS)	Read/Write(AW)
.tidata.word	Exist data (PROGBITS)	Read/Write(AW)

Reserved Section Name	Type	Attribute
.bss	No data (NOBITS)	Read/Write(AW)
.sebss	No data (NOBITS)	Read/Write(AW)
.sibss	No data (NOBITS)	Read/Write(AW)
.tibss	No data (NOBITS)	Read/Write(AW)
.tibss.byte	No data (NOBITS)	Read/Write(AW)
.tibss.word	No data (NOBITS)	Read/Write(AW)
.sdata	Exist data (PROGBITS)	GP with 1 instruction(AWG)
.sbss	Exist data (PROGBITS)	GP with 1 instruction(AWG)
.const	Exist data (PROGBITS)	Read only(A)
.sconst	Exist data (PROGBITS)	Read only(A)

- The linker limits the reserved sections below to the names of segments where they can be assigned.

Section Name	Segment Name
.sidata, .sibss, .tidata, .tibss, .tidata byte, .tibss.byte, .tidata.word, .tibss.word	SIDATA
.sedata, .sebss	SEDATA
.sconst	SCONST

If one of these section names is specified for [Name], then the name of the parent segment is referenced. Although these sections cannot be moved within a segment, they can be moved to other segments.

- For the following reserved sections, the linker creates a fixed correspondence between the output and input section names. For this reason, even if the input section name is omitted, the linker will assign it automatically.
.pro_epi_runtime, .tidata, .tibss, .tidata.byte, .tibss.byte, .tidata.word, .sidata, .sibss, .sedata, .sebss

(3) [Symbol list] area

Display the list of currently configured symbols.

(a) [Name]

Display the symbol name.
This item can be edited directly. If the symbol name is changed, the value of [Name] in the [Symbol detail] area is also changed.

(b) [Type]

Display the type of the symbol.
This item can be edited directly. If the type is changed, the value of [Type] in the [Symbol detail] area is also changed.

(c) [Address]

Specify the start address to allocate the symbol.
This item can be edited directly. If the address is changed, the value of [Address] in the [Symbol detail] area is also changed.

(d) Button

Add symbol	Adds a new symbol directly below the row selected in the list. The symbol name is "NewSymbol_*XXX*" by default. (*XXX*: 0 to 255 in decimal numbers) Make detailed symbol settings in [Symbol detail] area. This button is invalid when 256 symbols are registered in the list.
Delete symbol	Deletes the section that is selected in the list.

This area has the following functions.

- Move a symbol row
  You can move symbol rows by dragging and dropping them.

(4) [Symbol detail] area

Display and edit detailed information on the symbol selected in the [Symbol list] area.

Name	Specify the symbol name. The following characters can be used only: 0-9, A-Z, a-z, _, ., /, \.		
	Default	NewSymbol_*XXX* (*XXX*: 0 to 255 in decimal numbers)	
	How to change	Directly enter to the text box or edit by the Character String Input dialog box which appears when clicking the [...] button.	
	Restriction	Up to 1022 characters	
Type	Select the type of the symbol.		
	Default	TP symbol(%TP_SYMBOL)	
	How to change	Select from the drop-down list.	
	Restriction	TP symbol(%TP_SYMBOL)	Sets the TP symbol as the type of the symbol.
		GP symbol(%GP_SYMBOL)	Sets the GP symbol as the type of the symbol.
		EP symbol(%EP_SYMBOL)	Sets the EP symbol as the type of the symbol.
Base symbol name	Specify the base symbol (TP symbol that is used when the GP symbol value is defined) from among the TP symbol that already exists. If a base symbol name is specified, the offset value from the TP symbol value will be the GP symbol value. The following characters can be used only: 0-9, A-Z, a-z, _, ., /, \. This property is displayed only when [GP symbol(%GP_SYMBOL)] in the [Type] property is selected.		
	Default	Blank	
	How to change	Directly enter to the text box or edit by the Character String Input dialog box which appears when clicking the [...] button.	
	Restriction	Up to 1022 characters	

Address	Specify the symbol to allocate the section. If this field is blank, the address is considered automatically by the link function of the compiler.	
	Default	Blank
	How to change	Directly enter to the text box.
	Restriction	0x0 to 0xFFFFFFFF (hexadecimal number)
Alignment value	Specify the alignment conditions of the symbol. When the odd number value is specified, it changes to the even number value by automatically adding one. If this field is blank, the value is considered as 0x4 by the link function of the compiler.	
	Default	Blank
	How to change	Directly enter to the text box.
	Restriction	0x0 to 0xFF (hexadecimal number)
Segment name	Specify the segment name that will be referenced by TP and GP symbol values. The specified segment name is displayed as the subproperty. This property is not displayed when [EP symbol(%EP_SYMBOL)] in the [Type] property is selected.	
	Default	Segment name[*number of set items*]
	How to change	Edit by the Segment Select dialog box which appears when clicking the [...] button.

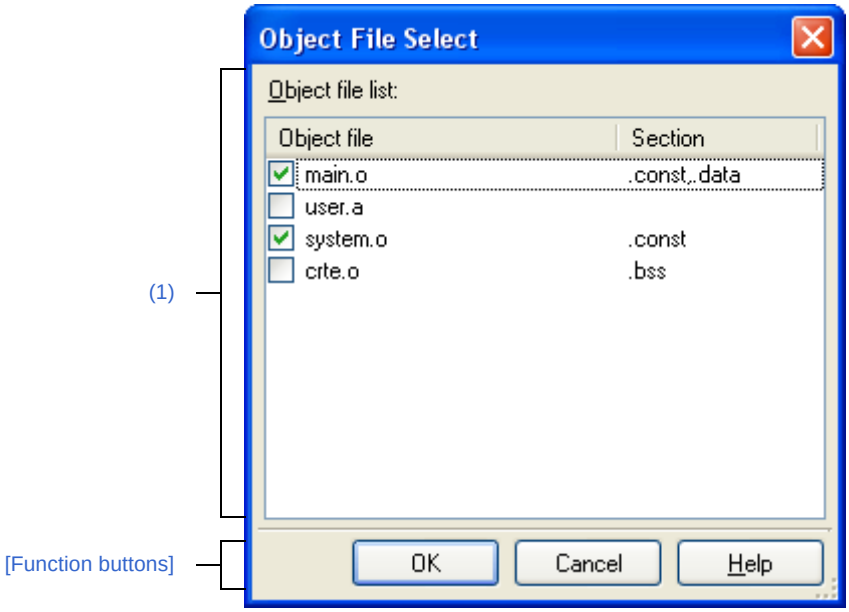
[Function buttons]

Button	Function
Symbol	Toggles the [Symbol list] area and [Symbol detail] area between visible and hidden.
Generate	Generates a link directive file (named *project-name*.dir) based on the specified memory, segments, sections, and symbol allocation information, and then adds to the project. The link directive file is generated in the project folder. The link directive file that has been generated is also shown on the project tree, under the File node. The generated link directive file will be a build target. If a link directive file has already been registered to the project, then the file will be removed from the build target.
Close	Closes the dialog box.
Help	Displays the help of this dialog box.

Object File Select dialog box

This dialog box is used to select the object file to set in the caller of the dialog box from among object files and library files added to the project.

Figure A-37. Object File Select Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- In the Link Directive File Generation dialog box, select a section in the [Segment / Section list] area, and then click the [...] button on [Object file name] in the [Segment / Section detail] area.

[Description of each area]

(1) [Object file list] area

Display a list of object files and library files added to the project that opened the Link Directive File Generation dialog box, and the sections that specify them in the Link Directive File Generation dialog box.

(a) [Object File]

Display the following file name list.

Select files to set to [Object file name] in the [Segment / Section detail] area in the Link Directive File Generation dialog box that opened this dialog box, via check boxes.

- The object module files generated from the source files added to the project
- The object module files added directly to the project tree
- The library files added directly to the project tree

Remarks 1. Move the mouse cursor over a file name to display a tooltip with the absolute path of that file.

2. In the Link Directive File Generation dialog box that opened this dialog box, in the [Segment / Section detail] area, if an object file is already set in [Object file name], the check box for that object file will be selected by default.

(b) [Section]

Display the section that specifies the corresponding object file in the Link Directive File Generation dialog box.
If an object file is specified from multiple sections, they are displayed separated by commas.
If the section that specifies the object file does not exist, this field is blank.

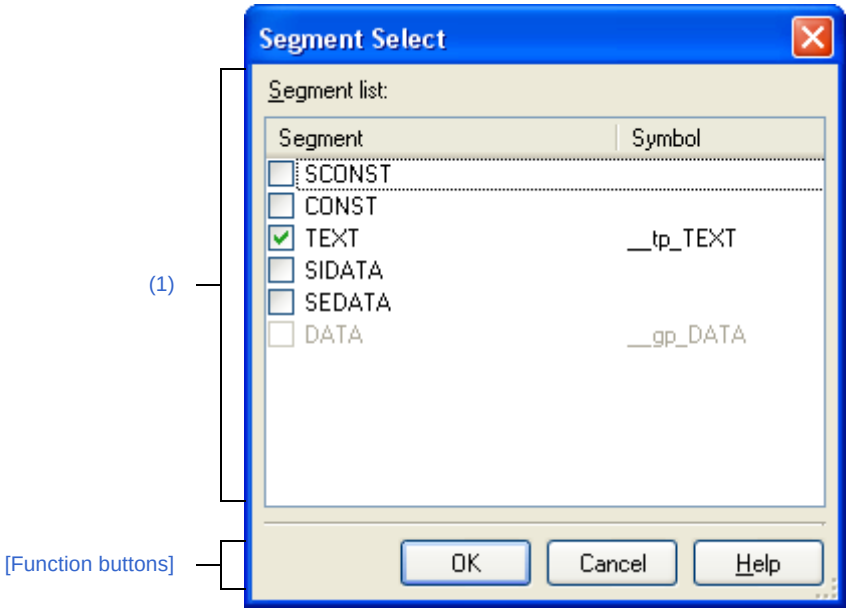
[Function buttons]

Button	Function
OK	Closes this dialog box and sets the selected file to [Object file name] in the [Segment / Section detail] area in the Link Directive File Generation dialog box.
Cancel	Cancels the file selecting and closes the dialog box.
Help	Displays the help of this dialog box.

Segment Select dialog box

This dialog box is used to select the segment to set in the caller of the dialog box from the segments currently set in the Link Directive File Generation dialog box.

Figure A-38. Segment Select Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- In the Link Directive File Generation dialog box, select a symbol in the [Symbol list] area, and then click the [...] button on [Segment name] in the [Symbol detail] area.

[Description of each area]

(1) [Segment list] area

Display the list of currently set segments in the Link Directive File Generation dialog box and symbols that specify them.

(a) [Segment]

Display a list of segment names currently set in the Link Directive File Generation dialog box.
Select segments to set to [Segment name] in the [Symbol detail] area in the Link Directive File Generation dialog box that opened this dialog box, via check boxes.

Remarks 1. Move the mouse cursor over a file name to display a tooltip with the absolute path of that file.

2. In the Link Directive File Generation dialog box that opened this dialog box, in the [Symbol detail] area, if a segment is already set in [Segment name], the check box for that segment will be selected by default.

3. The check box for the segment that specifies a symbol other than the one that opened this dialog box will be disabled.

(b) [Symbol]

Specify the symbol specifying the displayed segment.

If the symbol that specifies the segment does not exist, this field is blank.

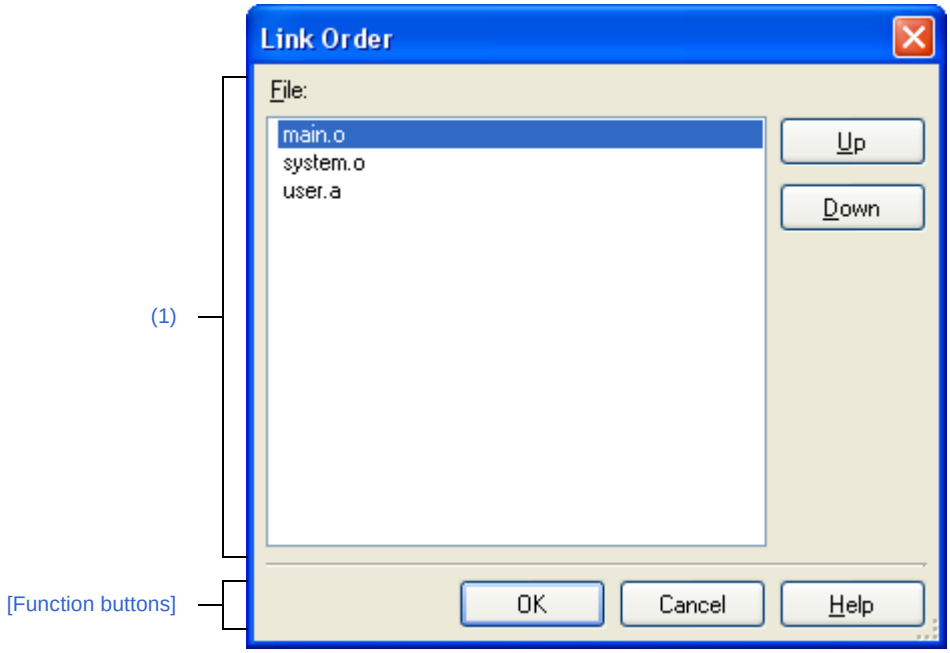
[Function buttons]

Button	Function
OK	Closes this dialog box and sets the selected segment to [Segment name] in the [Symbol detail] area in the Link Directive File Generation dialog box.
Cancel	Cancels the file selecting and closes the dialog box.
Help	Displays the help of this dialog box.

Link Order dialog box

This dialog box is used to display object module files and library files to input to the linker and configure these link order.

Figure A-39. Link Order Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- On the Project Tree panel, select the Build tool node, and then select [Set Link Order...] from the context menu.

[Description of each area]

(1) File list display area

Show the file list to input to linker.

(a) [File]

Display the following file name lists in input order to linker.

- Object module files that are generated from the source file registered in the selected main project or sub-project.
- Object module files that are directly added to the project tree in the selected main project or subproject.
- Library files that are directly added to the project tree in the selected main project or subproject.

By default, input order to linkers is the order registered in the project.
You can change the input order by changing the display order of files.
Use [Up] or [Down] buttons, or drag and drop the file name to change the display order.

Remarks 1. When the mouse cursor is hovered over a file name, the path of the file appears in a popup. If the file is on the same drive as the project file, then it appears as the relative path; if it is on the different drive, then it appears as the absolute path.

2. The object module file that is generated from the newly added source file and newly added object module file are added to the end of the module file list. The newly added library file is added to the end of the list.

3. When the file is dragged and dropped, the multiple files that are next to each other can be selected together.

(b) Button

Up	Moves the selected file to up.
Down	Moves the selected file to down.

Remark Note that above buttons are disabled when any file is not selected.

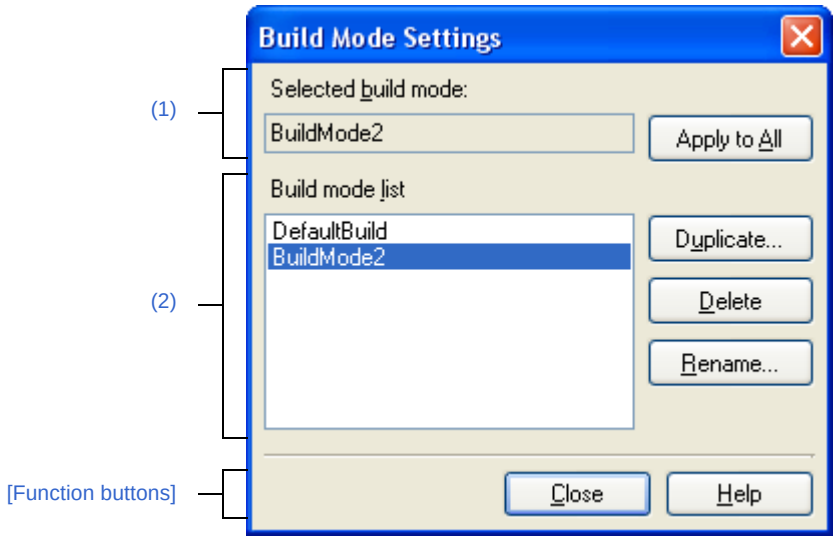
[Function buttons]

Button	Function
OK	Sets the file input order to linker as the display order of the File list display area and closes this dialog box.
Cancel	Cancels the link order settings and closes this dialog box.
Help	Displays the help of this dialog box.

Build Mode Settings dialog box

This dialog box is used to add and delete build modes and configure the current build mode in batch.

Figure A-40. Build Mode Settings Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- From the [Build] menu, select [Build Mode Settings...].

[Description of each area]

(1) [Selected build mode] area

Show the build mode selected in the [Build mode list] area.

(a) Button

Apply to All	Sets the build mode of the main project and all subprojects of the currently opened project to the currently displayed build mode.

(2) [Build mode list] area

Show all the build modes that exist in the currently opening project (main project and subproject) in a list.
Current build mode in the selected project is selected by default.
The current build modes of all projects are same, the build mode is selected by default. If they are not same, "DefaultBuild" will be selected.
Note that the "DefaultBuild" is the default build mode and is always shown at the top.

(a) Button

Duplicate...	Duplicates the selected build mode. The Character String Input dialog box opens and the build mode is duplicated with the name entered and added to the main project and all the subprojects in the currently opening project. When the build mode with "*" mark does not exist in the main project or subproject and duplicate the build mode, DefaultBuild is duplicated. Up to 20 build modes can be added.
Delete	Deletes the selected build mode. Note that DefaultBuild cannot be deleted.
Rename...	Renames the selected build mode. Rename the build mode with entered name in the opening the Character String Input dialog box.

Caution When duplicating or renaming the build mode, the existing build mode name cannot be used.

Remarks 1. Up to 127 characters can be used as a build mode name. When the input violates any restriction, the following messages are shown in the tooltip.

Message	Description
A build mode with the same name already exists.	The entered build mode name already exists.
More than 127 characters cannot be specified.	Build mode name is too long (more than 128 characters).
The build mode name is invalid. The following characters cannot be used: \, /, :, *, ?, ", <, >, |	Invalid build mode name is entered. The characters, (\, /, :, *, ?, ", <, >, |) cannot be used as the name is used for the folder name.

2. Up to 20 build modes can be added. When the input violates any restriction, the following messages are shown in the tooltip.

Message	Description
The maximum number of build modes that can be set per project/subproject is 20.	The number of build modes exceed 20.

[Function buttons]

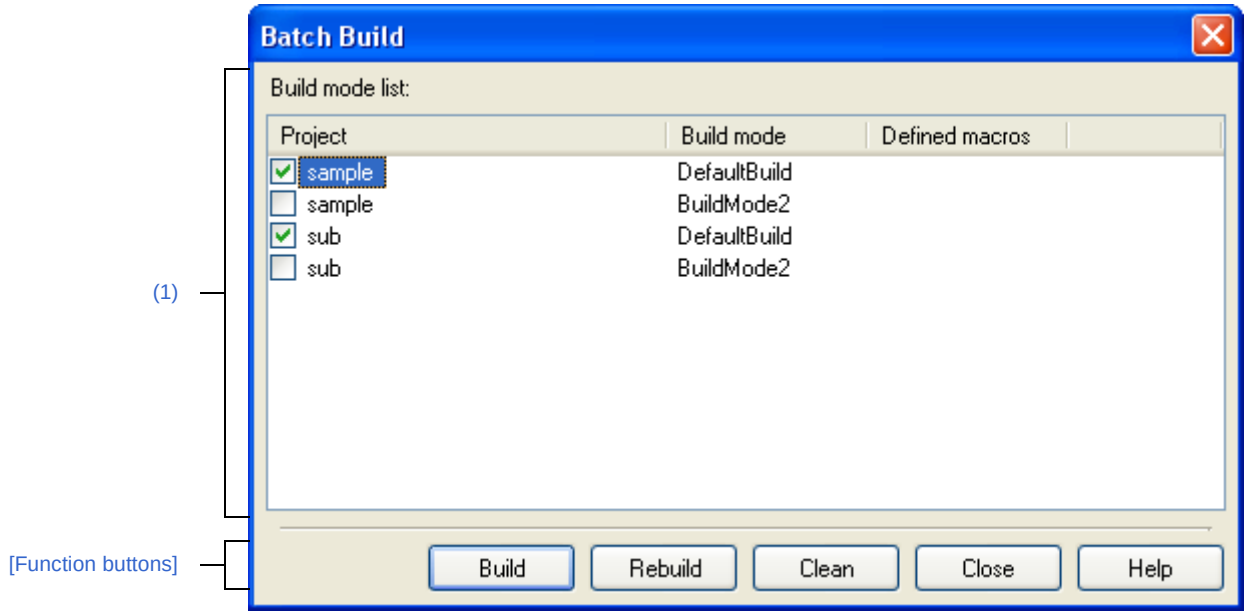
Button	Function
Close	Closes this dialog box.
Help	Displays the help of this dialog box.

Batch Build dialog box

This dialog box is used to do build, rebuild and clean process in batch with the build mode that each project (main project and subproject) has.

Remark Order of the batch build follows the build order of the project which the subproject comes before the main project.
When more than one build mode is selected for a main project or a subproject, all the selected build modes are built and then the next subproject or main project is built.

Figure A-41. Batch Build Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- From the [Build] menu, select [Batch Build...].

[Description of each area]

(1) [Build mode list] area

Show the combination list of the names of the main project and the subproject which the currently opening project has and build modes and defined macros which they have.

(a) [Project]

Show the main project and the subproject which the currently opening project has.
Select the combination of the main project and subproject to build and the build modes.
When this dialog box is opened for the first time after the project is created, all the check boxes are unchecked. From the second time, the previous setting is retained.

(b) [Build mode]

Show build modes which the main project and subproject have.

(c) [Defined macros]

Show defined macros separated with "|", configured for the combination of the main project and the subproject and their build modes in the [Compile Options] tab and the [Assemble Options] tab in the Property panel.
Note that the defined macro in Compile Option comes before the one in Assemble Option and they are separated with ", ".

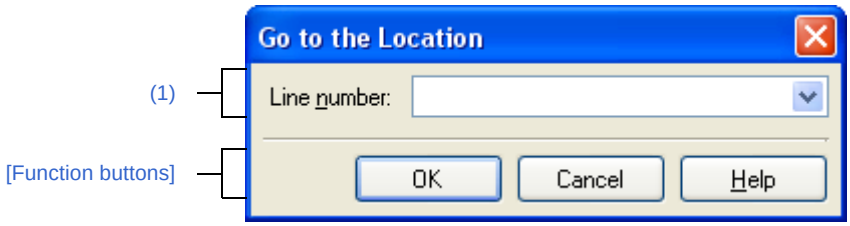
[Function buttons]

Button	Function
Build	Closes this dialog box and executes a batch build of the selected projects in the respective build modes. The execution result of the build are displayed on the Output panel. After the batch build is complete, the build mode configuration restores to the one before this dialog box was opened. Note that this buttons is disabled when any project is not selected.
Rebuild	Closes this dialog box and executes a batch rebuild of the selected projects in the respective build modes. The execution result of the rebuild are displayed on the Output panel. After the batch rebuild is complete, the build mode configuration restores to the one before this dialog box was opened. Note that this buttons is disabled when any project is not selected.
Clean	Closes this dialog box and deletes the files built in the respective build modes set for the selected projects. The execution result of the clean are displayed on the Output panel. After the clean is complete, the build mode configuration restores to the one before this dialog was opened. Note that this buttons is disabled when any project is not selected.
Close	Closes this dialog box.
Help	Displays the help of this dialog box.

Go to the Location dialog box

This dialog box is used to move the caret to the designated location.

Figure A-42. Go to the Location Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- From the [Edit] menu, select [Go To...].

[Description of each area]

(1) [Line number] area

Specify the line number (decimal number) or symbol name of the location to which the caret is moved.
You can directly enter the characters into the text box or select from the input history in the drop down list (maximum numbers of the history: 10).

[Function buttons]

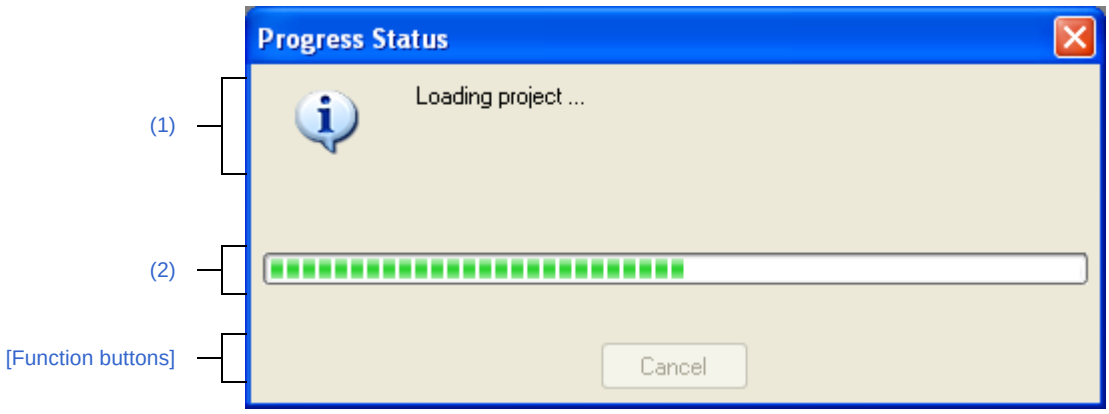
Button	Function
OK	Displays the designated location at the top of the target panel display and moves the caret there. Note that this button is enabled when the project that the opened file is registered is the active project and other than library project.
Cancel	Cancels the criteria and closes this dialog box.
Help	Displays the help of this dialog box.

Progress Status dialog box

This dialog box is used to show how the process has been progressed when the time consuming process is taken place.

This dialog box automatically closes when the process in progress is done.

Figure A-43. Progress Status Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- This dialog box automatically opens when a message is output while the time consuming process is in progress.

[Description of each area]

(1) Message display area

Display the message output while process is in progress (edit not allowed).

(2) Progress bar

The progress bar shows the current progress of the process in progress with the bar length.

When the process is 100% done (the bar gets to the right end), this dialog box automatically closed.

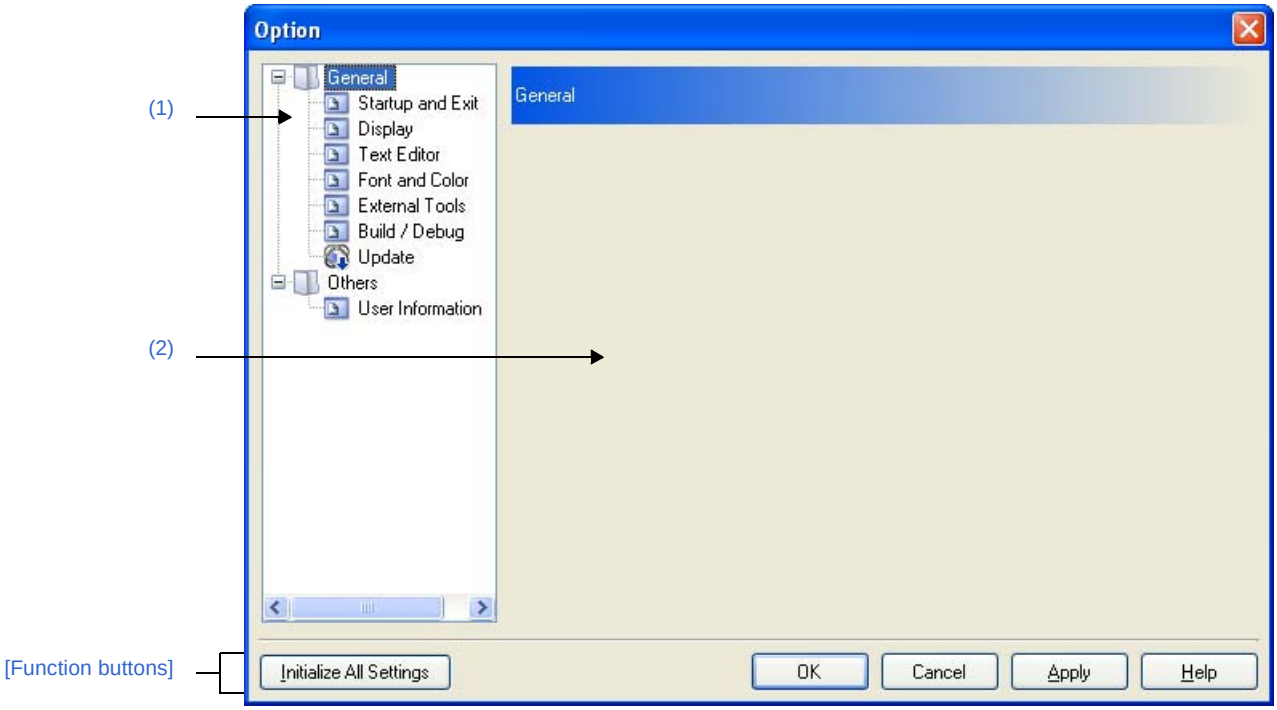
[Function buttons]

Button	Function
Cancel	Cancels the process in progress and closes this dialog box. Note that if the process termination is impossible, this button is disabled.

Option dialog box

This dialog box is used to configure the CubeSuite+ environment.
All settings made via this dialog box are saved as preferences for the current user.

Figure A-44. Option Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- From the [Tool] menu, select [Options...].

[Description of each area]

(1) Category selection area

Select the items to configure from the following categories.

Category	Description
[General - Startup and Exit] category	Configure startup and shutdown.
[General - Display] category	Configure messages from the application.
[General - Text Editor] category	Configure the text editor.
[General - Font and Color] category	Configure the fonts and colors shown on each panel.
[General - External Tools] category	Configure the startup of external tools.
[General - Build/Debug] category	Configure building and debugging.

Category	Description
[General - Update] category	Configure update.
[Other - User Information] category	Configure user information.

Remark See "CubeSuite+ Start" for details about categories other than [General - Build/Debug].

(2) Settings

This area is used to configure the various options for the selected category.

For details about configuration for a particular category, see the section for the category in question.

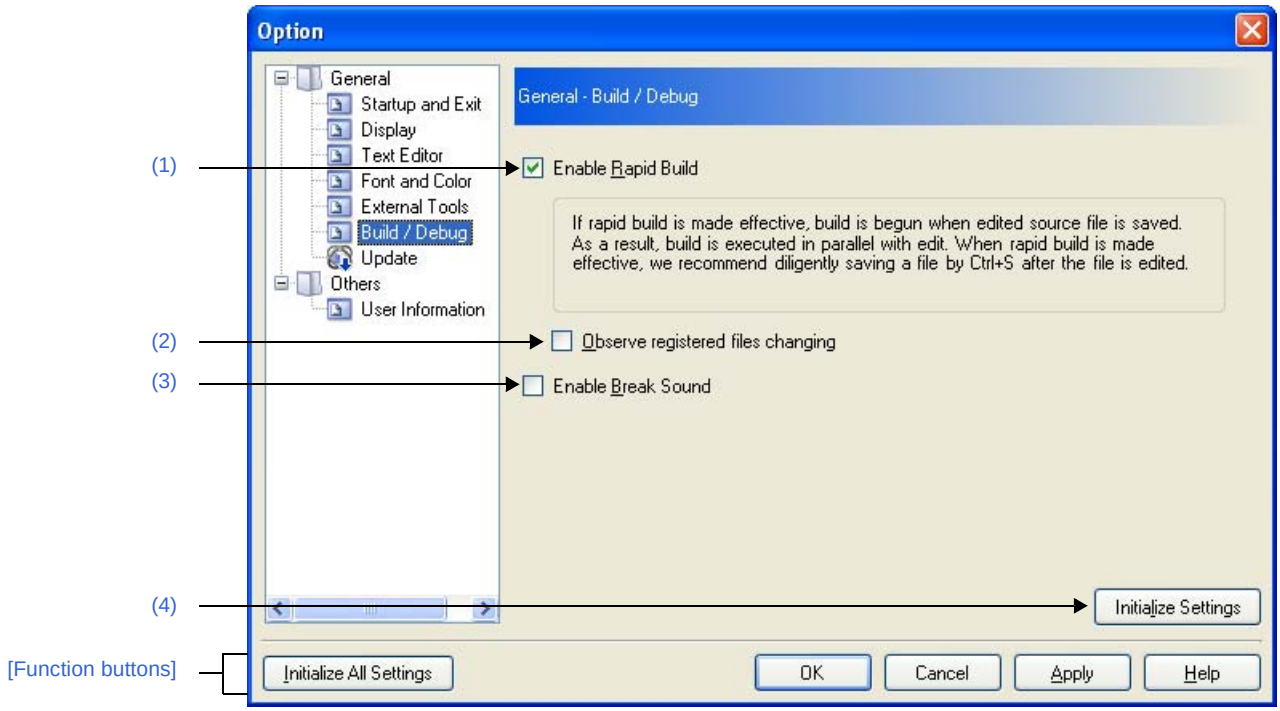
[Function buttons]

Button	Function
Initialize All Settings	Restore all settings on this dialog box to their default values. Note, however, that newly added items in the [General - External Tools] category will not be removed.
OK	Apply all setting and closes this dialog box.
Cancel	Ignore the setting and closes this dialog box.
Apply	Applied all setting (does not close this dialog box).
Help	Display the help of this dialog box.

[General - Build/Debug] category

Use this category to configure general setting relating to building and debugging.

Figure A-45. Option Dialog Box ([General - Build/Debug] Category)



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- From the [Tool] menu, select [Options...].

[Description of each area]

(1) [Enable Rapid Build]

☑	Enable the rapid build Note feature (default).
☐	Do not use the rapid build feature.

Note This feature automatically begins a build when the source file being edited is saved.
Enabling this feature makes it possible to perform builds while editing source files.
If this feature is used, we recommend saving frequently after editing source files.

(2) [Observe registered files changing]

This item is only enabled if the [Enable Rapid Build] check box is selected.

☑	Start a rapid build when a source file registered in the project is edited or saved by an external text editor or the like.
☐	Do not start a rapid build when a source file registered in the project is edited or saved by an external text editor or the like (default).

Remark This item is only enabled if the [Enable Rapid Build] check box is selected.

Cautions 1. The rapid build will not finish if this item is selected, and the files to be built have been registered for automatic editing or overwriting (e.g. by commands executed before or after the build).
If the rapid build does not finish, unselect this item, and stop the rapid build.

2. If this item is selected, a file that is registered in the project but does not exist (a file grayed out) will not be observed even if it is registered again by the Explorer etc.
To observe the file, reload the project file, or select this item again after unselecting this item and closing this dialog box.

(3) [Enable Break Sound]

☑	Beep when the execution of a user program is halted due to a break event (hardware or software break).
☐	Do not beep when the execution of a user program is halted due to a break event (hardware or software break) (default).

(4) Buttons

Initialize Settings	Return all currently displayed setting to their default values.

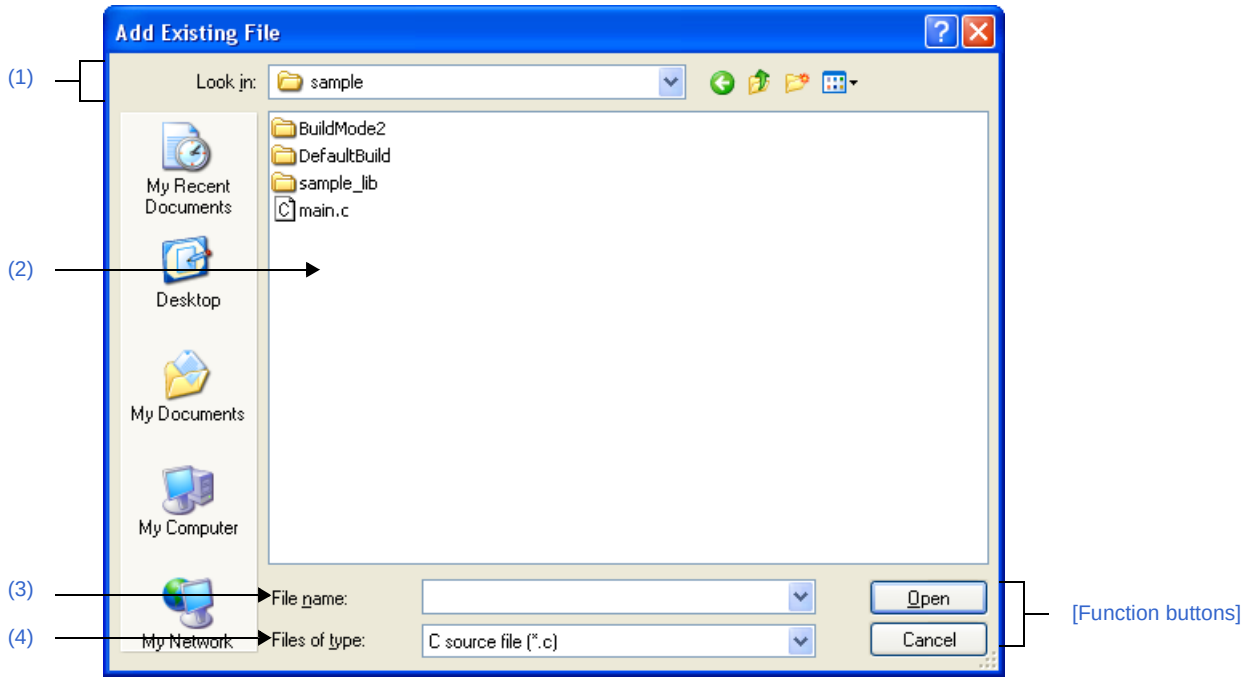
[Function buttons]

Button	Function
Initialize All Settings	Restore all settings on this dialog box to their default values. Note, however, that newly added items in the [General - External Tools] category will not be removed.
OK	Apply all setting and closes this dialog box.
Cancel	Ignore the setting and closes this dialog box.
Apply	Apply all setting (does not close this dialog box).
Help	Display the help of this dialog box.

Add Existing File dialog box

This dialog box is used to select existing files to add to projects.

Figure A-46. Add Existing File Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- From the [File] menu, select [Add] >> [Add File...].
- On the Project Tree panel, select either one of the Project node, Subproject node, File node, or file, and then select [Add] >> [Add File...] from the context menu.

[Description of each area]

(1) [Look in] area

Select the folder that the file to add to projects exists.
The project folder is selected by default.

(2) File list area

File list that matches to the selections in [Look in] and [Files of type] is shown.

(3) [File name] area

Designate the file name of the file to add to projects.

(4) [Files of type] area

Designate the file type of the file to add to projects.

C source file(*.c)	C language source file
Header file(*.h; *.inc)	Header file
Assemble file(*.s)	Assembly language source file
Link directive file(*.dir; *.dr)	Link directive file
Section file (*.sf)	Section file
Archive file(*.a)	Archive file
Object file(*.o)	Object file
Text file(*.txt)	Text format
All Files(*.*)	All the format (default)

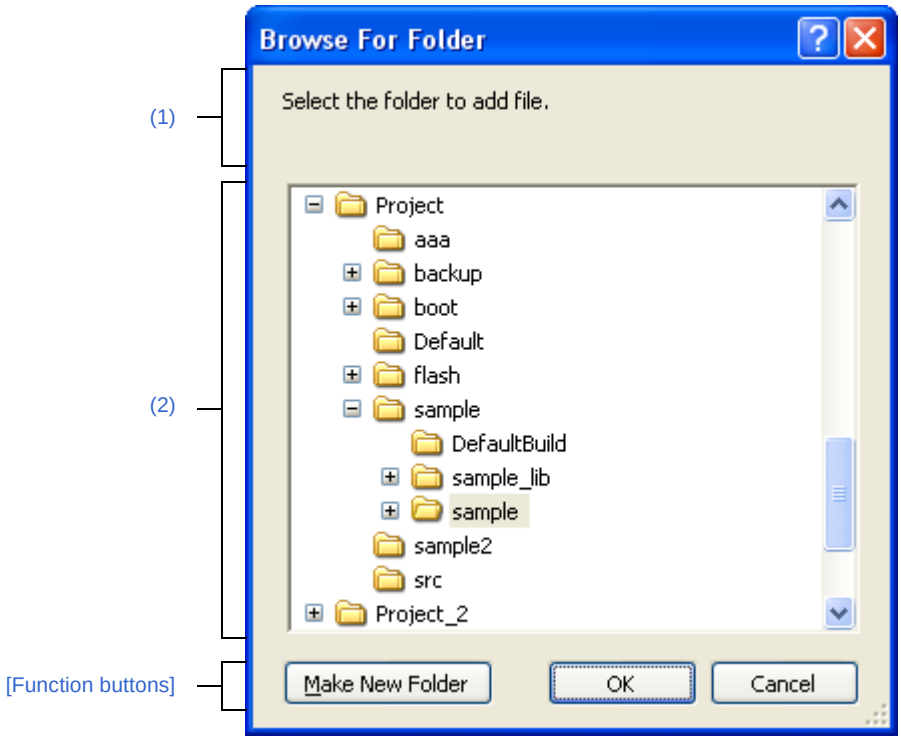
[Function buttons]

Button	Function
Open	Adds the designated file to a project.
Cancel	Closes this dialog box.

Browse For Folder dialog box

This dialog box is used to select a folder and retrieve it for the caller.

Figure A-47. Browse For Folder dialog box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- In the Add File dialog box, click the [...] button in the [File location] area.
- In Path Edit dialog box, click [...] button in the path edit area.
- On the Property panel, select the following properties, and then click the [...] button.
  - From the [Common Options] tab, [Intermediate file output folder] in the [Output File Type and Path] category, [Output folder] in the[Frequently Used Options(for Compile)] category, [Output folder for ROMized object file] in the [Frequently Used Options(for ROMization)] category, [Output folder for hex file] in the [Frequently Used Options(for Hex Convert)] category, [Output folder for section file] in the [Frequently Used Options(for Section File Generate)] category, and [Temporary folder] in the [Others] category.
  - From the [Compile Options] tab, [Output folder for assembly file], [Output folder for assemble list], and [Output folder for frequency information file] in the [Output File] category.
  - From the [Assemble Options] tab, [Output folder for assemble list file] in the [Assemble List] category.
  - From the [Link Options] tab, [Output folder] in the [Output File] category, [Output folder for link map file] in the [Link Map] category.
  - From the [ROMization Process Options] tab, [Output folder for ROMized object file] in the [Output File] category, [Output folder for ROMization section file] in the [Section List] category, [Output folder for memory map file] in the [Memory Map] category.

- From the [Hex Convert Options] tab, [Output folder for hex file] in the [Output File] category.
- From the [Archive Options] tab, [Output folder] in the [Output File] category.
- From the [Section File Generate Options] tab, [Output folder for section file] in the [Output File] category.
- From the [Individual Compile Options] tab, [Output folder for assembly file], [Output folder for assemble list], and [Output folder for frequency information file] in the [Output File] category.
- From the [Individual Assemble Options] tab, [Output folder for assemble list file] in the [Assemble List] category.

[Description of each area]

(1) Message area

Show messages related to folders selected in this dialog box.

(2) Folder location area

Select a folder to set in the caller of the dialog box.
By default, the folder set in the caller is selected.

Remark When the area is blank or the path which does not exist is entered, "C:\Documents and Settings*user name*\My Documents" is selected instead.

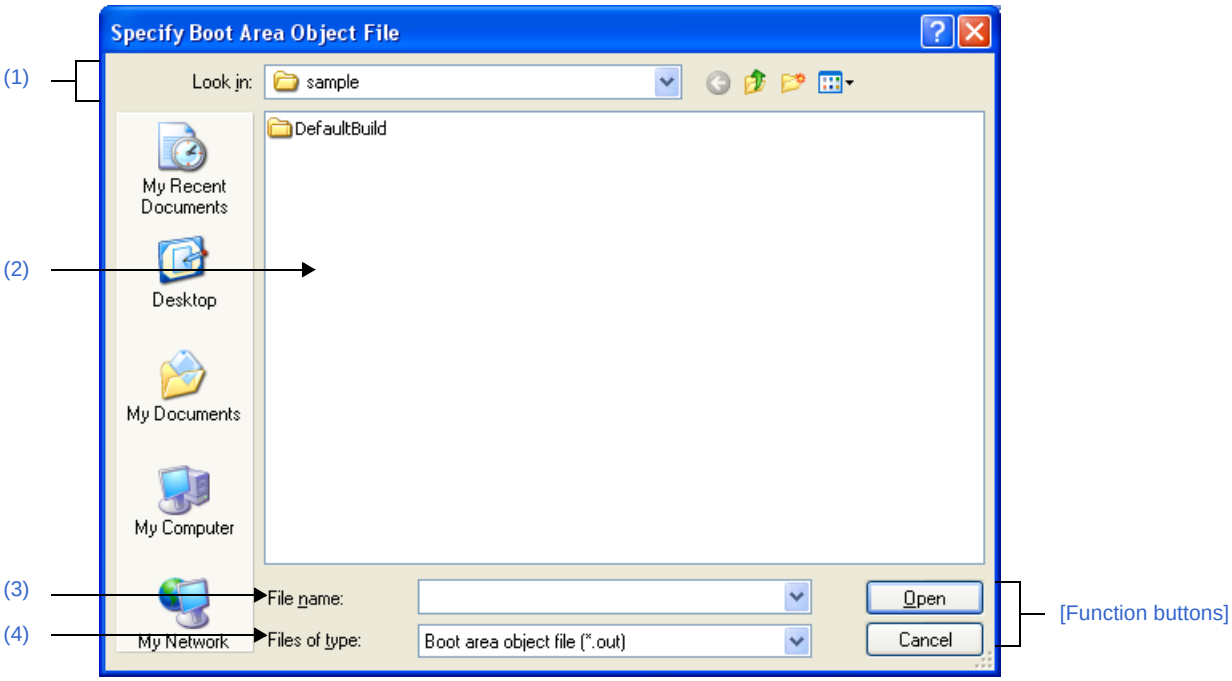
[Function buttons]

Button	Function
Make New Folder	Creates a new folder in the root of the selected folder. The default folder name is "New Folder".
OK	The designated folder path is set to the area that this dialog box is called from.
Cancel	Closes this dialog box.

Specify Boot Area Object File dialog box

This dialog box is used to select the boot area object file to set in the caller of the dialog box.

Figure A-48. Specify Boot Area Object File Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- On the Property panel, select the following properties, and then click the [...] button.
  - From the [Common Options] tab, [Boot area object file name] in the [Flash] category.

[Description of each area]

(1) [Look in] area

Select the folder where the file to be set in the caller of this dialog box exists.

The project folder is selected by default.

(2) File list area

File list that matches to the selections in [Look in] and [Files of type] is shown.

(3) [File name] area

Specify the file name to set in the caller of the dialog box.

(4) [Files of type] area

Specify the file type to set in the caller of the dialog box.

Boot area object file(*.out)	Boot area object file (default)
All Files(*.*)	All the format

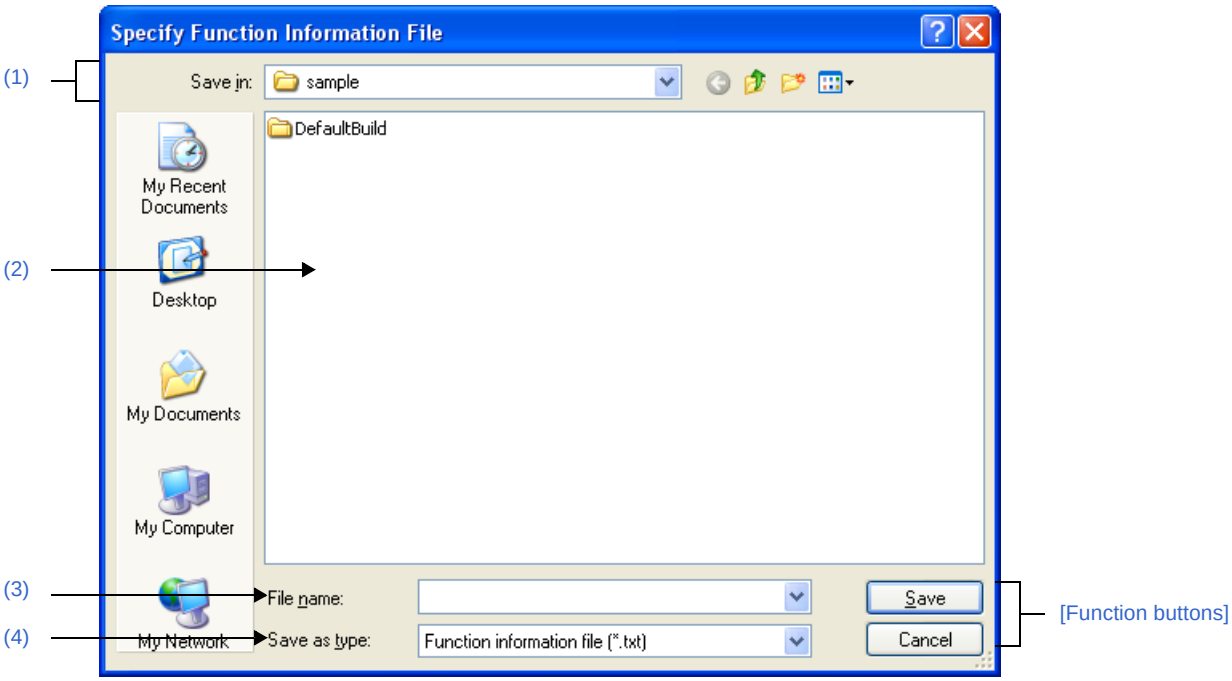
[Function buttons]

Button	Function
Open	The designated file is set to the area that this dialog box is called from.
Cancel	Closes this dialog box.

Specify Function Information File dialog box

This dialog box is used to select the function information file to set in the caller of the dialog box.

Figure A-49. Specify Function Information File Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- On the Property panel, select the following properties, and then click the [...] button.
  - From the [Compile Options] tab, [Function information file name] in the [Optimization(Details)] category.
  - From the [Individual Compile Options] tab, [Function information file name] in the [Optimization(Details)] category.

[Description of each area]

(1) [Save in] area

Select the folder where the file to be set in the caller of this dialog box exists.
The project folder is selected by default.

(2) File list area

File list that matches to the selections in [Save in] and [Save as type] is shown.

(3) [File name] area

Specify the file name to set in the caller of the dialog box.

(4) [Save as type] area

Specify the file type to set in the caller of the dialog box.

Function information file(*.txt)	Function information file (default)
All Files(*.*)	All the format

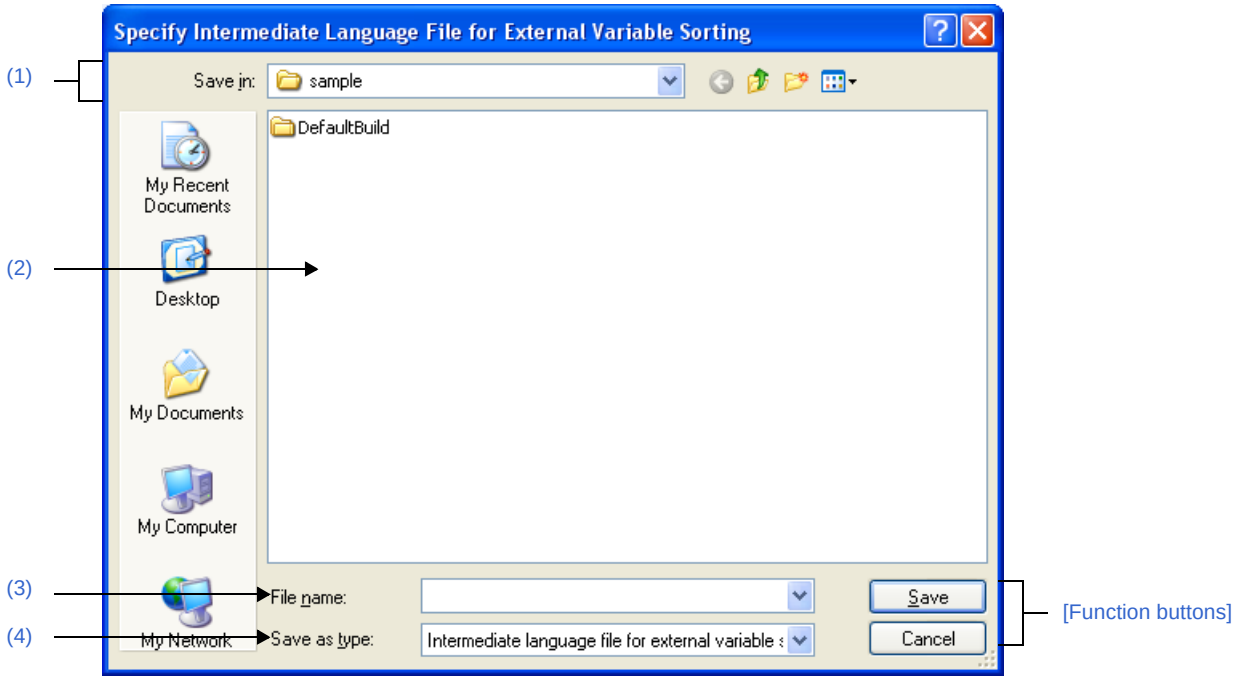
[Function buttons]

Button	Function
Save	The designated file is set to the area that this dialog box is called from.
Cancel	Closes this dialog box.

Specify Intermediate Language File for External Variable Sorting dialog box

This dialog box is used to select the intermediate language file for external variable sorting to set in the caller of the dialog box.

Figure A-50. Specify Intermediate Language File for External Variable Sorting Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- On the Property panel, select the following properties, and then click the [...] button.
  - From the [Compile Options] tab, [Intermediate language file name for external variable sorting] in the [Optimization(Details)] category.

[Description of each area]

(1) [Save in] area

Select the folder where the file to be set in the caller of this dialog box exists.
The project folder is selected by default.

(2) File list area

File list that matches to the selections in [Save in] and [Save as type] is shown.

(3) [File name] area

Specify the file name to set in the caller of the dialog box.

(4) [Save as type] area

Specify the file type to set in the caller of the dialog box.

Intermediate language file for external variable sorting(*.ic)	Intermediate language file for external variable sorting

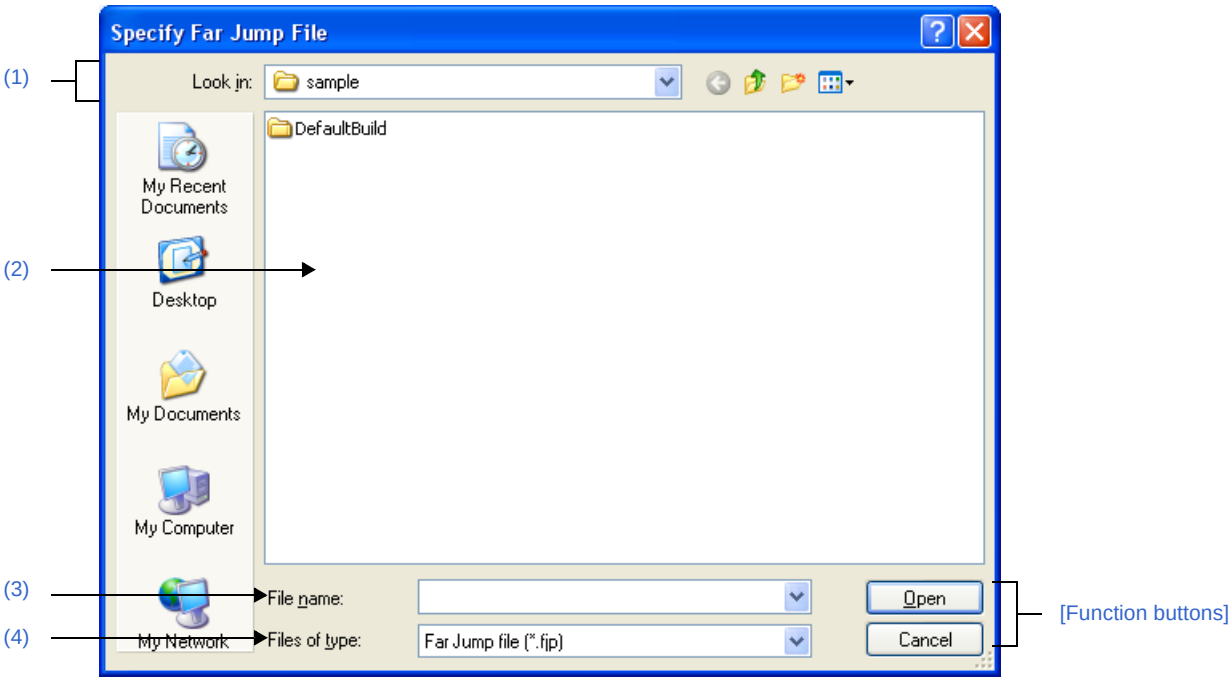
[Function buttons]

Button	Function
Save	The designated file is set to the area that this dialog box is called from.
Cancel	Closes this dialog box.

Specify Far Jump File dialog box

This dialog box is used to select the Far Jump file to set in the caller of the dialog box.

Figure A-51. Specify Far Jump File Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- On the Property panel, from the [Compile Options] tab, in the [Input File] category, after selecting the [Far Jump file name] property, open the Path Edit dialog box by clicking the [...] button.
  And then click the [...] button in the dialog box.

[Description of each area]

(1) [Look in] area

Select the folder where the file to be set in the caller of this dialog box exists.
The project folder is selected by default.

(2) File list area

File list that matches to the selections in [Look in] and [Files of type] is shown.

(3) [File name] area

Specify the file name to set in the caller of the dialog box.

(4) [Files of type] area

Specify the file type to set in the caller of the dialog box.

Far Jump file(*.fjp)	Far Jump file

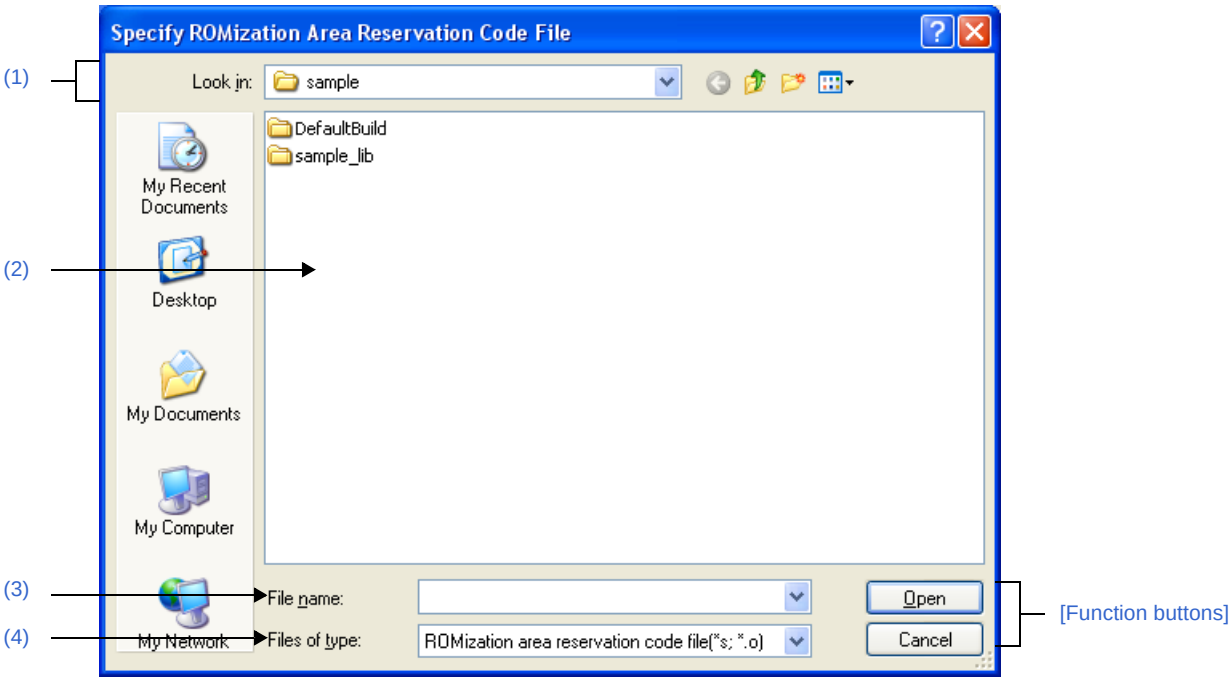
[Function buttons]

Button	Function
Open	The designated file is set to the area that this dialog box is called from.
Cancel	Closes this dialog box.

Specify ROMization Area Reservation Code File dialog box

This dialog box is used to select the ROMization area reservation code file to set in the caller of the dialog box.

Figure A-52. Specify ROMization Area Reservation Code File Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- On the Property panel, select the following properties, and then click the [...] button.
- From the [ROMization Process Options] tab, [ROMization area reservation code file name] in the [Input File] category.

[Description of each area]

(1) [Look in] area

Select the folder where the file to be set in the caller of this dialog box exists.
The project folder is selected by default.

(2) File list area

File list that matches to the selections in the [Look in] area and [File of type] area is shown.

(3) [File name] area

Specify the file name to set in the caller of the dialog box.

(4) [Files of type] area

Specify the file type to set in the caller of the dialog box.

ROMization area reservation code file(*s; *.o)	ROMization area reservation code file name (default)

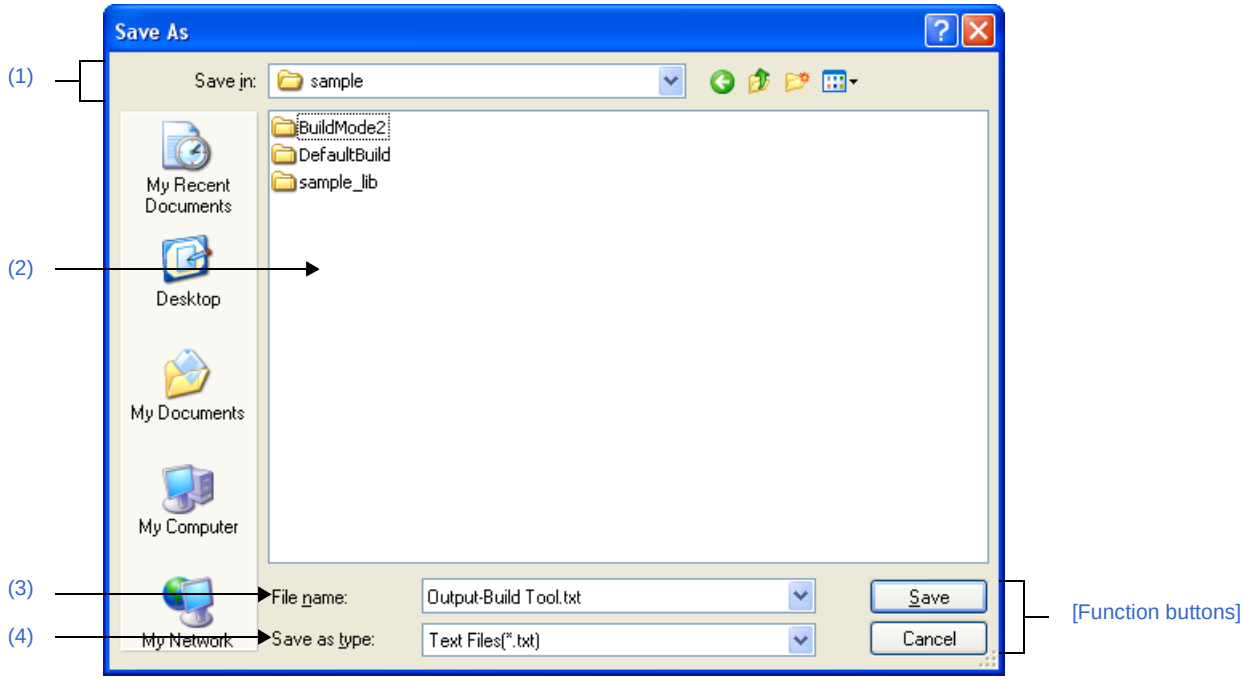
[Function buttons]

Button	Function
Open	Sets the specified file in the caller of the dialog box.
Cancel	Closes the dialog box.

Save As dialog box

This dialog box is used to save the editing file or contents of each panel to a file with a name.

Figure A-53. Save As Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- Focus the Editor panel, and then select [Save *file name* As...] from the [File] menu.
- Focus the Output panel, and then select [Save *tab name* As...] from the [File] menu.

[Description of each area]

(1) [Save in] area

Select the folder to save the panel contents in the file.

The following folders are selected by default.

(a) In the Editor panel

The folder that currently editing file is saved.

(b) In the Output panel

The project folder is selected when the file is save for the first time. The previously selected file is selected after the second time.

(2) File list area

File list that matches the selections in the [Save in] area and [Save as type] area is shown.

(3) [File name] area

Specify the file name to save.

(4) [Save as type] area

(a) In the Editor panel

The following file types are displayed depend on the file type of the currently editing file.

Text file(*.txt)	Text format
C source file(*.c)	C language source file
Header file(*.h; *.inc)	Header file
Assemble file(*.s)	Assembly language source file
Link directive file(*.dir; *.dr)	Link directive file
Section file (*.sf)	Section file
Map file(*.map)	Map file
Hex file (.hex)	Hex file

(b) In the Output panel

The following file types are displayed.

Text file(*.txt)	Text format

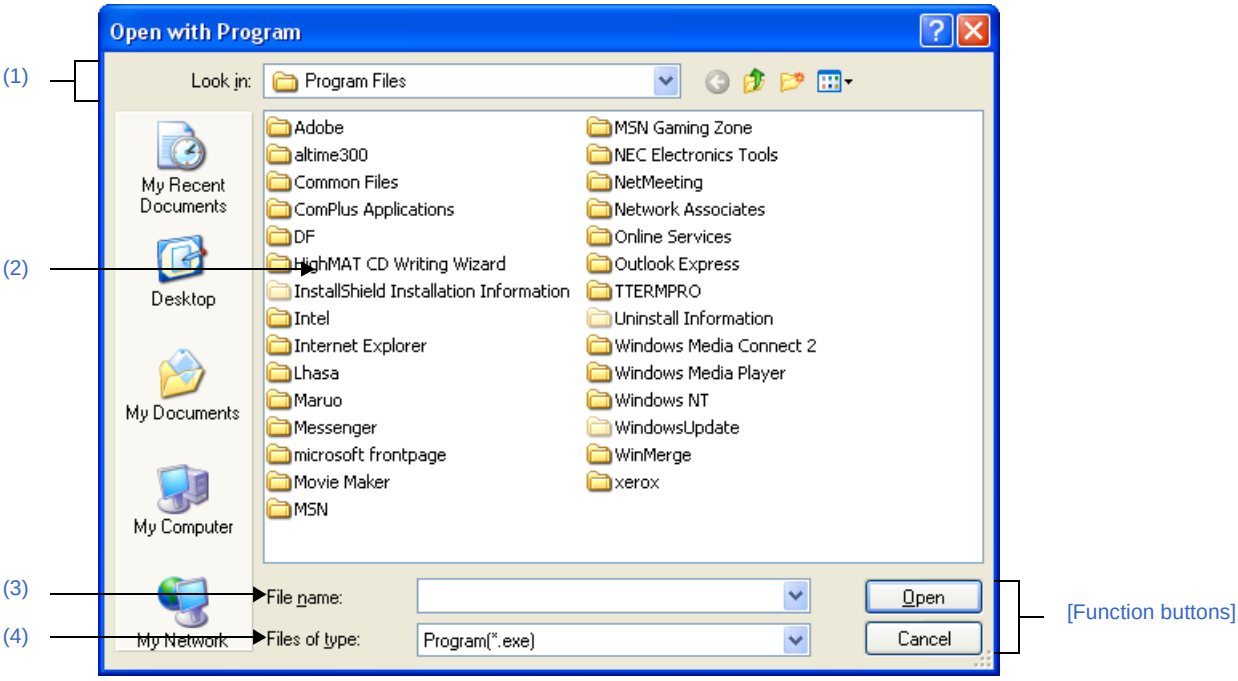
[Function buttons]

Button	Function
Save	Saves the file as the designated file name.
Cancel	Closes this dialog box.

Open with Program dialog box

This dialog box is used to select the application to open the file selected in Project Tree.

Figure A-54. Open with Program Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- On the Project Tree panel, select a file, and then select [Open with Selected Application...] from the context menu.

[Description of each area]

(1) [Look in] area

Select the folder where the application to open the file is stored.

Program folder (for Windows XP, "C:\Program Files") is selected by default.

(2) File list area

File list that matches to the selections in the [Look in] area and [File of type] area is shown.

(3) [File name] area

Specify the executable file name of the application to open the file.

(4) [Files of type] area

Specify the executable file type of the application to open the file.

Program(*.exe)	Executable format (default)
All Files (*.*)	All the formats

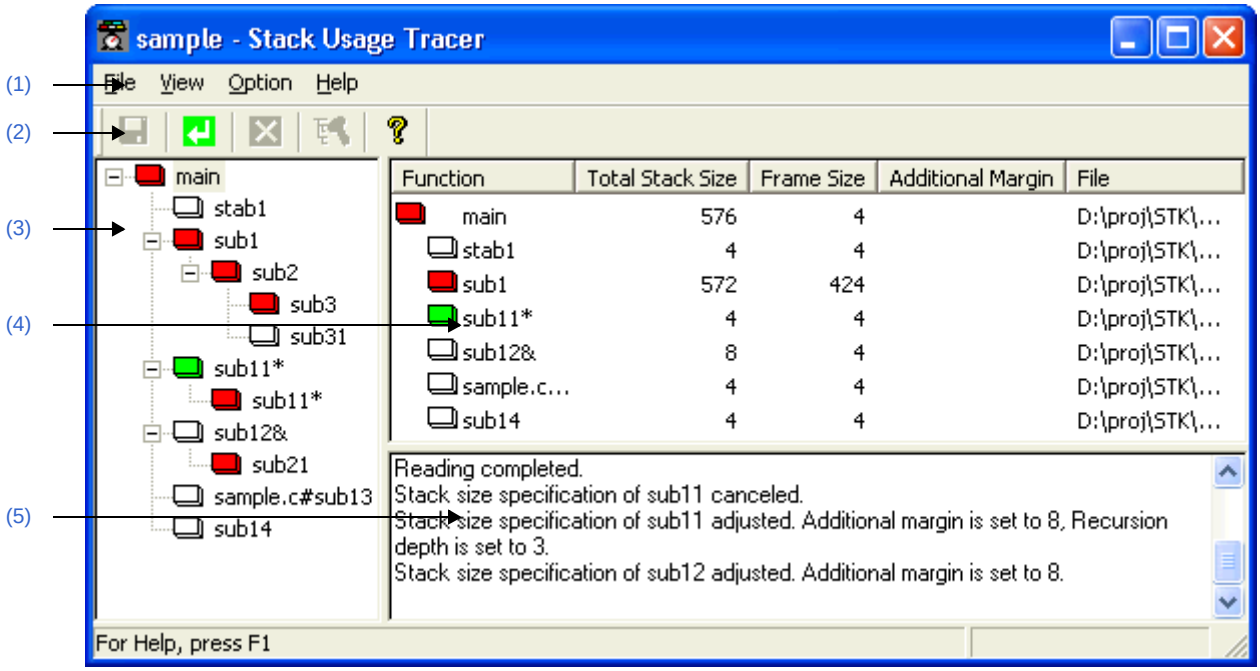
[Function buttons]

Button	Function
Open	Opens the file with the specified application.
Cancel	Closes this dialog box.

Stack Usage Tracer window

This is the first window to open when the stack usage tracer is launched.
Use this window to check or modify the amount of stack used on a per-function basis.

Figure A-55. Stack Usage Tracer Window



The following items are explained here.

- [How to open]
- [Description of each area]
- [Caution]

[How to open]

- From the [Tool] menu, select [Startup Stack Usage Tracer].

[Description of each area]

(1) Menu bar

This area consists of the following menu items.

(a) [File] menu

Save Call Chain with Maximum Stack from Selected Function...	Opens the Save As dialog box for saving the call chain with the greatest total stack size (including the stack size of callee functions) of the function selected in the tree display area / list display area to an output result file. Functions in the same manner as the button.
Save All Call Chains from Selected Function...	Opens the Save As dialog box for saving all call chains of the function selected in the tree display area / list display area to an output result file.
Save Call Chain with Maximum Stack from Every Root...	Opens the Save As dialog box for saving the call chain of the function displayed in the tree display area with the largest total stack size to an output result file.

Save All Call Chains from Every Root...	Opens the Save As dialog box for saving all call chains of all functions displayed in the tree display area to an output result file.
Load Stack Size Specification File...	Opens the Open dialog box for loading a stack size specification file.
Save Stack Size Specification File...	Opens the Save As dialog box for saving the results of the operations made in the Adjust Stack Size dialog box (e.g. changes to function information) to a stack size specification file.
Exit sk850	Closes this window.

Remark The output result file can only be saved in text format (*.txt) or CSV format (*.csv).

(b) [View] menu

Recalculate Stack Size	Recalculates the total stack size. Functions in the same manner as the  button.	
Stop	Forcibly stop the action of the stack usage tracer (e.g. recalculating the total stack size). Functions in the same manner as the  button.	
Sort List by	Changes the function display order in the list display area.	
	Function Name	Sort by function name.
	Icon Type	Sort by icon display priority (High:  to Low: ).
	Stack Size	Sort by total stack size.
	Frame Size	Sort by frame size.
	Additional Margin	Sort by additional margin.
	File Name	Sort by file name.

(c) [Option] menu

Stack Size Unknown / Adjusted Function Lists...	Opens the Stack Size Unknown / Adjusted Function Lists dialog box to display a list of functions with unknown frame size, functions for which information (additional margin, recursion depth, or callee functions) has been modified, and functions for which the stack usage tracer has forcibly set an additional margin.
Adjust Stack Size...	Opens the Adjust Stack Size dialog box to change the information (additional margin, recursion depth, and callee functions) for the function selected in the tree display area / list display area. This dialog box is used to change the information (additional margin, recursion depth, and callee functions) for the selected function. Functions in the same manner as the  button.
Reset Function	Resets the information (additional margin, recursion depth, and callee functions) for the selected function to the default values. This button will be grayed out if all the information for the selected function has the default values.
Reset All Functions	Resets the information (additional margin, recursion depth, and callee functions) for all functions to the default values. This button will be grayed out if all the information for all functions has the default values.

(d) [Help] menu

sk850 Help	Displays the help of this window. Functions in the same manner as the  button.
About sk850...	Opens the Version Information dialog box of the stack usage tracer.

(2) Toolbar

This area consists of the following buttons.

	Opens the Save As dialog box for saving the call chain with the greatest total stack size (including the stack size of callee functions) of the function selected in the tree display area / list display area to an output result file. Functions in the same manner as when [Save Call Chain with Maximum Stack from Selected Function...] is selected from the [File] menu.
	Recalculates the total stack size. Function in the same manner as when [Recalculate Stack Size] is selected from the [View] menu.
	Forcibly stop the action of the stack usage tracer (e.g. recalculating the total stack size). Functions in the same manner as when [Stop] is selected from the [View] menu.
	Opens the Adjust Stack Size dialog box to change the information (additional margin, recursion depth, and callee functions) for the function selected in the tree display area / list display area. Functions in the same manner as when [Adjust Stack Size...] is selected from the [Option] menu.
	Displays the help of this window. Functions in the same manner as when [sk850 Help] is selected from the [Help] menu.

(3) Tree display area

The calling relationship of the functions is shown in tree format.

The table below shows the meaning of the icon displayed to the left of the string representing the function name.

	The function directly called by a given function with the largest total stack size
	Information (additional margin, recursion depth, or callee functions) has been modified via the Adjust Stack Size dialog box or a stack size specification file
	Recursive function
	The stack usage tracer has not acquired any stack information for this function
	Other than the above

Remark The display priority for icons is from High:  to Low:  .

(a) Context menu

Select a function in this area, and then right click with the mouse. The context menu described below appears.

Adjust Stack Size...	Opens the Adjust Stack Size dialog box to change the information (additional margin, recursion depth, and callee functions) for the selected function.

(4) List display area

Display the stack information for a single function (function name, total stack size, frame size, additional margin, and file name) in list format.

Function	Displays the function name. Note that this area will only display functions from level 1 (the selected function) and level 2 (functions called directly by the selected function).
Total Stack Size	Displays the total stack size (including the stack size of callee functions; in bytes).
Frame Size	Displays the frame size (not including the stack size of callee functions; in bytes).
Additional Margin	Displays the value to mandatorily added to frame size (in bytes).
File	Displays the file name.

The table below shows the meaning of the icon displayed to the left of the string representing the function name.

	The function directly called by a given function with the largest total stack size
	Information (additional margin, recursion depth, or callee functions) has been modified via the Adjust Stack Size dialog box or a stack size specification file
	Recursive function
	The stack usage tracer has not acquired any stack information for this function
	Other than the above

(a) Context menu

Select a function in this area, and then right click with the mouse. The context menu described below appears.

Adjust Stack Size...	Opens the Adjust Stack Size dialog box to change the information (additional margin, recursion depth, and callee functions) for the selected function.	
Sort List by	Changes the function display order in the list display area.	
	Function Name	Sort by function name.
	Icon Type	Sort by icon display priority (High:  to Low: ).
	Stack Size	Sort by total stack size.
	Frame Size	Sort by frame size.
	Additional Margin	Sort by additional margin.
	File Name	Sort by file name.

(5) Message display area

Display operation logs of the stack usage tracer.

[Caution]

- Assembly files
  The stack usage tracer calculates total stack size by collecting information from the assembly files output by the C compiler as intermediate files, with debugging information added. As a consequence, in order to obtain stack information at the function level using the stack usage tracer, it is necessary to configure the compiler options to output "Assembly files with debugging information".

- Timing of static analysis
  The stack usage tracer performs static analysis upon startup, and displays the calling relationship between functions and function-level stack information in its main window. Consequently, changes to the calling relationship between functions or function-level stack information (e.g. adding files, changing compiler options, or modifying the source code) will not be reflected in this window.

- Functions analyzed
  The stack usage tracer only analyzes functions contained in assembly files with debugging information output by the C compiler as intermediate files, and in library files provided by the build tool. Consequently, functions in assembly files written by the user and library files created by the user are not analyzed. For this reason, the information for these files must be set using the Adjust Stack Size dialog box.

- Icon display colors
  Display priorities (High:  to Low: ) are assigned to icons displayed in the tree display area/list display area in the window. Consequently, you must be aware that even if the  icon (function called directly by same function with greatest total stack size) is displayed, information with relatively low priority, such as the  icon (frame size unknown) will be hidden by the GUI.

- Determining the maximum stack size
  When the stack usage tracer searches for the path with the largest stack size, it assumes that functions that are not analyzed have a stack size of zero. Consequently, when determining the maximum stack size, you must make sure that there are no functions under [Unknown Functions] in the Stack Size Unknown / Adjusted Function Lists dialog box.

- Tree display for recursive functions
  The window's tree display area only displays up to the second call of a recursive function. Consequently, the third and subsequent calls are hidden.

- Library functions bsearch, exit, and qsort
  The stack usage tracer treats bsearch, exit, and qsort as unknown functions, even if they are in a library file provided by the build tool. Consequently, if you are using these functions, you must set the relevant information (e.g. recursion depth and callee functions) in the Adjust Stack Size dialog box.

- Callee functions
  The stack usage tracer only allows the following types of "callee functions" to be added in the Adjust Stack Size dialog box: functions contained in C source files, and functions that are explicitly called (not called using a pointer). Consequently, the [All Functions] section of the Adjust Stack Size dialog box only displays functions meeting the above conditions.

- Functions called by multiple functions

  The stack usage tracer treats the stack information of functions called by multiple functions as unique. Consequently, it is not possible to change the stack information for such functions depending on which function is calling them.

  Example If you select function sub called by func1 in the tree display area and open the Adjust Stack Size dialog box, the changes are reflected in sub called by func2 as well.

```
int     sub ( int i );
void    func1 ( void );
void    func2 ( void );

void main ( void ) {
    func1 ( );
    func2 ( );
}
int sub ( int i ) {
    i++;
    return ( i );
}

void func1 ( void ) {
    int ret, i = 0;
    ret = sub ( i );
}

void func2 ( void ) {
    int ret, i = 100;
    ret = sub ( i );
}
```

- ASM statements in C source

  If C source contains ASM statements, the stack usage tracer may output the following message: "W9432 : Illegal format in file (path name : line number)". If this occurs, fix the problem by disabling the code in question using #if declarations or the like, or commenting it out.

- Calls to indirectly recursive functions

  If a recursion path consists of multiple functions, the stack size may be calculated incorrectly.

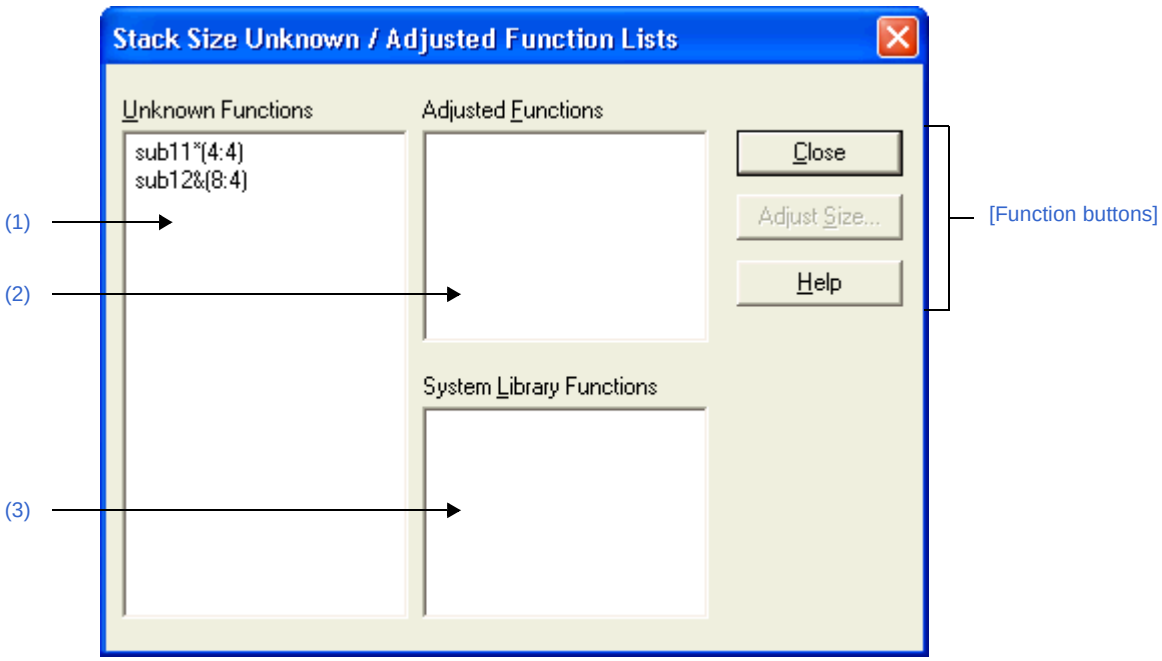
  Example Assuming that the frame size of recursive functions "func_rec1/func_rec2" is 8 bytes, if the recursion depth of "func_rec1/func_rec2" is set to 3 in the Adjust Stack Size dialog box, then although the stack size of func1 will be calculated correctly as "(8 + 24) * 3", the stack size of func2 will be calculated as "8 * 3", ignoring calls to func_rec1.

```
void    func_rec1 ( int i );
void    func_rec2 ( int i );
void    func1 ( void );
void    func2 ( void );

void main ( void ) {
    func1 ( );
    func2 ( );
}
void func_rec1 ( int i ) {
    func_rec2 ( i );
}

void func_rec2 ( int i ) {
    if ( i ) {
        func_rec1 ( i - 1 );
    }
}

void func1 ( void ) {
    func_rec1 ( 2 );
}

void func2 ( void ) {
    func_rec2 ( 2 );
}
```

Stack Size Unknown / Adjusted Function Lists dialog box

This dialog box is used to display a list of functions for which the stack usage tracer could not obtain stack information; functions for which information (additional margin, recursion depth, and callee functions) was changed intentionally, and functions for which the stack usage tracer forcibly set an additional margin.

Figure A-56. Stack Size Unknown / Adjusted Function Lists Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- On the Stack Usage Tracer window, select the [Stack Size Unknown / Adjusted Function Lists...] from the [Option] menu.

[Description of each area]

(1) [Unknown Functions]

Display a list of "unknown functions" -- functions for which the stack usage tracer could not obtain stack information. This area generally displays unknown functions in the following format.

function name (total stack size : frame size)

Remarks 1. If the unknown function is written in assembly language, then the underscore (_) pre-appended to the symbol name is deleted, and the name is surrounded by square brackets ([ ]); this is displayed as the function name.

2. If the unknown function is a recursive function, then an asterisk (*) is appended to the end of the function name.

3. If the unknown function includes functions called indirectly using function pointers, then an ampersand (&) is appended to the end of the function name.
4. If the unknown function is a static function, then "file name#" is appended to the end of the function name.

(2) [Adjusted Functions]

Display a list of functions for which information (additional margin, recursion depth, or callee functions) has been modified intentionally via the Adjust Stack Size dialog box or a stack size specification file. This area generally displays modified ("adjusted") functions in the following format.

function name (total stack size : frame size : additional margin)

Remarks 1. If the adjusted function is written in assembly language, then the underscore (_) pre-appended to the symbol name is deleted, and the name is surrounded by square brackets ([ ]); this is displayed as the function name.

2. If the adjusted function is a recursive function, then an asterisk (*) is appended to the end of the function name.
3. If the adjusted function includes functions called indirectly using function pointers, then an ampersand (&) is appended to the end of the function name.
4. If the adjusted function is a static function, then "file name#" is appended to the end of the function name.
5. If the only action performed in the Adjust Stack Size dialog box was adding "callee functions", then the display format of this area will be as follows.
   function name (total stack size : frame size)

(3) [System Library Functions]

Display a list of automatically configured system library functions for which the frame size is unknown, and the stack usage tracer has forcibly set an additional margin. This area generally displays modified system library functions in the following format.

function name (total stack size : ? : additional margin)

Remarks 1. The underscore (_) pre-appended to the symbol name is deleted, and the name is surrounded by square brackets ([ ]); this is displayed as the function name.

2. An appropriate frame size is added to corresponding system library functions in the stack usage tracer's database as additional margin.

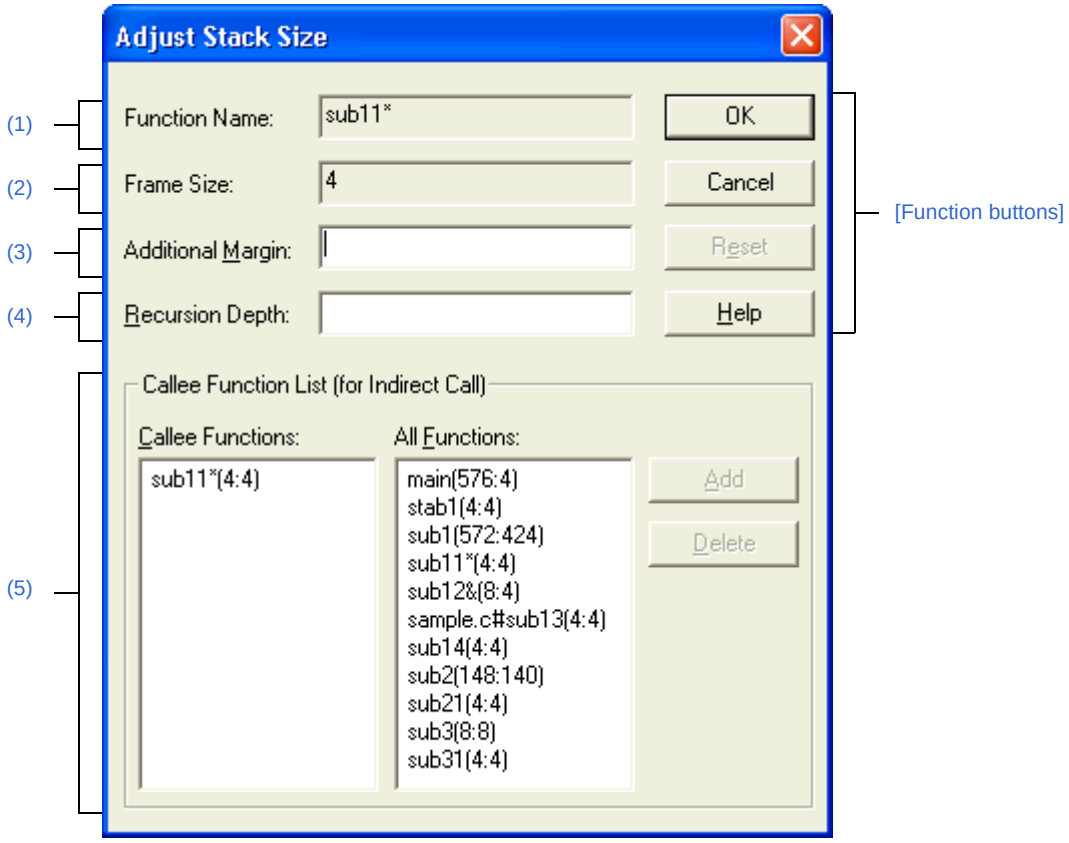
[Function buttons]

Button	Function
Close	Closes this dialog box.
Adjust Size...	Opens the Adjust Stack Size dialog box to change the information (additional margin, recursion depth, and callee functions) for the function selected in the [Unknown Functions]/[Adjusted Functions]/[System Library Functions].
Help	Displays the help of this dialog box.

Adjust Stack Size dialog box

This dialog box is used to change the information (additional margin, recursion depth, and callee functions) for the selected function.

Figure A-57. Adjust Stack Size Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- On the tree display area/list display area of the Stack Usage Tracer window, select a function, and then select [Adjust Stack Size...] from the [Option] menu.
- On the tree display area/list display area of the Stack Usage Tracer window, select a function, and then click the button from toolbar.
- On the tree display area/list display area of the Stack Usage Tracer window, select a function, and then select [Adjust Stack Size...] from the context menu.
- On the [Unknown Functions]/[Adjusted Functions]/[System Library Functions] of the Stack Size Unknown / Adjusted Function Lists dialog box, select a function, and then click the [Adjust Size...] button.

[Description of each area]

(1) [Function Name]

Display the function name of the selected function.

Remarks 1. If the selected function is written in assembly language or it is a system library function, then the underscore (_) pre-appended to the symbol name is deleted, and the name is surrounded by square brackets ([ ]); this is displayed as the function name.

2. If the selected function is a recursive function, then an asterisk (*) is appended to the end of the function name.

3. If the selected function includes functions called indirectly using function pointers, then an ampersand (&) is appended to the end of the function name.

4. If the selected function is a static function, then "file name#" is appended to the end of the function name.

(2) [Frame Size]

Display the frame size (not including the stack size of callee functions; in bytes) of the selected function.

Remark If the frame size is not known, then a question mark (?) is displayed; if it is over the maximum limit, then "SIZEOVER" is displayed.

(3) [Additional Margin]

Specify the value to forcibly add to the selected function (in bytes), either as a decimal number, or as a hexadecimal number starting with "0x" or "0X".

(4) [Recursion Depth]

Specify the recursion depth, either as a decimal number, or as a hexadecimal number starting with "0x" or "0X".

Remark If the selected function is not a recursive function, then this item will be grayed out.

(5) [Callee Function List (for Indirect Call)] area

(a) [Callee Functions]

Display a list of "callee" functions called by the selected function (functions called indirectly using a function pointer or the like).

This area generally displays callee functions in the following format.

function name (total stack size : frame size : additional margin)

Remarks 1. If the callee function is written in assembly language or it is a system library function, then the underscore (_) pre-appended to the symbol name is deleted, and the name is surrounded by square brackets ([ ]); this is displayed as the function name.

2. If the callee function is a recursive function, then an asterisk (*) is appended to the end of the function name.

3. If the callee function includes functions called indirectly using function pointers, then an ampersand (&) is appended to the end of the function name.

4. If the callee function is a static function, then "file name#" is appended to the end of the function name.

5. Functions added intentionally from [All Functions] by clicking the [Add] button are shown with a plus sign (+) appended to the end of the function name.

(b) [All Functions]

Display a list of functions that can be added as functions called by the selected function ("callee functions").
This area generally displays functions that can be added in the following format.

function name (total stack size : frame size : additional margin)

Remarks 1. If the function that can be added is written in assembly language or it is a system library function, then the underscore (_) pre-appended to the symbol name is deleted, and the name is surrounded by square brackets ([ ]); this is displayed as the function name.

2. If the function that can be added is a recursive function, then an asterisk (*) is appended to the end of the function name.

3. If the function that can be added includes functions called indirectly using function pointers, then an ampersand (&) is appended to the end of the function name.

4. If the function that can be added is a static function, then "file name#" is appended to the end of the function name.

(c) Button area

Add	Adds the function selected in [All Functions] to [Callee Functions]. If no function is selected in [All Functions], then this button will be grayed out.
Delete	Deletes the function selected in [Callee Functions] from [Callee Functions]. If no function is selected in [Callee Functions], then this button will be grayed out.

Remark Functions can only be deleted from [Callee Functions] if the function name ends with a plus sign (+) (functions added from [All Functions] intentionally by clicking [Add]).

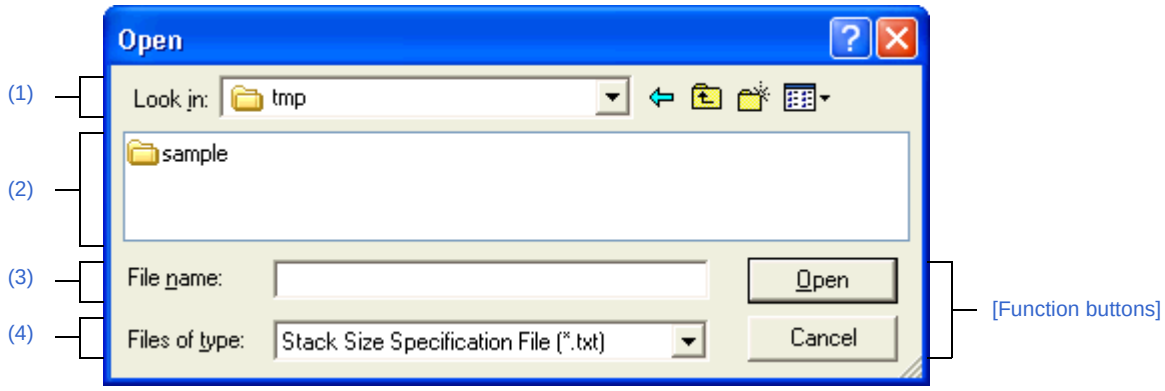
[Function buttons]

Button	Function
OK	Reflects the settings in the Stack Usage Tracer window / save them to the project file (*.prj), then close the dialog.
Cancel	Ignores the setting and closes this dialog box.
Reset	Resets the information (additional margin, recursion depth, and callee functions) for the selected function to the default values. This button will be grayed out if all the information for the selected function has the default values.
Help	Displays the help of this dialog box.

Open dialog box

This dialog box is used to open an existing stack size specification file.

Figure A-58. Open Dialog Box



The following items are explained here.

- [How to open]
- [Description of each area]
- [Function buttons]

[How to open]

- On the Stack Usage Tracer window, select [Load Stack Size Specification File...] from the [File] menu.

[Description of each area]

(1) [Look in] area

Select the folder containing the stack size specification file you wish to open.

(2) List of files

This area displays a list of files matching the conditions selected in [Look in] area and [Files of type] area.

(3) [File name] area

Specify the file name of the stack size specification file to open.

(4) [Files of type] area

Select the type of file to open.

Stack Size Specification File (*.txt)	Text format

[Function buttons]

Button	Function
Open	Opens the specified file.
Cancel	Ignores the setting and closes this dialog box.

APPENDIX B COMMAND REFERENCE

This appendix describes the detailed specifications of each command included in the build tool.

B.1 C Compiler

The C compiler creates relocatable object files and object files executable on the target system from C language source programs described in C source files.

The C compiler acts as the driver of the modules included in the package and performs operations such as macro expansion, comment processing, merging of intermediate language files, optimization, creation/conversion from assembler source programs to machine language instructions, and linking of object files.

The C compiler performs processing in the following sequence.

As is shown in "Figure B-1. Operation Flow of C Compiler", the processing flow varies slightly depending on the specified optimization level.

(1) Front end (cafe)

Performs macro expansion and comment processing of a C source program and then converts the program into an intermediate language program.

(2) Pre-optimizer (popt)

Rearranges the functions in the intermediate language program.

If this command is activated from the command line, and if "File merging option (-Om)" is specified, two or more intermediate language programs are merged into one.

If "Level 2 advanced option (Speed precedence)" is specified, inline expansion is performed for the functions in the intermediate language program.

(3) Global optimization module (opt)

Optimizes the intermediate language program.

(4) Code generation module (cgen)

Converts the intermediate language program into an assembler source program.

(5) Machine-dependent optimization module (impr)

Optimizes the assembler source program.

(6) Assembler (as850)

Converts the assembler source program into machine language instructions and creates a relocatable object file.

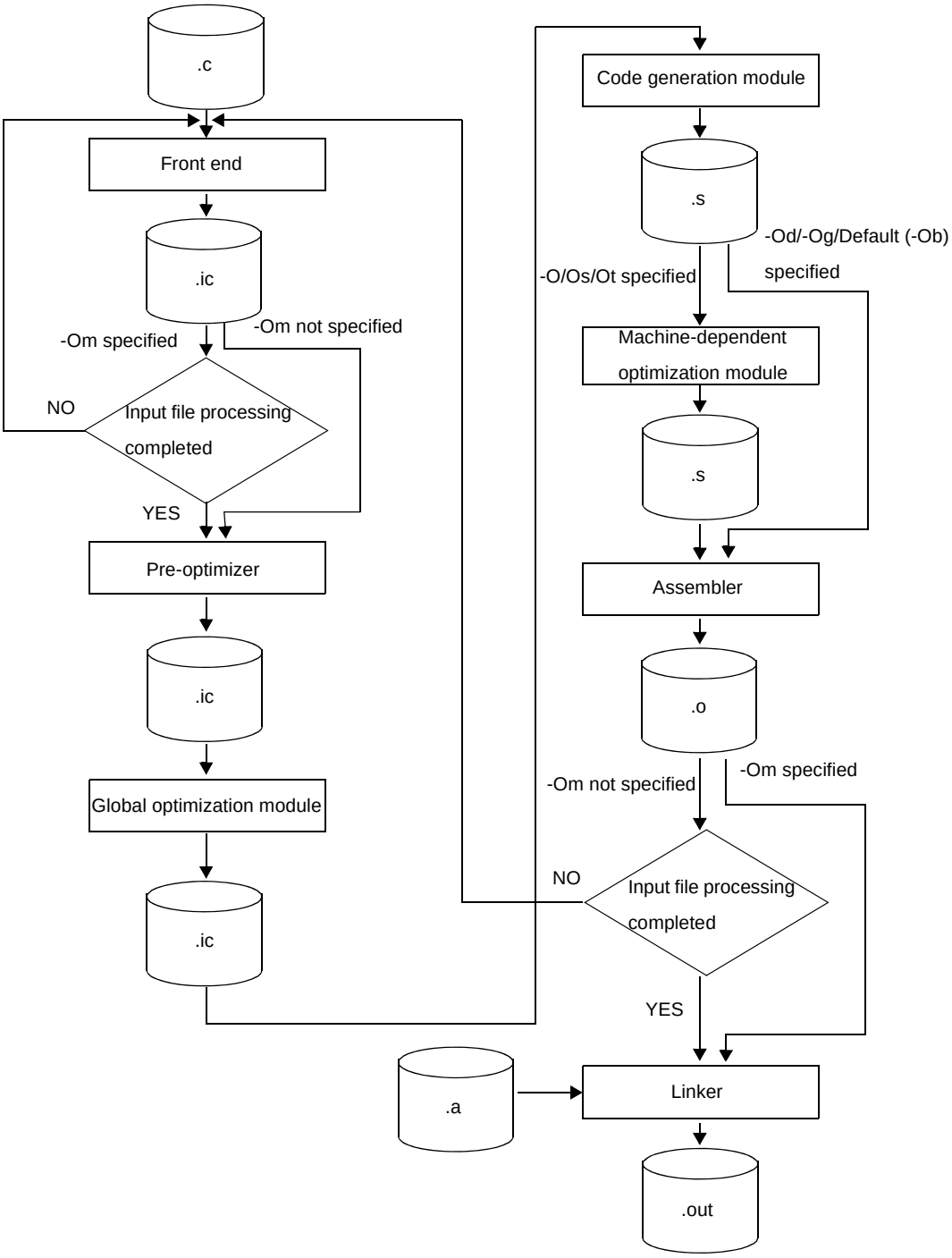
(7) Linker (ld850)

Links the relocatable object file, and creates an executable object file.

The global optimization module and machine-dependent optimization module are called only when the optimization option is specified.

It is assumed that the modules of (1) through (5) are started from the C compiler. Consequently, operation is not guaranteed if any of these modules is started alone.

Figure B-1. Operation Flow of C Compiler



B.1.1 I/O files

The C compiler can specify the following files as input files or output files.

file.c	C source file (called the .c file)
file.ic	Intermediate language file (called the .ic file)
file.s	Assembler source file (called the .s file)
file.o	Object file (called the .o file)
file.a	Archive file (called the .a file)

- The .s file is passed to the assembler without modification (a source program directly coded in assemble language does not go through the machine-dependent optimization module).
- All the files other than .c, .ic, and .s files, such as .a and .o files, are all passed as is to the linker.

The input file names supported by Windows can be specified, but "@" cannot be used at the head of a file name because it is regarded as a command option.
If the kanji code of the file is EUC, a file name or folder name cannot be used in Japanese.

B.1.2 Executable object

The C compiler can read a C source file and create an executable object file at the same time since it starts both the assembler and linker.

You can also use an option (-S) to stop the process just before launching the assembler and linker, and output compiler code and generate relocatable object files (see "B.1.3 Method for manipulating" for details about the method for manipulating).

Examples of starting commands from command line are shown below (see "B.1.4 Option" for details about options).

(1) When executing everything from the C compiler

```
C:\>ca850 -cpu 3201 file.c obj.o
```

This specifies "-cpu 3201" (V850ES/SA2) as the device and reads *file*.c and *obj*.o to create an executable object file a.out. At this time, crtE.o is linked as the startup module and the standard libraries libc.a and libm.a are referenced.

```
C:\>ca850 -cpu 3201 -R org_crt.o file.c obj.o
```

This reads *file*.c and *obj*.o to create an executable object file a.out. At this time, *org_crt*.o is linked as the startup module and the standard libraries libc.a and libm.a are referenced.

(2) When starting from the C compiler to the assembler, and starting the linker alone

```
C:\>ca850 -cpu 3201 -c file.c asm.s
```

This reads *file*.c and *asm*.o to create a relocatable object file *file*.o and *asm*.o.

```
C:\>ld850 -cpu 3201 org_crt.o file.o asm.o obj.o -lc
```

This links *org_crt*.o, *file*.o, *asm*.o, and *obj*.o to create the executable object file a.out. At this time, libc.a is referenced.

(3) When starting the C compiler, assembler, and linker by themselves

```
C:\>ca850 -cpu 3201 -c file.c
```

This reads *file*.c to create a relocatable object file *file*.o.

```
C:\>as850 -cpu 3201 asm.s
```

This reads *asm*.s to create a relocatable object file *asm*.o.

```
C:\>ld850 org_crt.o file.o asm.o -lc
```

This links *org_crt*.o, *file*.o, and *asm*.o to create the executable object file a.out. At this time, libc.a is referenced.

B.1.3 Method for manipulating

This section explains how to manipulate the C compiler.

(1) Command input method

Enter the following from the command prompt.

```
C:\>ca850 [option] ... file-name [file-name or option] ...
      [ ]:     Can be omitted
      ...:     Pattern in proceeding [ ] can be repeated
```

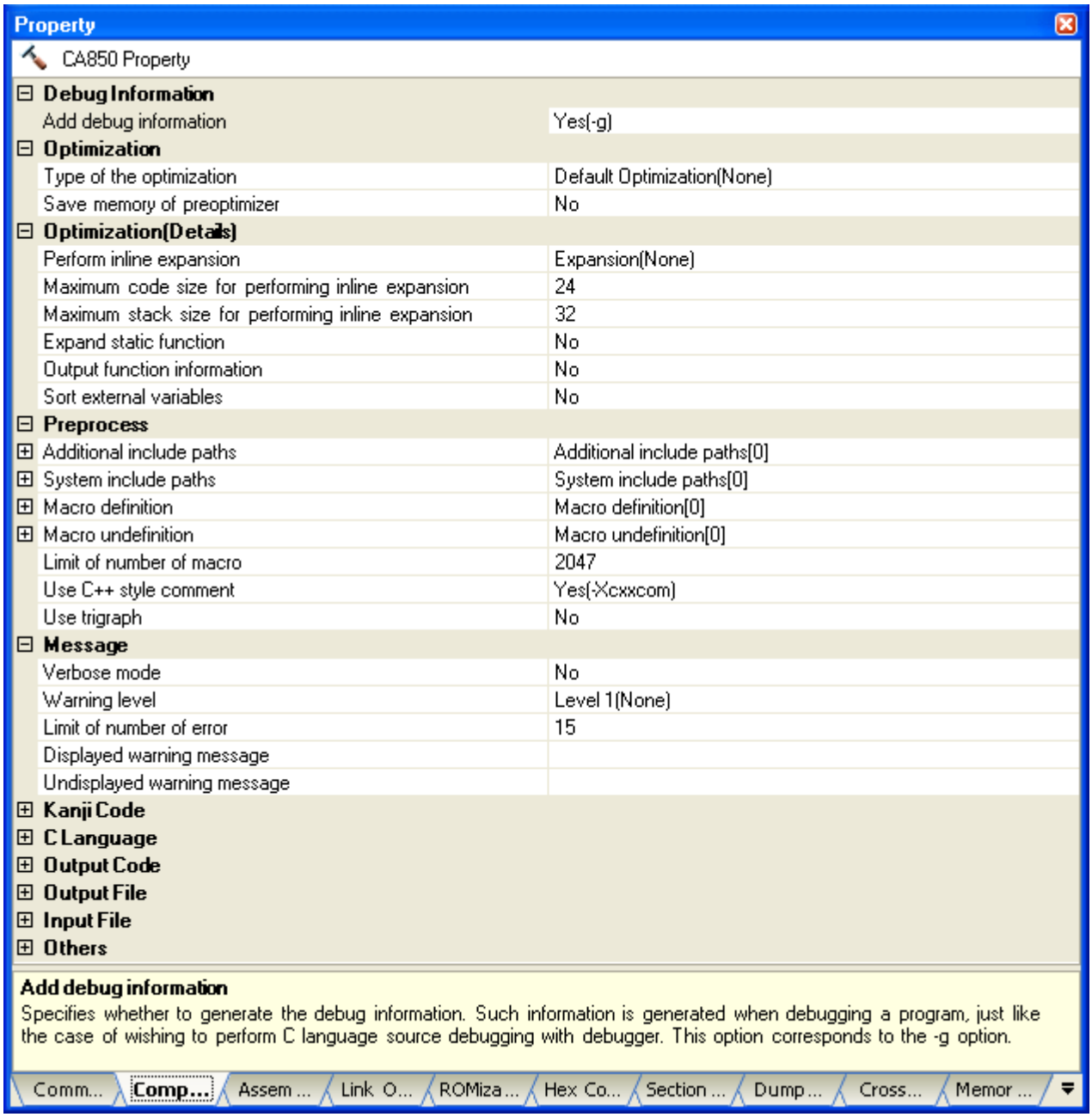
(2) Set options in CubeSuite+

This section describes how to set compile options from CubeSuite+.

On CubeSuite+'s Project Tree panel, select the Build Tool node. Next, select the [View] menu -> [Property]. The Property panel opens .Next, select the [Compile Options] tab.

You can set the various compile options by setting the necessary properties in this tab.

Figure B-2. Property Panel: [Compile Option] Tab



B.1.4 Option

This section explains compile options.

Caution When launching from the command line, if an option that is not listed in "Table B-1. Compile Options" is assigned, then these options are assumed to be for the linker and are passed to the linker.

The types and explanations for compile options are shown below.

Table B-1. Compile Options

Classification	Option	Description
Version/help display/ operation status	-V	Outputs the version information of the C compiler to the standard error output.
	-help	Outputs option descriptions to the standard error output.
	-v	Outputs the execution status of the C compiler to the standard error output in detail.
Output file specification	-Fic	Specifies where an intermediate language file is to be saved.
	-Fo	Specifies where an object file is to be saved.
	-Fs	Specifies where an assembly language file is to be saved.
	-Fv	Specifies where an assemble list file is to be saved.
	-o	Specifies the output file.
	-temp	Specifies the work folder.
Controlling source debugger	-Xno_word_bitop	Prohibits replacing the ld.w/ld.h and st.w/st.h instructions with 1-bit manipulation instructions.
	-g	Outputs symbol information for the source debugger.
Device specification	-X256M	Treats the memory space as having 256 MB.
	-Xbpc	Sets the higher address of the programmable peripheral I/O register.
	-cn	Embeds the magic number common to V850 core.
	-cnv850e	Embeds the magic number common to V850Ex core.
	-cnv850e2	Embeds the magic number common to V850E2 core.
	-cpu	Specifies the target device.
	-devpath	Specifies the folder to search device files.
Compiler control specification	-S	Outputs the assembler source file without executing any modules after the assembler.
	-a	Outputs an assemble list.
	-c	Outputs the object file without starting the linker.
	-m	Executes the only front end, generates an .ic file, and then terminates processing.
ROMization control	-Xr	This option is necessary when creating a ROMization object.

Classification	Option	Description
Preprocessor processing setting	-C	Includes source program comments in the preprocessing output.
	-D	Assumes that #define is entered before the C source program.
	-E	Executes preprocessing only for a C source program and outputs the results to the standard output.
	-I	Specifies the folder to search the header file of the C source program.
	-P	Executes preprocessing only for a C source program and outputs the results to a file.
	-U	Assumes that #undef is entered before the C source program.
	-Wa,-D	Assumes that .set is entered before the assembler source.
	-Wa,-I,	Specifies the folder to search the header file of the assembler source file.
	-Xcxxcom	In addition to ordinary comments, interprets all characters that appear after "//" and before the end of the line as comments.
	-Xd	Outputs a warning message in response to initialization of a pointer type external variable which uses a variable address that is not an automatic variable or which uses a function address.
	-Xm	Specifies the upper limit for the number of macro identifiers.
	-t	Replaces a trigraph sequence.
Memory saving during compilation	-Wp,-D	Reduces the memory capacity used in the pre-optimizer phase during compiling.
	-Wi,-D	Reduce the memory capacity used in the machine dependent optimization phase during compiling.
Error output specification	+err_file	Adds and saves error messages to the file.
	-err_file	Overwrites and saves error messages to the file.
	-err_limit	Specifies the maximum number of error messages to be output.
Expansion function specification	-cc78k	Enables the expansion functions compatible with the 78K microcontrollers C compiler CC78K*x*.
Optimization	-Od	This is the optimize for debugging option.
	-Ob	This is the default optimization option.
	-Og	This is the standard optimization option.
	-O	This is the Level 1 advanced optimization.
	-Os	This is the Level 2 advanced optimization option (object size precedence).
	-Ot	This is the Level 2 advanced optimization option (execution speed precedence).
Target code optimization	-Wi,-O4	Analyzes the data flow strictly and perform the most advanced optimization.
	-Wi,-P	Prevents optimization that allows branch destination labels to be aligned.
File merging	-Om	Merges the files when two or more files are specified at the same time.

Classification	Option	Description
Inline expansion optimization control	-Wp,-G	Restricts the stack size for a function subject to inline expansion in the intermediate language so that inline expansion is not performed for the large value.
	-Wp,-N	Restricts the intermediate language size for a function subject to inline expansion so that inline expansion is not performed for the large value.
	-Wp,-S	Performs inline expansion of a static function that is referenced only once unconditionally.
	-Wp,-I	Outputs function information to the standard output or additionally outputs to the file.
	-Wp,-inline	Performs inline expansion of only a function for which #pragma inline is specified.
	-Wp,-no_inline	Suppresses inline expansion of all functions, including the function for which #pragma inline is specified.
	-Wp,-r	Deletes unnecessary functions from the functions called from an entry function after inline expansion.
Loop expansion optimization control	-Wo,-Ol	Expands a loop the specified times using "for" and "while".
	-Wo,-Xlo	Expands a loop by fixing the number of times of expanding the loop.
strcpy, strcmp expansion	-Xi	Sets a 4-byte alignment condition for arrays and structures and performs inline expansion of strcpy() or strcmp() function calls.
External variable sort	-Wo,-Op	Rearranges external variables starting from the largest alignment size.
Branch instruction control	-Wo,-XFo	Arranges and outputs branch instructions, giving precedence to the code size.
Register use control	-r	Allocates the specified external variable to the specified register.
	-reg	Limits the number of registers used by the C compiler.
	-Xmask_reg	Uses the mask register function.
Prologue/epilogue processing control	-Xpro_epi_runtime	Specifies whether or not to perform prologue/epilogue processing of the function based on runtime library function calls.
Variable placement control	-G	Allocates data of less than the specified bytes to the .sdata or .sbss section.
	-Xsconst	Allocates const attribute data and character string literals to the .sconst section.
	-Xcre_sec_data	Outputs the frequency information file for the variables used by the section file generator.
	-Xcre_sec_data_only	
	-Xsec_file	Specifies the name of the section file that is used to specify section allocation of data when the C compiler is activated.
signed/unsigned control	-Xbitfield	Specifies whether int type bit fields that do not indicate the type specifier are handled as signed or unsigned.
	-Xchar	Specifies whether char type that do not indicate the type specifier are handled as signed or unsigned.
	-Xenum_type	Specifies which integer type the enumeration type matches.
Switch-case statement output code control	-Xcase	Specifies a mode in which the code of a switch statement is to be output.
	-Xword_switch	Generates one 4-byte branch table per case label in a switch statement.

Classification	Option	Description
Structure packing control	-Xbyte	Specifies indirect address access to a structure in byte units.
	-Xpack	Specifies alignment of structure members.
Far jump output control	-Xfar_jump	Uses jmp directive to branch to the specified function.
	-Xj	Uses the jmp instruction for an ordinary interrupt function defined in C language.
Comment output	-Xc	Outputs the C source program as a comment to the assembler source file.
ANSI standard	-Xe	Uses runtime library, without using the mulh and divh directives for integers corresponding to data that is 16 bits or less.
	-Xdefvar	Treats tentative definition of variables as definition.
	-ansi	Makes C compiler processing comply strictly with the ANSI standard and outputs an error or warning for a specification that violates the standard.
Library specification	-L	Specifies the folder to search libraries.
	-R	Specifies the startup module to be used when startup goes as far as the linker.
	-l	Specifies the archive file that is referenced by the linker.
Warning message control	-w	Specifies the level, output, and suppression of a warning message.
	-won	Outputs a warning message of the specified number.
	-woff	Suppresses a warning message of the specified number.
Command file specification	@	Handles the specified file as a command file.
CPU bug patch	-Xv850patch	Specifies the -p option for the assembler for an assembler source file output by the C compiler to output a code corresponding to a CPU fault.
Each module	-W	Specifies options to each module.
Other	+Oc	Performs advanced optimization.

Table B-2. Mark Used in Option Descriptions

[V850E2]	Option dedicated to V850E2 core
[V850E]	Option dedicated to V850Ex core
[78K-compatible]	Option compatible with 78K microcontrollers C compiler CC78Kx

Version/help display/operation status

The version/help display/operation status options are as follows.

- -V
- -help
- -v

-V

[Description format]

```
-V
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs the version information of the C compiler to the standard error output.

[Example of use]

- To output the version information of the C compiler to the standard error output, describe as:

```
C:\>ca850 -V
```

-help

[Description format]

```
-help
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs option descriptions to the standard error output.

[Example of use]

- To output option descriptions to the standard error output, describe as:

```
C:\>ca850 -help
```

-v

[Description format]

```
-v
```

- Interpretation when omitted

  None

[Function Description]

- This option outputs the execution status of the C compiler to the standard error output in detail.

[Example of use]

- To output the execution status of the C compiler to the standard error output in detail, describe as:

```
C:\>ca850 -v prime.c
```

Output file specification

The output file specification options are as follows.

- -Fic
- -Fo
- -Fs
- -Fv
- -o
- -temp

-Fic

[Description format]

```
-Fic[=outfile]
```

- Interpretation when omitted
  None

[Function Description]

- This option specifies where an intermediate language file generated during compilation is to be saved.

(1) If the file name is specified as *outfile*

Saves *outfile* to the current folder under the specified file name.
The extension of *outfile* is restricted to ".ic".

(2) If the folder is specified as *outfile*

Saves the file under the file name with extension .c replaced by .ic to the specified folder.

(3) If =*outfile* is omitted

Saves the file under the file name with extension .c replaced by .ic to the current folder.

(4) If two or more files are output

Creates a folder specified for *outfile*, and saves the files under each file name with extension .c replaced by .ic.

[Example of use]

- To save the intermediate language file to folder "D:\sample" with "main.ic" as a file name, describe as:

```
C:\>ca850 -cpu f3719 -Fic=D:\sample main.c
```

-Fo

[Description format]

```
-Fo[=outfile]
```

- Interpretation when omitted
  Saves the file under the file name with extension .c or .s replaced by .o to the current folder.

[Function Description]

- This option specifies where an object file generated during compilation is to be saved.

(1) If the file name is specified as *outfile*
Saves *outfile* to the current folder under the specified file name.

(2) If the folder is specified as *outfile*
Saves the file under the file name with extension .c or .s or .ic replaced by .o to the specified folder.

(3) If =*outfile* is omitted
Saves the file under the file name with extension .c or .s or .ic replaced by .o to the current folder.

(4) If two or more files are output
Creates a folder specified for *outfile*, and saves the files under each file name with extension .c or .s or .ic replaced by .ic.

[Example of use]

- To save the object file with "sample.o" as a file name, describe as:

```
C:\>ca850 -cpu f3719 -Fo=sample.o main.c
```

-Fs

[Description format]

```
-Fs[=outfile]
```

- Interpretation when omitted
  None

[Function Description]

- This option specifies where an assembly language file generated during compilation is to be saved.

(1) If the file name is specified as *outfile*

Saves *outfile* to the current folder under the specified file name.

(2) If the folder is specified as *outfile*

Saves the file under the file name with extension .c or .ic replaced by .s to the specified folder.

(3) If =*outfile* is omitted

Saves the file under the file name with extension .c or .ic replaced by .s to the current folder.

(4) If two or more files are output

Creates a folder specified for *outfile*, and saves the files under each file name with extension .c or .ic replaced by .s.

[Example of use]

- To save the assembly language file to folder "D:\sample" with "main.s" as a file name, describe as:

```
C:\>ca850 -cpu f3719 -Fs=D:\sample main.c
```

-Fv

[Description format]

```
-Fv[=outfile]
```

- Interpretation when omitted
  None

[Function Description]

- This option specifies where an assemble list generated during compilation is to be saved.

(1) If the file name is specified as *outfile*
Saves *outfile* to the current folder under the specified file name.

(2) If the folder is specified as *outfile*
Saves the file under the file name with extension .c or .s or .ic replaced by .v to the specified folder.

(3) If =*outfile* is omitted
Saves the file under the file name with extension .c or .s or .ic replaced by .v to the current folder.

(4) If two or more files are output
Creates a folder specified for *outfile*, and saves the files under each file name with extension .c or .s or .ic replaced by .v.

- If this option and the -a option are not specified, an assemble list is not generated.

[Example of use]

- To save the assemble list with "sample.v" as a file name, describe as:

```
C:\>ca850 -cpu f3719 -Fv=sample.v main.c
```

-o

[Description format]

```
-o outfile
```

- Interpretation when omitted
  The output file is saved to the current folder.

[Function Description]

- This option specifies an output file as *outfile*.

(1) If this option is specified with the -S option
An assembler file (.s) is specified.

(2) If this option is specified with the -c option
A relocatable object file (.o) is specified.

(3) If this option is specified with the -m option
A front-end output file (.ic) is specified.

(4) Other than above
An executable object file (.out) is specified. The default assumption is a.out.

(5) If two or more files are output
An error occurs.

- It is valid even if compiling is stopped midway by specifying the compiler control option -S, -c, or -m.

[Example of use]

- To save the executable object file with "sample.out" as a file name, describe as:

```
C:\>ca850 -cpu f3719 -o sample.out main.c
```

-temp

[Description format]

```
-temp=dir
```

- Interpretation when omitted
  Temporary files are created in the folder specified by the environment variable TEMP or in the root folder of the current drive.

[Function Description]

- This option specifies the work folder for generating temporary files that are used internally.
- If the capacity of the hard disk runs short and a temporary file cannot be generated, an error occurs. This error can be avoided by using this option.

[Example of use]

- To use folder "D:\tmp" as a work folder for generating temporary files, describe as:

```
C:\>ca850 -cpu f3719 -temp=D:\tmp main.c
```

Controlling source debugger

The controlling source debugger options are as follows.

- -Xno_word_bitop
- -g

-Xno_word_bitop

[Description format]

```
-Xno_word_bitop
```

- Interpretation when omitted
  This option replaces the ld.w/ld.h and st.w/st.h instructions with 1-bit manipulation instructions (set1, clr1, tst1, and not1).

[Function Description]

- This option prohibits replacing the ld.w/ld.h and st.w/st.h instructions with 1-bit manipulation instructions (set1, clr1, tst1, and not1).
- If a read/write event of a variable is set during debugging, an event may not be occur if these instructions are replaced by 1-bit manipulation instructions. If this option is specified in such a case, the ld.w/ld.h and st.w/st.h instructions are not replaced by 1-bit manipulation instructions, it makes debugging easy.

[Example of use]

- To prohibit replacing the ld.w/ld.h and st.w/st.h instructions with 1-bit manipulation instructions (set1, clr1, tst1, and not1), describe as:

```
C:\>ca850 -cpu f3719 -Xno_word_bitop main.c
```

-g

[Description format]

```
-g
```

- Interpretation when omitted
  Symbol information for the source debugger is not output.

[Function Description]

- This option outputs symbol information for the source debugger.
  In other words, performing debugging at the C source level is possible by specifying this option.
- When the assembler is started via the C compiler, specification of this option is regarded as the same as specifying the -g option of the assembler. As a result, performing debugging at the assembler source level is possible.

[Example of use]

- To output symbol information for the source debugger and make performing debugging at the C source level possible, describe as:

```
C:\>ca850 -cpu f3719 -g main.c
```

Device specification

The device specification options are as follows.

- -X256M
- -Xbpc
- -cn
- -cnv850e
- -cnv850e2
- -cpu
- -devpath

-X256M

[Description format]

```
-X256M
```

- Interpretation when omitted
  The memory space is treated as having 64 MB and the addresses are resolved.

[Function Description]

[V850E]

- This option treats the memory space as having 256 MB.
- Set this option in accordance with the chipset to be used. The physical address space of the V850Ex core has 256 MB in many cases. When creating an application that uses a space between 64 MB and 256 MB, specify this option.

[Example of use]

- To treat the memory space as having 256 MB, describe as:

```
C:\>ca850 -cpu f3719 -X256M main.c
```

-Xbpc

[Description format]

```
-Xbpc=num
```

- Interpretation when omitted
  The higher address of the programmable peripheral I/O register is treated as 0.

[Function Description]

- This option sets the higher address of the programmable peripheral I/O register.
- In *num*, specify only the part of address from which the highest bit of the BPC register is removed.
- If the target device has programmable peripheral I/O register functions (such as V850E/IA1) and you want to set the variable address portion (= value set in BPC register), the value must be determined when compiling (assembling) the application.
- If this option is specified, compilation (assembly) is performed using the specified value. When this option is specified, be sure to specify a value.
  A binary, octal, decimal, or hexadecimal number can be used for the value. If an invalid value is specified, or if a value outside the range that can be set in the BPC register is specified, a warning message is output and this option is ignored.
- One value is set for an entire application. If you specify "-Xbpc" or "-bpc" when setting options by file, make the values the same between files.
  However, this option is not needed to be specify for files that do not use the programmable peripheral I/O register
- If this option is specified for a target device that does not have programmable peripheral I/O register functions or when assembling as a common for V850 core/V850Ex core/V850E2 core, a warning message is output and this option is ignored.
- This option is for determining the address of the programmable peripheral I/O register when compiling (assembling) and does not actually reflect a value in the BPC register. For operation, it is necessary to set a value in the BPC register separately using a startup module or the like.
  See "CubeSuite+ V850 Coding" about a sample of the startup routine. Also, a sample appears (commented out) in the startup module included in the package.
- The assembler outputs the .bpc section which is a reserved section when the programmable peripheral I/O register is referenced, regardless of whether this option is specified or omitted.
  This section is used for checking when linking. The .bpc section is a special reserved section for information and is never loaded into memory. Therefore, it need not be specified in a link directive like a normal section.

[Example of use]

- If the target device is V850E/IA1, the following option setting treats the start address of the programmable peripheral I/O register area to be shifted 14 bits to the left, or "0x48d0000".

```
C:\>ca850 -cpu 3116 -Xbpc=0x1234 main.c
```

Specify the following descriptions in the startup module to make the variable portion of the start address of the programmable peripheral I/O register "0x1234" and set the flag 0x8000 that enables the use of this function.

```
mov     0x9234,r10      -- 0x1234 | 0x8000 = 0x9234
st.h    r10, BPC
```

-cn

[Description format]

```
-cn
```

- Interpretation when omitted
  None

[Function Description]

- This option embeds the magic number common to V850 core into the object to be generated.

[Example of use]

- To embed the magic number common to V850 core into the object, describe as:

```
C:\>ca850 -cn -c main.c
```

-cnv850e

[Description format]

```
-cnv850e
```

- Interpretation when omitted
  None

[Function Description]

[V850E]

- This option embeds the magic number common to V850Ex core into the object to be generated.

[Example of use]

- To embed the magic number common to V850Ex core into the object, describe as:

```
C:\>ca850 -cnv850e -c main.c
```

-cnv850e2

[Description format]

```
-cnv850e2
```

- Interpretation when omitted

  None

[Function Description]

[V850E2]

- This option embeds the magic number common to V850E2 core into the object to be generated.

[Example of use]

- To embed the magic number common to V850E2 core into the object, describe as:

```
C:\>ca850 -cnv850e2 -c main.c
```

-cpu

[Description format]

```
-cpu device-name
```

- Interpretation when omitted
  This option cannot be omitted (except when specifying -cn, -cnv850e, -cnv850e2 or #pragma cpu).

[Function Description]

- This option specifies the target device[Note].

Note This option and "#pragma cpu *device-name*" are identical.
If specification by the -cpu option and specification by the #pragma directive are specified but have different contents, this option takes priority.

- If this option is omitted and nothing has been specified by the -cn, -cnv850e, -cnv850e2 option, or #pragma directive, compilation is stopped.

[Example of use]

- To specify V850E as the target device, describe as:

```
C:\>ca850 -cpu f3719 main.c
```

-devpath

[Description format]

```
-devpath=dir
```

- Interpretation when omitted
  The device file is searched from the standard folder.

[Function Description]

- This option searches a device file from folder *dir*.

[Example of use]

- To search a device file from folder D:\dev, describe as:

```
C:\>ca850 -cpu f3719 -devpath=D:\dev main.c
```

Compiler control specification

The compiler control specification options are as follows.

- -S
- -a
- -c
- -m

-S

[Description format]

```
-S
```

- Interpretation when omitted
  Phases after the assembler are also executed.

[Function Description]

- This option outputs the generated assembler source file without executing any modules after the assembler.
- The output file name uses .s as the extension instead of .c or .ic. Use the -o option to specify the output file name (see the description of the -o option). Also, the output file name can be specified by the -Fs option.

[Example of use]

- To output the assembler source file (main.s) without executing any modules after the assembler, describe as:

```
C:\>ca850 -cpu f3719 -S main.c
```

-a

[Description format]

```
-a
```

- Interpretation when omitted
  No assemble list is output.

[Function Description]

- This option outputs an assemble list. The file name uses .v as the extension instead of .c or .s or .ic (see "3.1 Assembler").
- When the -Og, -O, -Os, or -Ot option is specified, a part of the assemble list may be incorrectly output due to instruction rearrangement for optimization by the assembler.

[Example of use]

- To output the assemble list (main.v), describe as:

```
C:\>ca850 -cpu f3719 -a main.c
```

-c

[Description format]

```
-c
```

- Interpretation when omitted
  The procedure up to the point of starting the linker is performed.

[Function Description]

- This option outputs the object file without starting the linker.
- The file name uses .o as the extension instead of .c or .s or .ic.
- Use the -o option to specify the output file name (see the description of the -o option). Also, the output file name can be specified by the -Fo option.

[Example of use]

- To output an object file (main.o), describe as:

```
C:\>ca850 -cpu f3719 -c main.c
```

-m

[Description format]

```
-m
```

- Interpretation when omitted
  Modules after the font end are also executed.

[Function Description]

- This option executes the only front end, generates an .ic file, and then terminates processing.

[Example of use]

- To execute the only front end and output the intermediate language file (main.c), describe as:

```
C:\>ca850 -cpu f3719 -m main.c
```

ROMization control

The ROMization control option is as follows.

- -Xr

-Xr

[Description format]

```
-Xr
```

- Interpretation when omitted
  An object that does not have ROMization information is created.

[Function Description]

- This option is necessary when creating a ROMization object.
- The compiler processing is as follows.

(1) The label for the first argument of a function beginning with "_ rcopy" has attempted to indicate the first address (aligned on 4-byte boundaries) that exceeds the end of the .text section in the object.

(2) Consequently, this indicates the area reservation code for the rompsec section (default name: rompcrt.o) and libr.a to be linked by the linker.

- See "B.4.3 Creating object for ROMization" for details about the method of creating the ROMization object.

[Example of use]

- To output the object file (a.out) that has ROMization information, describe as:

```
C:\>ca850 -cpu f3719 -Xr main.c
```

Preprocessor processing setting

The preprocessor processing setting options are as follows.

- -C
- -D
- -E
- -I
- -P
- -U
- -Wa,-D
- -Wa,-I
- -Xcxxcom
- -Xd
- -Xm
- -t

-C

[Description format]

```
-C
```

- Interpretation when omitted
  None

[Function Description]

- This option includes source program comments in a C source program's preprocessing output. This option is valid only when the -E or -P option is specified.

[Example of use]

- To include source program comments in the preprocessing output and output the results to the standard output, describe as:

```
C:\>ca850 -cpu f3719 -C -E main.c
```

-D

[Description format]

```
-Dname[=def]
```

- Interpretation when omitted
  None

[Function Description]

- This option assumes that #define *name def* is entered before the C source program.
- If *def* is omitted, it is regarded as 1. Up to 256 of this options can be specified.

[Example of use]

- To assume that "#define sample 256" is entered before the C source program, describe as:

```
C:\>ca850 -cpu f3719 -Dsample=256 main.c
```

-E

[Description format]

```
-E
```

- Interpretation when omitted
  None

[Function Description]

- This option executes preprocessing only for a C source program and outputs the results to the standard output.
- The results include the line numbers and file name of the source program.

[Example of use]

- To execute preprocessing only and outputs the results to the standard output, describe as:

```
C:\>ca850 -cpu f3719 -E main.c
```

-I

[Description format]

```
-Idir
```

- Interpretation when omitted
  The header file of the C source program is searched from the standard folder.
  The standard folder is "install folder\CA850\Vx.xx[Note]\inc850".

Note V*x.xx* is the version of the C compiler.

[Function Description]

- The header file of the C source program is searched from folder *dir*, the standard folder in that order.
  Up to 100 of this options can be specified.
- If #include "header file name" is specified in the #include statement, folders with source files are searched first.

[Example of use]

- To search the header file of the C source program from folder D:\head, the standard folder in that order, describe as:

```
C:\>ca850 -cpu f3719 -ID:\head main.c
```

-P

[Description format]

```
-P
```

- Interpretation when omitted
  None

[Function Description]

- This option executes preprocessing only for a C source program and outputs the results to the file under the file name with extension .c replaced by .i.
- The line numbers and file name of the source program are not output.

[Example of use]

- To execute preprocessing only and outputs the results to the file (main.i), describe as:

```
C:\>ca850 -cpu f3719 -P main.c
```

-U

[Description format]

```
-Uname
```

- Interpretation when omitted
  None

[Function Description]

- This option assumes that #undef *name* is entered before the C source program.
  Up to 256 of this options can be specified.

[Example of use]

- To assume that "#undef test" is entered before the C source program, describe as:

```
C:\>ca850 -cpu f3719 -Utest main.c
```

-Wa,-D

[Description format]

```
-Wa,-Dname[=num]
```

- Interpretation when omitted
  None

[Function Description]

- This option assumes that ".set *name*, *num*" is entered before the assembler source.
- If *num* is omitted, it is regarded as 1.

[Example of use]

- To assume that ".set _sample, 256" is entered before the assembler source, describe as:

```
C:\>ca850 -cpu f3719 -Wa,-D_sample=256 main.c
```

-Wa,-I

[Description format]

```
-Wa,-I,dir
```

- Interpretation when omitted
  The header file of the assembler source file is searched from the standard folder.

[Function Description]

- The header file of the assembler source file is searched from folder *dir*, the standard folder in that order.
  If the header file is not found in the standard folder, the folder where assembler source files are located and the folder where C source files are located are searched in that order.

[Example of use]

- To search the header file of the assembler source file from folder D:\head, the standard folder in that order, describe as:

```
C:\>ca850 -cpu f3719 -Wa,-I,D:\head main.c
```

-Xcxxcom

[Description format]

```
-Xcxxcom
```

- Interpretation when omitted
  None

[Function Description]

- In addition to ordinary comments, this option interprets all characters that appear after "//" and before the end of the line as comments (C++ comment style).

[Example of use]

- To interpret all characters that appear after "//" and before the end of the line as comments, describe as:

```
C:\>ca850 -cpu f3719 -Xcxxcom main.c
```

-Xd

[Description format]

```
-Xd
```

- Interpretation when omitted
  This option does not output a warning message in response to initialization of a pointer type external variable which uses a variable address that is not an automatic variable or which uses a function address.

[Function Description]

- This option outputs a warning message in response to initialization of a pointer type external variable which uses a variable address that is not an automatic variable or which uses a function address.

[Example of use]

- To output a warning message in response to initialization of a pointer type external variable which uses a variable address that is not an automatic variable or which uses a function address, describe as:

```
C:\>ca850 -cpu f3719 -Xd main.c
```

-Xm

[Description format]

```
-Xmnum
```

- Interpretation when omitted
  -Xm2047

[Function Description]

- This option specifies the upper limit for the number of macro identifiers. Specify decimal numbers up to 999999 as *num*.
- This option increases the size of the buffer used by the preprocessor.
  It is not possible, however, to use this to calculate the specific length of the character buffer that can be obtained.

[Example of use]

- To specify 32000 as the upper limit for the number of macro identifiers, describe as:

```
C:\>ca850 -cpu f3719 -Xm32000 main.c
```

-t

[Description format]

```
-t
```

- Interpretation when omitted
  None

[Function Description]

- This option replaces a trigraph sequence. This option specifies a three-character (trigraph) string to be replaced by a single character defined by the ANSI standard.
  See the documents related to the ANSI standard for details.

[Example of use]

- To replace a trigraph sequence, describe as:

```
C:\>ca850 -cpu f3719 -t main.c
```

Memory saving during compilation

The memory saving during compilation options are as follows.

- -Wp,-D
- -Wi,-D

-Wp,-D

[Description format]

```
-Wp,-D
```

- Interpretation when omitted
  None

[Function Description]

- This option reduces the memory capacity used in the pre-optimizer phase during compiling.
- Specify this option if compiling is not completed correctly because the memory of the machine runs short. When this option is specified, the compilation speed slow down.

[Example of use]

- To reduce the memory capacity used in the pre-optimizer phase during compiling, describe as:

```
C:\>ca850 -cpu f3719 -Wp,-D main.c
```

-Wi,-D

[Description format]

```
-Wi,-D
```

- Interpretation when omitted
  None

[Function Description]

- This option reduces the memory capacity used in the machine dependent optimization phase during compiling.
- Specify this option if compiling is not completed correctly because the memory of the machine runs short.
- When this option is specified, the compilation speed slow down.

[Example of use]

- To reduce the memory capacity used in the machine dependent optimization phase during compiling, describe as:

```
C:\>ca850 -cpu f3719 -Wi,-D main.c
```

Error output specification

The error output specification options are as follows.

- +err_file
- -err_file
- -err_limit

+err_file

[Description format]

```
+err_file=file
```

- Interpretation when omitted
  None

[Function Description]

- This option adds and saves error messages to file *file*.

[Example of use]

- To add and save error messages to the file "err", describe as:

```
C:\>ca850 -cpu f3719 +err_file=err main.c
```

-err_file

[Description format]

```
-err_file=file
```

- Interpretation when omitted
  None

[Function Description]

- This option overwrites and saves error messages to file *file*.

[Example of use]

- To overwrite and save error messages to the file "err", describe as:

```
C:\>ca850 -cpu f3719 -err_file=err main.c
```

-err_limit

[Description format]

```
-err_limit=num
```

- Interpretation when omitted
  The maximum number of error messages to be output is regarded as 15.

[Function Description]

- This option specifies the maximum number of error messages to be output, *num*.
- Specify 15 to 50 in decimal numbers as *num*.

[Example of use]

- To specify 50 as the maximum number of error messages to be output, describe as:

```
C:\>ca850 -cpu f3719 -err_limit=50 main.c
```

Expansion function specification

The expansion function specification option is as follows.

- -cc78k

-cc78k

[Description format]

```
-cc78k
```

- Interpretation when omitted

  The expansion functions compatible with the 78K microcontrollers C compiler CC78K*x* is invalid.

[Function Description]

[78K-compatible]

- This option enables the expansion functions compatible with the 78K microcontrollers C compiler CC78K*x*.

[Example of use]

- To enable the expansion functions compatible with the 78K microcontrollers C compiler CC78K*x*, describe as:

```
C:\>ca850 -cpu f3719 -cc78k main.c
```

Optimization

The optimization options are as follows.

- -Od
- -Ob
- -Og
- -O
- -Os
- -Ot

-Od

[Description format]

```
-Od
```

- Interpretation when omitted
  -Ob

[Function Description]

- This is the optimize for debugging option.
- This option generates codes emphasizing source debugging, without putting stress on the ROM capacity and execution speed.
- Its function is equivalent to the default optimization of CA850 Ver. 2.41 or earlier.

[Example of use]

- To generate codes emphasizing source debugging, describe as:

```
C:\>ca850 -cpu f3719 -Od main.c
```

-Ob

[Description format]

```
-Ob
```

- Interpretation when omitted
  -Ob

[Function Description]

- This is the default optimization option.
  This option generates codes emphasizing source debugging.
- It performs optimization within a range where source debugging is not affected.

[Example of use]

- To generate codes emphasizing source debugging within a range where source debugging is not affected, describe as:

```
C:\>ca850 -cpu f3719 -Ob main.c
```

-Og

[Description format]

```
-Og
```

- Interpretation when omitted
  -Ob

[Function Description]

- This is the standard optimization option.
  This option performs appropriate optimization.
- It performs optimization that allows debugging of the C source in most cases.
- Both the execution speed and code size are improved from those of the default option because external variables are assigned to registers.

[Example of use]

- To perform appropriate optimization, describe as:

```
C:\>ca850 -cpu f3719 -Og main.c
```

-O

[Description format]

```
-O
```

- Interpretation when omitted
  -Ob

[Function Description]

- This is the Level 1 advanced optimization.
  This option performs optimization emphasizing the ROM capacity.

[Example of use]

- To perform optimization emphasizing the ROM capacity, describe as:

```
C:\>ca850 -cpu f3719 -O main.c
```

-Os

[Description format]

```
-Os
```

- Interpretation when omitted
  -Ob

[Function Description]

- This is the Level 2 advanced optimization option (object size precedence).
  This option performs the maximum optimization placing the utmost emphasis on the ROM capacity.

[Example of use]

- To perform the maximum optimization placing the utmost emphasis on the ROM capacity, describe as:

```
C:\>ca850 -cpu f3719 -Os main.c
```

-Ot

[Description format]

```
-Ot
```

- Interpretation when omitted
  -Ob

[Function Description]

- This is the Level 2 advanced optimization option (execution speed precedence).
  This option performs the maximum optimization placing the utmost emphasis on the execution speed rather than the ROM capacity.

[Example of use]

- To perform the maximum optimization placing the utmost emphasis on the execution speed, describe as:

```
C:\>ca850 -cpu f3719 -Ot main.c
```

Target code optimization

The target code optimization options are as follows.

- -Wi,-O4
- -Wi,-P

-Wi,-O4

[Description format]

```
-Wi,-O4
```

- Interpretation when omitted
  None

[Function Description]

- This option strictly analyzes the data flow and performs the most advanced optimization.
- Specify this option, in addition to the optimization option -O, -Os, or -Ot, to perform more advanced optimization.
- Specifically, this option executes optimization as follows.
  - Optimization of registers extending over a branch instruction
  - Optimization of absolute value operations
  - Optimization of a cmp instruction extending over a branch instruction
  - Optimization of a return instruction extending over a branch instruction
- Depending on the source, the result may be the same as that of -O, -Os, or -Ot. The compiling time is longer than that of -Os or -Ot.

[Example of use]

- To analyze the data flow strictly and perform the most advanced optimization, describe as:

```
C:\>ca850 -cpu f3719 -Os -Wi,-O4 main.c
```

-Wi,-P

[Description format]

```
-Wi,-P
```

- Interpretation when omitted
  None

[Function Description]

- This option prevents optimization that allows branch destination labels to be aligned.
- This option can reduce the size of the execution code.
- This option is valid when Level 2 advanced option (execution speed precedence) -Ot is specified.

[Example of use]

- To prevent optimization that allows branch destination labels to be aligned during performing optimization giving priority to the execution speed, describe as:

```
C:\>ca850 -cpu f3719 -Ot -Wi,-P main.c
```

File merging

The file merging option is as follows.

- -Om

-Om

[Description format]

```
-Om
```

- Interpretation when omitted
  None

[Function Description]

- When two or more files are specified at the same time, this option merges the files.
- Although it will slow down the compiler, you can widen the scope of inline expansion by specifying optimization options -O, -Os, and -Ot at the same time. However, it makes source debugging difficult.

[Example of use]

- When two or more files are specified at the same time, to merges the files, describe as:

```
C:\>ca850 -cpu f3719 -Om -Os main.c sub.c
```

Inline expansion optimization control

The inline expansion optimization control options are as follows.

- -Wp,-G
- -Wp,-N
- -Wp,-S
- -Wp,-I
- -Wp,-inline
- -Wp,-no_inline
- -Wp,-r

-Wp,-G

[Description format]

```
-Wp,-Gnum
```

- Interpretation when omitted
  -Wp,-G32

[Function Description]

- This option restricts the stack size for a function subject to inline expansion to *num* specification in the intermediate language so that inline expansion is not performed for any value larger than *num*.
- See the -Wp,-I option for details about a yardstick of *num*.

[Example of use]

- To restrict the stack size for a function subject to inline expansion to 64 in intermediate language, describe as:

```
C:\>ca850 -cpu f3719 -Wp,-G64 main.c
```

-Wp,-N

[Description format]

```
-Wp,-Nnum
```

- Interpretation when omitted
  When the Level 2 advanced option (execution speed precedence) is specified, it is assumed that -Wp,-N128 has been specified. Otherwise, it is assumed that -Wp,-N24 has been specified.

[Function Description]

- This option restricts the intermediate language size for a function subject to inline expansion to *num* specification so that inline expansion is not performed for any value larger than *num*.
- See the -Wp,-I option for details about a yardstick of *num*.

[Example of use]

- To restrict the intermediate language size for a function subject to inline expansion to 64, describe as:

```
C:\>ca850 -cpu f3719 -Wp,-N64 main.c
```

-Wp,-S

[Description format]

```
-Wp,-S
```

- Interpretation when omitted
  None

[Function Description]

- This option unconditionally performs inline expansion of a static function that is referenced only once.

[Example of use]

- To perform inline expansion of a static function that is referenced only once unconditionally, describe as:

```
C:\>ca850 -cpu f3719 -Wp,-S -Os main.c
```

-Wp,-l

[Description format]

```
-Wp,-l[=file]
```

- Interpretation when omitted
  Function information is not output.

[Function Description]

- This option outputs function information to the standard output or additionally outputs to *file*.
- The output information is a yardstick for the value to be specified by the -Wp,-G and -Wp,-N options. For example, a function called is expanded inline if the function requires stack size equal to or less than the value specified by -Wp,-N. Also, it is expanded inline if the function requires code size equal to or less than the value specified by -Wp,-G.
- Note that the stack size output by this option is the size in intermediate language output by the pre-optimizer and is different from the stack size actually used by the function.

[Example of use]

- To output function information to the standard output, describe as:

```
C:\>ca850 -cpu f3719 -Wp,-l main.c
```

-Wp,-inline

[Description format]

```
-Wp,-inline
```

- Interpretation when omitted
  None

[Function Description]

- This option performs inline expansion of only a function for which #pragma inline is specified.
- When -Ot is specified, the compiler automatically identifies the function and performs inline expansion.
- Specify this option to expand only the function specified by the user.

[Example of use]

- To perform inline expansion of only a function for which #pragma inline is specified, describe as:

```
C:\>ca850 -cpu f3719 -Wp,-inline -Ot main.c
```

-Wp,-no_inline

[Description format]

```
-Wp,-no_inline
```

- Interpretation when omitted
  None

[Function Description]

- This option suppresses inline expansion of all functions, including the function for which #pragma inline is specified.
- It is useful for suppressing all inline expansion functions when -Ot is specified.

[Example of use]

- To suppress inline expansion of all functions, describe as:

```
C:\>ca850 -cpu f3719 -Wp,-no_inline -Ot main.c
```

-Wp,-r

[Description format]

```
-Wp,-r[funcname]
```

- Interpretation when omitted
  None

[Function Description]

- This option deletes unnecessary functions from the functions called from an entry function, *funcname*, after inline expansion.
- Specify *funcname* by prefixing '_' to a function described in C language. If *funcname* is not specified, it is assumed that "_main" has been specified.
- The function that is called only by an assembler source is deleted as an unnecessary function because the calling is not recognized.
  Interrupt functions and real-time OS tasks are not included as functions subject to deletion.

[Example of use]

- To delete unnecessary functions from the functions called from an entry function "func", after inline expansion.

```
C:\>ca850 -cpu f3719 -Wp,-r_func -Om -Os main.c sub.c
```

Loop expansion optimization control

The loop expansion optimization control options are as follows.

- -Wo,-Ol
- -Wo,-Xlo

-Wo,-Ol

[Description format]

```
-Wo,-Ol[num]
```

- Interpretation when omitted
  None

[Function Description]

- This option expands a loop *num* times using "for" and "while".
- This option can be specified only when performing optimization giving priority to the execution speed.
- The loop is converted into execution of a loop that is executed N times (N is a constant) and execution of a loop that includes a code expanded *num* times.
  If the code size after expansion is too great or if the number of times of execution of the loop is too few, the number of times of expansion may decrease, or the loop may not be expanded at all. In addition, a loop having a complicated structure, such as having inner loops, may not be expanded.
- If 0 or 1 is specified as *num*, expansion is suppressed[Note]. If *num* is not specified, it is assumed that 4 has been specified. Specify *num* in decimal numbers.

Note This option is useful when loop expansion does not need to be performed with the Level 2 advanced option (execution speed precedence) specified.

[Example of use]

- To expand a loop that is executed 10 times four times, describe as:

```
C:\>ca850 -cpu f3719 -Wo,-Ol4 -Ot main.c
```

If the following source is compiled,

```
i = 0;
while(i < 10) {
    /* Processing */
    ++i;
}
```

The following results are obtained.

```
i = 0;
/* Processing */
i =1;
/* Processing */
i = 2;
while(i < 10) {
    /* Processing */
    ++i;
    /* Processing */
    ++i;
    /* Processing */
    ++i;
    /* Processing */
    ++i;
}
```

-Wo,-Xlo

[Description format]

```
-Wo,-Xlo
```

- Interpretation when omitted
  None

[Function Description]

- This option expands a loop by fixing the number of times of expanding the loop to the value specified by -Wo,-Ol*num*.
- This option can be specified only when performing optimization giving priority to the execution speed.

[Example of use]

- To expands a loop by fixing the number of times of expanding the loop to 4 times, describe as:

```
C:\>ca850 -cpu f3719 -Wo,-Xlo -Ot main.c
```

strcpy, strcmp expansion

The strcpy, strcmp expansion option is as follows.

- -Xi

-Xi

[Description format]

```
-Xi
```

- Interpretation when omitted
  Inline expansion of strcpy() or strcmp() function calls does not performed.

[Function Description]

- This option sets a 4-byte alignment condition for arrays (including character strings) and structures and performs inline expansion of strcpy() or strcmp() function calls.
- This improves the execution speed of the object but it also increases the code size.
- This option executes conversion only when the second argument of strcpy() is a character string or when strcmp() is called. In addition, the program requires four-byte alignment of the arguments (the C compiler aligns the second argument of strcpy() since it is a character string).
- This option can not be specified together with the -Xpack option.

[Example of use]

- To set a four-byte alignment condition for arrays (including character strings) and structures and performs inline expansion of strcpy() or strcmp() function calls, describe as:

```
C:\>ca850 -cpu f3719 -Xi main.c
```

External variable sort

The external variable sort option is as follows.

- -Wo,-Op

-Wo,-Op

[Description format]

```
-Wo,-Op[=file]
```

- Interpretation when omitted
  External variables are not rearranged sequentially, starting from the largest alignment size.

[Function Description]

- This option rearranges external variables allocated to a section other than const/sconst sequentially, starting from the largest alignment size.
- If intermediate file *file* is specified, the definition and tentative definition of variables in the source file allocated to a section other than const/sconst having external linkage are moved to *file*. After being moved, the definition and tentative definition of variables in the source file are treated in the same manner as declaration. An error will not occur even if *file* does not exist at the beginning.

[Example of use]

- To rearrange external variables allocated to a section other than const/sconst sequentially, starting from the largest alignment size, describe as:

```
C:\>ca850 -cpu f3719 -Wo,-Op main.c
```

Branch instruction control

The branch instruction control option is as follows.

- -Wo,-XFo

-Wo,-XFo

[Description format]

```
-Wo,-XFo
```

- Interpretation when omitted
  A code that the debug information is given priority for branch instructions is output.

[Function Description]

- This option arranges and outputs branch instructions, giving precedence to the code size.
  However, it makes source debugging difficult.
- This option is valid when -Og, -O, -Os, or -Ot is specified.

[Example of use]

- To output a code with branch instructions arranged so that the code size is given priority and performs appropriate optimization, describe as:

```
C:\>ca850 -cpu f3719 -Os -Wo,-XFo main.c
```

Register use control

The register use control options are as follows.

- -r
- -reg
- -Xmask_reg

-r

[Description format]

```
-rnum=sym
```

- Interpretation when omitted
  External variables are not be statically allocated to a register.

[Function Description]

- This option allocates the specified external variable *sym* to register r*num*.
- In *num*, specify a register other than the mask register that is vacated by specifying the -reg option.
- *sym* is an external variable name. A volatile variable, variable using address operator, aggregate, array, variable having internal linkage, and peripheral I/O register cannot be specified.

[Example of use]

- To allocate external variable "arg" to register "r18" (when using the 22-register mode), describe as:

```
C:\>ca850 -cpu f3719 -reg22 -r18=arg main.c
```

-reg

[Description format]

```
-regn
```

- Interpretation when omitted
  -reg32

[Function Description]

- This option limits the number of registers used by the C compiler as *n* registers (*n* = register mode).
  The range of values that can be specified for *n* are as follows.

Table B-3. Register Mode

Register Mode (*n*)	Working Registers	Registers for Register Variables
22	r10 to r14	r25 to r29
26	r10 to r16	r23 to r29
32	r10 to r19	r20 to r29

- This option cannot be set independently for each source file. It is always used for all files.
- Since the settings by this option are also recognized by the linker, a library of the appropriate mode is referenced.
- By specifying this option, the register mode of the software register bank function can be changed.

[Example of use]

- To limit the number of registers used by the C compiler as 22 registers, describe as:

```
C:\>ca850 -cpu f3719 -reg22 main.c
```

-Xmask_reg

[Description format]

```
-Xmask_reg
```

- Interpretation when omitted
  The mask register function is invalid.

[Function Description]

- This option specifies use of the mask register function.
- When this function is used, the C compiler outputs codes, assuming that an 8-bit mask value, 0xff, is set to r20 and a 16-bit mask value, 0xffff, is set to r21. Mask values must be set to the mask registers (r20 and r21) by a user program such as the startup routine.
- With the V850 microcontrollers, byte data and half-word data are sign-extended to word length, depending on the value of the highest bit, when they are loaded from memory to registers. Consequently, the mask code of the higher bits may be generated when an operation on unsigned char or unsigned short type data is performed. When the result of an operation is stored in a register variable, a mask code is generated for unsigned byte data and unsigned half-word data to clear the higher bits.
  In both the cases, generation of the mask code can be avoided if word data is used. If word data cannot be used and a mask code is generated, the code size can be reduced by using the mask register function.
- To decide whether the mask register function is to be used or not, the following points must be thoroughly considered.
  - Is it a program that outputs many mask codes?
  - Two registers for register variables are used as mask registers: Does this have any effect?
- If an object that uses a mask register and an object that does not use a mask register exist together when this option is specified, the linker outputs an error.
- In the 32 register mode, -mask_reg is passed to the linker. As a result, the standard library is searched by the linker first in the mask register folder (lib850\r32msk) and then the standard folder.

[Example of use]

- To use the mask register function, describe as:

```
C:\>ca850 -cpu f3719 -Xmask_reg main.c
```

Prologue/epilogue processing control

The prologue/epilogue processing control option is as follows.

- -Xpro_epi_runtime

-Xpro_epi_runtime

[Description format]

```
-Xpro_epi_runtime[=on|=off]
```

- Interpretation when omitted
  -Xpro_epi_runtime=off (when -Ot is specified)
  -Xpro_epi_runtime=on (-Ot is not specified)

[Function Description]

- This option specifies whether or not to perform prologue/epilogue processing of the function based on runtime library function calls.
- If "on" is specified, prologue/epilogue processing of the function is performed based on runtime library function calls.
- If neither [=on] or [=off] is specified, it is assumed that [=on] has been specified. This option is set to "on" by default, and is set to "off" if [=off] is specified or the -Ot option is specified.

[Example of use]

- Not to perform prologue/epilogue processing of the function based on runtime library function calls, describe as:

```
C:\>ca850 -cpu f3719 -Xpro_epi_runtime=off main.c
```

Variable placement control

The variable placement control options are as follows.

- -G
- -Xsconst
- -Xcre_sec_data
- -Xcre_sec_data_only
- -Xsec_file

-G

[Description format]

```
-Gnum
```

- Interpretation when omitted
  all data is allocated to the .sdata section or the .sbss section.

[Function Description]

- This option allocates data of less than *num* bytes to the .sdata or .sbss section.
- Data specified by the .sdata or .sbss section in the #pragma section directive or in "B.7.1 Section file" is allocated to that section regardless of the size.
- Specify *num* in decimal numbers. A yardstick for the value to be set is output by the -A option of the linker.

[Example of use]

- To allocate data of less than 16 bytes to the .sdata or .sbss section, describe as:

```
C:\>ca850 -cpu f3719 -G16 main.c
```

-Xsconst

[Description format]

```
-Xsconst[=num]
```

- Interpretation when omitted
  all the const attribute data and character string literals are allocated to the .const section.

[Function Description]

- This option allocates const attribute data and character string literals to the .sconst section.
- If *num* has been specified, data whose size is *num* bytes or less is allocated to the .sconst section and if *num* has been omitted, allocation is performed regardless of the data size.
- Specify *num* in decimal numbers.
- If a different option is specified for each file, a code of a different method of placing and referencing variables may be generated and an error or warning may be output during linking.

[Example of use]

- To allocates const attribute data and character string literals to the .sconst section, describe as:

```
C:\>ca850 -cpu f3719 -Xsconst main.c
```

-Xcre_sec_data

[Description format]

```
-Xcre_sec_data[=outfile]
```

- Interpretation when omitted
  The frequency information file for the variables is not output.

[Function Description]

- This option outputs the frequency information file for the variables used by the Section File Generator.

(1) If the file name is specified as *outfile*
Saves *outfile* to the current folder under the specified file name.

(2) If the folder is specified as *outfile*
Saves the file under the file name with extension .c or .ic replaced by .sec to the specified folder.

(3) If =*outfile* is omitted
Saves the file under the file name with extension .c or .ic replaced by .sec to the current folder.

(4) If two or more files are output
Creates a folder specified for *outfile*, and saves the files under each file name with extension .c or .ic replaced by .sec.

- If several C source files exist, and a frequency information file is to be created with a file name specified for each file, specify this option with "=*outfile*" for each C source file from the command line. C source files are specified one at a time.
- The frequency information file for the variables outputs information how often the ld or st instruction accesses variables in the C source file. Nothing is performed on the assembler source file.
- If this option and the -Xcre_sec_data_only option are specified at the same time, the -Xcre_sec_data_only option takes precedence.

[Example of use]

- To output the frequency information file for the variables (main.sec), describe as:

```
C:\>ca850 -cpu f3719 -Xcre_sec_data main.c
```

-Xcre_sec_data_only

[Description format]

```
-Xcre_sec_data_only[=outfile]
```

- Interpretation when omitted
  The frequency information file for the variables is not output.

[Function Description]

- This option outputs the frequency information file for the variables used by the Section File Generator.
  However, unlike the -Xcre_sec_data, this option outputs only the frequency information file for the variables and does not perform object generation.
- This option is used when outputting only the frequency information file.

(1) If the file name is specified as *outfile*

Saves *outfile* to the current folder under the specified file name.

(2) If the folder is specified as *outfile*

Saves the file under the file name with extension .c or .ic replaced by .sec to the specified folder.

(3) If =*outfile* is omitted

Saves the file under the file name with extension .c or .ic replaced by .sec to the current folder.

(4) If two or more files are output

Creates a folder specified for *outfile*, and saves the files under each file name with extension .c or .ic replaced by .sec.

- If several C source files exist, and a frequency information file is to be created with a file name specified for each file, specify this option with "=*outfile*" for each C source file from the command line. C source files are specified one at a time (by specifying -c).
- The frequency information file for the variables outputs information how often the ld or st instruction accesses variables in the C source file. Nothing is performed on the assembler source file.

[Example of use]

- To output only the frequency information file for the variables (main.sec) and not to perform object generation, describe as:

```
C:\>ca850 -cpu f3719 -Xcre_sec_data_only main.c
```

-Xsec_file

[Description format]

```
-Xsec_file=file
```

- Interpretation when omitted
  None

[Function Description]

- This option specifies the name of the section file (see "B.7.1 Section file") that is used to specify section allocation of data when the C compiler is activated. Be sure to specify the file name.
- Two or more section files can be input by specifying this option two or more times.

[Example of use]

- To specify the name of the section file (section) that is used to specify section allocation of data when the C compiler is activated, describe as:

```
C:\>ca850 -cpu f3719 -Xsec_file=section main.c
```

signed/unsigned control

The signed/unsigned control options are as follows.

- -Xbitfield
- -Xchar
- -Xenum_type

-Xbitfield

[Description format]

```
-Xbitfield=string
```

- Interpretation when omitted
  int type bit fields that do not indicate the type specifier (signed or unsigned) are handled as signed.

[Function Description]

- This option specifies whether int type bit fields that do not indicate the type specifier (signed or unsigned) are handled as signed or unsigned.
- The following can be specified as *string*.

s	Handled as signed
signed	Handled as signed
u	Handled as unsigned
unsigned	Handled as unsigned

- A warning message is output when the specification is handled as unsigned.

[Example of use]

- To handle int type bit fields that do not indicate the type specifier (signed or unsigned) as signed, describe as:

```
C:\>ca850 -cpu f3719 -Xbitfield=s main.c
```

-Xchar

[Description format]

```
-Xchar=string
```

- Interpretation when omitted
  This option handles char type that do not indicate the type specifier (signed or unsigned) as signed.

[Function Description]

- This option specifies whether char type that do not indicate the type specifier (signed or unsigned) are handled as signed or unsigned.
- The following can be specified as *string*.

s	Handled as signed
signed	Handled as signed
u	Handled as unsigned
unsigned	Handled as unsigned

[Example of use]

- To handle char type that do not indicate the type specifier (signed or unsigned) as signed, describe as:

```
C:\>ca850 -cpu f3719 -Xchar=s main.c
```

-Xenum_type

[Description format]

```
-Xenum_type=string
```

- Interpretation when omitted
  The enumeration type is handled as signed int.

[Function Description]

- This option specifies which integer type the enumeration type matches.
- The following can be specified as *string*.

char	Handled as signed char
uchar	Handled as unsigned char
short	Handled as short
ushort	Handled as unsigned short

[Example of use]

- To handle the enumeration type as signed char, describe as:

```
C:\>ca850 -cpu f3719 -Xenum_type=char main.c
```

Switch-case statement output code control

The switch-case statement output code control options are as follows.

- -Xcase
- -Xword_switch

-Xcase

[Description format]

```
-Xcase=string
```

- Interpretation when omitted
  The code output format for switch statements that the compiler considers optimal is automatically determined.

[Function Description]

- This option specifies a mode in which the code of a switch statement is to be output.
- The following can be specified as *string*.

ifelse	Outputs the code in the same format as the if-else statement along a string of case statements. If the case statements are written in the order of frequency or if only a few labels are used, select this option. Because the case statements are compared starting from the top, unnecessary comparison can be reduced and the execution speed can be increased if the case statement that most often matches is written first.
binary	Outputs the code in the binary search format. Searches for a matching case statement by using a binary search algorithm. If this option is selected when many labels are used, any case statement can be found at almost the same speed.
table	Outputs the code in a table jump format. References a table indexed on the values in the case statements, and selects and processes case labels from the switch statement values. Code will branch to all the case statements with about the same speed.If case values are not used in succession, an unnecessary area is created.

- A warning message is output when the specification is handled as unsigned.

[Example of use]

- To output a code for the switch statement in the binary search format, describe as:

```
C:\>ca850 -cpu f3719 -Xcase=binary main.c
```

-Xword_switch

[Description format]

```
-Xword_switch
```

- Interpretation when omitted
  2-byte branch tables are generated.

[Function Description]

- This option generates one 4-byte branch table per case label in a switch statement.
- Specify this option when a compile error occurs because the switch statement is long.

[Example of use]

- To generate 4-byte branch tables per case label, describe as:

```
C:\>ca850 -cpu f3719 -Xword_switch main.c
```

Structure packing control

The structure packing control options are as follows.

- -Xbyte
- -Xpack

-Xbyte

[Description format]

```
-Xbyte
```

- Interpretation when omitted
  None

[Function Description]

- This option specifies indirect address access to a structure in byte units.
- Use this option if a limit is exceeded when the structure packing function is used.

[Example of use]

- To specify indirect address access to a structure in byte units, describe as:

```
C:\>ca850 -cpu f3719 -Xbyte main.c
```

-Xpack

[Description format]

```
-Xpack=num
```

- Interpretation when omitted
  None

[Function Description]

- By using this option, the specified alignment can be used without aligning structure members in accordance with the type of each member.
- The data size can be reduced but the code size increases. 1, 2, 4, or 8 can be specified as *num*. The default value is 8[Note].
- If this option is specified if structure packing is specified by the #pragma directive in the C source, the value specified by this option is applied to all structures until the first #pragma directive appears. After that, the value of the #pragma directive is applied.
  Even after the #pragma directive has appeared, however, the value specified by the option is applied if the default value is specified.
- This option can not be specified together with the -Xi option.
- This option has following restrictions, when using the V850/V850Ex/V850E2 core that is set to disable misalign access. These restrictions are the same as for #pragma pack.
- The addresses of structure members cannot be correctly obtained.
- Accessing a bit field also accesses data area because the type of the member is read.
  If the width of the bit field is less than the type of the member, the outside of the object is accessed because the type of the member is read. Usually, no problem with execution occurs, but an illegal access may be made if I/O is mapped.

Note With this version, the operation when the value of *num* is "4" is the same as that when it is "8".

[Example of use]

- To align structure members by using the specified alignment (1), describe as:

```
C:\>ca850 -cpu f3719 -Xpack=1 main.c
```

Far jump output control

The far jump output control options are as follows.

- -Xfar_jump
- -Xj

-Xfar_jump

[Description format]

```
-Xfar_jump=file
-Xfar_jump file
```

- Interpretation when omitted
  The jarl directive is used to branch to the function.

[Function Description]

- The jmp directive is used to branch to the function specified in *file*.
- The linker outputs an error if the function is in a range that cannot be branched to by the jarl or jr directive (±2MB or more), in which case this option is used to recompile.
- A extension is necessary for a file name. The extension ".fjp" is recommended.
- This option cannot be specified to call a function at the flash side from the boot side by using the flash/external ROM re-link function. See "B.3.3 Boot-flash relink function" for details.

[Example of use]

- To use jmp directive to branch to the function specified in func.fjp, describe as:

```
C:\>ca850 -cpu f3719 -Xfar_jump=func.fjp main.c
```

-Xj

[Description format]

```
-Xj
```

- Interpretation when omitted
  The jr instruction is used for an ordinary interrupt function defined in C language.

[Function Description]

- This option uses the jmp instruction for an ordinary interrupt function defined in C language.
- The linker outputs an error if the function is in a range that cannot be branched to by the jr directive (1MB or more), in which case this option is used to recompile. The jr instruction is used if this option is omitted.
- This option cannot be specified to call a function at the flash side from the boot side by using the flash/external ROM re-link function. See "B.3.3 Boot-flash relink function" for details.

[Example of use]

- To use the jmp instruction for an ordinary interrupt function defined in C language, describe as:

```
C:\>ca850 -cpu f3719 -Xj main.c
```

Comment output

The comment output option is as follows.

- -Xc

-Xc

[Description format]

```
-Xc
```

- Interpretation when omitted
  The C source program is not output as a comment to the assembler source file.

[Function Description]

- This option outputs the C source program as a comment to the assembler source file.
- However, the output comments are for reference only and may not correspond exactly to the code.
  For example, comments concerning global variables, local variables, function declarations, etc., may be output to incorrect positions. If the code is deleted by the optimization, only the extracted comment may remain.
- To use this option, one of -S, -a, -Fs, or -Fv must be specified.

[Example of use]

- To output the C source program as a comment to the assembler source file (main.s), describe as:

```
C:\>ca850 -cpu f3719 -Xc -S main.c
```

ANSI standard

The ANSI standard options are as follows.

- -Xe
- -Xdefvar
- -ansi

-Xe

[Description format]

```
-Xe
```

- Interpretation when omitted
  The mulh and divh directives are used for integers corresponding to data that is 16 bits or less.

[Function Description]

- This option specifies that runtime library ___mul/___mulu or ___div/___divu will be used when using the V850, runtime library mul/mulu or div/divu will be used when using the V850E, without using the mulh and divh directives for integers corresponding to data that is 16 bits or less.
- This option slows the processing speed but strictly performs with the multiplication and division processing under the ANSI standard.
- The runtime library of the C compiler is prepared as the standard library of CA850 so that the instructions not provided to the architecture of the V850 microcontrollers satisfy the ANSI standard.

[Example of use]

- To use runtime library ___mul/___mulu or ___div/___divu for integers corresponding to data that is 16 bits or less, describe as:

```
C:\>ca850 -cpu f3719 -Xe main.c
```

-Xdefvar

[Description format]

```
-Xdefvar
```

- Interpretation when omitted
  None

[Function Description]

- This option treats tentative definition of variables as definition.
- If this option is specified, then if there are tentative definitions with the same name in multiple files, it is possible that they will not be linked into one definition during linking, and a multiple-definition error will occur.

[Example of use]

- To treat tentative definition of variables as definition, describe as:

```
C:\>ca850 -cpu f3719 -Xdefvar main.c
```

-ansi

[Description format]

```
-ansi
```

- Interpretation when omitted
  Compatibility with the conventional C language specifications is conferred and processing continues after warning message is output.

[Function Description]

- This option makes C compiler processing comply strictly with the ANSI standard and outputs an error or warning for a specification that violates the standard.
- Extended description other than in _asm format is recognized.
- Specifying this option defines the macro name __STDC__.
- Processing when compiling in strict adherence to the language specification is as follows.

(1) Trigraph sequences

Replaces trigraphs. They are not replaced if this option is not specified.

(2) Bit fields

An error occurs if a type other than an int type is specified in a bit field. If this option is not specified, a warning is output and the specification is permitted.

(3) Scope of arguments

If an automatic variable with the same name as a function argument is declared, a duplicate definition error occurs. If this option is not specified, a warning is output and the automatic variable is valid.

(4) Pointer assignment

(a) An error occurs if a pointer type numeric value is assigned to a general integer type variable. If this option is not specified, a warning is output and the pointer is assigned by casting.

(b) An error occurs if pointers that point to different types are assigned. If this option is not specified, a warning is output and the specification is permitted.

(5) Type conversion

An error occurs if a non-left side value array is converted to a pointer. If this option is not specified, a warning is output and the specification is permitted.

(6) Comparison operators

An error occurs if an arithmetic type variable and a pointer are compared. If this option is not specified, a warning is output and the specification is permitted.

(7) Conditional operators

An error occurs if the second and third expressions are not both general integer types, the same structure, the same union, or pointer types to the same type of assignment target. If this option is not specified, a warning is output and the pointer is assigned by casting.

(8) #line-number

An error occurs. If this option is not specified, #line-number is treated the same way as "#line line-number".

(9) "#" character within a line

An error occurs. If this option is not specified, a warning is output and the specification is permitted.

(10) _asm

A warning is output and _asm is treated as a function call. However, __asm is valid. If this option is not specified, __asm is treated as an assembler insert.

(11) __STDC__

A macro with a value of 1 is defined. If this option is not specified, the macro name is not defined as a macro.

(12) Binary constant

Binary constant is unusable. If this option is not specified, a string that consists of "0b" or "0B" followed by one or more "0" or "1" is treated as a binary constant.

[Example of use]

- To make C compiler processing comply strictly with the ANSI standard and outputs an error or warning for a specification that violates the standard, describe as:

```
C:\>ca850 -cpu f3719 -ansi main.c
```

Library specification

The library specification options are as follows.

- -L
- -R
- -l

-L

[Description format]

```
-Ldir
```

- Interpretation when omitted
  Only the standard folder is searched.

[Function Description]

- This option searches libraries from folder *dir*, the standard folder in that order.
- The standard folder is "install folder\CA850\Vx.xx[Note]\lib850" and "install folder\CA850\Vx.xx[Note]\lib850\r32". If the register mode is specified, however, r22 or r26 folder is searched instead of r32 folder.

Note V*x.xx* is the version of the C compiler.

- See the -L option of the linker.

[Example of use]

- To searche libraries from folder "dir", the standard folder in that order, describe as:

```
C:\>ca850 -cpu f3719 -Llib main.c
```

-R

[Description format]

```
-R file
```

- Interpretation when omitted
  crtN.o or crtE.o in the standard folder is used as the startup module. The standard folder is "install folder\CA850\Vx.xx[Note]\lib850\r32(r26, r22)".

Note V*x.xx* is the version of the C compiler.

[Function Description]

- When startup goes as far as the linker, the startup module to be used is indicated to the linker as *file*.

[Example of use]

- To indicate to the linker that the startup module to be used is as start.o, describe as:

```
C:\>ca850 -cpu f3719 -R start.o main.c
```

-l

[Description format]

```
-lstring
```

- Interpretation when omitted
  Nothing is referenced. When activating the linker from the C compiler, however, the C compiler automatically passes the link specification of the standard library (-lc) and mathematical library (-lm) to the linker.

[Function Description]

- This option specifies the archive file that is referenced by the linker.
  When activating the linker from the C compiler, however, the C compiler automatically passes the link specification of the standard library (-lc) and mathematical library (-lm) to the linker.
- See the library specification option (-l) of the linker for how to specify an archive file.

[Example of use]

- To specify the archive file (libarc.a) that is referenced by the linker, describe as:

```
C:\>ca850 -cpu f3719 -larc main.c
```

Warning message control

The warning message control options are as follows.

- -w
- -won
- -woff

-w

[Description format]

```
-wnum
-wstring+
-wstring-
```

- Interpretation when omitted
  If -w*num* is omitted, it is assumed that -w1 has been specified.
  If -w*string*+, -w*string*- are omitted, the warning message output is according to the -w*num* level.

[Function Description]

- -w*num* specifies the level of warning messages.
- The following number can be specified as *num*.

0	Suppresses messages
1	Outputs normal warning messages
2	Outputs detailed warning messages

- If *num* is omitted, it is assumed that -w0 has been specified.
- -w*string*+ and -w*string*- specify outputting or suppressing a warning message for each parameter regardless of the level. A warning message is output when "+" has been specified or is suppressed when "-" has been specified.
- The following character strings can be specified as *string*.

bitfield_align	When bit field members have exceeded the boundary set by the alignment condition and have been allocated starting from the next boundary
bitfield_type	When a type that cannot be specified in the ANSI specification is specified for the bit field
callnodecl	When an undeclared function is called
cast_type	When conversion to a type whose size is smaller than that of the original type is performed
comparison	When the comparison expression is always true (or false)
nopic	When a pointer type external variable is initialized by using a variable address that is not an automatic variable or a function address
pragma	When a non-executable #pragm+a description appears
sharp	When a sharp symbol (#) appears in a source line

- An error occurs if neither "+" nor "-" has been specified.

[Example of use]

- To output detailed warning messages, describe as:

```
C:\>ca850 -cpu f3719 -w2 main.c
```

- To output warning messages when a type that cannot be specified in the ANSI specification is specified for the bit field, describe as:

```
C:\>ca850 -cpu f3719 -wbitfield_type+ main.c
```

-won

[Description format]

```
-won=num[,num]...
-won=num1-num2[,num3-num4]...
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs a warning message of the number specified by *num*.
- A warning message in the 2000s can be specified as *num*.
- When the W2042 warning message is output, specify "-won=2042". If *num1-num2* is specified, the warning messages from *num1* to *num2* are specified. *num* cannot be omitted.
- If a warning number not provided in the C compiler is specified, a warning message is output.

[Example of use]

- To output the W2042 warning message, describe as:

```
C:\>ca850 -cpu f3719 -won=2042 main.c
```

-woff

[Description format]

```
-woff=num[,num]...
-woff=num1-num2[,num3-num4]...
```

- Interpretation when omitted
  None

[Function Description]

- This option suppresses a warning message of the number specified by *num*.
- A warning message in the 2000s can be specified as *num*.
- When the W2042 warning message is suppressed, specify "-woff=2042". If *num1-num2* is specified, the warning messages from *num1* to *num2* are specified. *num* cannot be omitted.
- If a warning number not provided in the C compiler is specified, a warning message is output.

[Example of use]

- To suppress the W2042 warning message, describe as:

```
C:\>ca850 -cpu f3719 -woff=2042 main.c
```

Command file specification

The command file specification option is as follows.

- @

@

[Description format]

```
@cfile
```

- Interpretation when omitted
  Command files are assumed not to exist.

[Function Description]

- This option handles *cfile* as a command file (see "(2) Command file"). As a result, there is no need to be aware of the length limits of option character strings.
- In the command file, the arguments to be specified can be coded over several lines, but do not divide options, file names, and the like across two lines.

[Example of use]

- To handle "command" as a command file, describe as:

```
C:\>ca850 @command main.c
```

CPU bug patch

The CPU bug patch option is as follows.

- -Xv850patch

-Xv850patch

[Description format]

```
-Xv850patch[=num]
```

- Interpretation when omitted
  None

[Function Description]

- This option specifies the -p[*num*] option for the assembler according to the *num* specification for an assembler source file output by the C compiler to output a code corresponding to a CPU fault (see "(2) Options for avoiding CPU faults").
- 1, 2, 3, 4, 4a, 5, 6, 7, 8, 9, 10, or 11 can be specified as *num*. 5 to 10 are valid for the V850E/ES core only.
- If =*num* is omitted, it is assumed that "1, 2, 3, 4, 4a, 5, 6, 7, 8, 9, 10" has been specified as *num*.
- This option is to avoid faults of the CPU. To determine whether or not a fault that has occurred is from the CPU being used, see the documents supplied with the CPU.
- Only the -Xv850patch=11 option is handled by the C compiler. If the -Xv850patch=11 option is specified, the following instructions are not output.
  - set1/clr1/not1
  - Misalign access of V850E/ES core (during structure packing)

  If these instructions are used in an asm statement and an assembler source file, they are output as is because asm statements and assembly language source files are not checked.
- When specifying the -Xv850patch=11 option and describing bit access to the peripheral I/O register in the program, access to the peripheral I/O register is in word (4-byte) units. Change descriptions to byte/half-word unit operation, not bit access.
- The faults between CPU core and patch option is as follows (for the newest version µPD70(F)3xxx, not including maintenance or obsolete products).
  To determine whether or not the failure affects the CPU being used, see the CPU's documentation.

Table B-4. Faults Between CPU Core and -Xv850patch Option

CPU Core	-Xv850patch=11
V850 core	-
V850E/MS1	A
V850E1 core	A
V850ES core	A
V850E2 core	-

Remark A: Affected
-: Not affected

[Example of use]

- To specify the -p4a option for the assembler for an assembler source file output by the C compiler to output a code corresponding to a CPU fault, describe as:

```
C:\>ca850 -cpu f3719 -Xv850patch=4a main.c
```

Each module

The C compiler can pass options to each module.

- -W

-W

[Description format]

```
-Wx,option
```

- Interpretation when omitted
  None

[Function Description]

- This option passes *option* as an option for module *x*. If *option* includes a comma, the option is assigned as multiple options, each delimited by a comma.
- The following can be specified as module *x*.

p	Pre-optimizer (popt)
o	Global optimization module (opt)
i	Machine-dependent optimization module (impr)
a	Assembler (as850)
l	Linker (ld850)

(1) Pre-optimizer (popt)

(a) -Wp,-D

This option reduces the memory capacity used during compiling.

(b) -Wp,-G*num*

This option restricts the stack size for a function subject to inline expansion to *num* specification in intermediate language so that inline expansion is not performed for any value larger than *num*.
See the -Wp,-I option for details about a yardstick of *num*.
If this option is not specified, it is assumed that -Wp,-G32 has been specified.

(c) -Wp,-N*num*

This option restricts the intermediate language size for a function subject to inline expansion to *num* specification so that inline expansion is not performed for any value larger than *num*.
See the -Wp,-I option for details about a yardstick of *num*.
If this option is not specified and the Level 2 advanced option (execution speed precedence) is specified, it is assumed that -Wp,-N128 has been specified. Otherwise, it is assumed that -Wp,-N24 has been specified.

(d) -Wp,-S

This option performs inline expansion of a static function that is referenced only once unconditionally.

(e) -Wp,-l[=file]

This option outputs function information to the standard output or additionally outputs to *file*.
The output information is a yardstick for the value to be specified by the -Wp,-G and -Wp,-N options. For example, a function called is expanded inline if the function requires stack size equal to or less than the value specified by -Wp,-N. Also, it is expanded inline if the function requires code size equal to or less than the value specified by -Wp,-G.
Note that the stack size output by this option is the size in intermediate language output by the pre-optimizer and is different from the stack size actually used by the function.

(f) -Wp,-r[_*funcname*]

This option deletes unnecessary functions from the functions called from an entry function, *funcname*, after expansion.
Specify *funcname* by prefixing '_' to a function. If *funcname* is not specified, it is assumed that "_main" has been specified.
The function that is called only by an assembler statement is deleted as an unnecessary function because the calling is not recognized. Interrupt functions and real-time OS tasks are not included as functions subject to deletion.

(g) -Wp,-inline

This option performs inline expansion of only a function for which #pragma inline is specified.

(h) -Wp,-no_inline

This option suppresses inline expansion of all functions, including the function for which #pragma inline is specified.

(2) Global optimization module (opt)

(a) -Wo,-Ol[*num*]

This option expands a loop *num* times using "for" and "while".
This option can be specified only when performing optimization giving precedence to the execution speed.
The loop is converted into execution of a loop that is executed N times (N is a constant) and execution of a loop that includes a code expanded *num* times. If the code size after expansion is too great or if the number of times of execution of the loop is too few, the number of times of expansion may decrease, or the loop may not be expanded at all. In addition, a loop having a complicated structure, such as having inner loops, may not be expanded.
If 0 or 1 is specified as *num*, expansion is suppressed[Note]. If *num* is not specified, it is assumed that 4 has been specified. Specify *num* in decimal numbers.

Note This option is useful when loop expansion does not need to be performed with the Level 2 advanced option (execution speed precedence) specified.

Example

When a loop that is executed 10 times expands four times

```
i = 0;
while(i < 10) {
    /* Processing */
    ++i;
}
```

```
i = 0;
/* Processing */
i =1;
/* Processing */
i = 2;
while(i < 10) {
    /* Processing */
    ++i;
    /* Processing */
    ++i;
    /* Processing */
    ++i;
    /* Processing */
    ++i;
}
```

(b) -Wo,-Op[=*file*]

This option rearranges external variables allocated to a section other than const/sconst sequentially, starting from the largest alignment size.
If intermediate file *file* is specified, the definition and tentative definition of variables in the source file allocated to a section other than const/sconst having external linkage are moved to *file*. After being moved, the definition and tentative definition of variables in the source file are treated in the same manner as declaration. An error will not occur even if *file* does not exist at the beginning.

(c) -Wo,-XFo

This option outputs code giving precedence to the code size for branch instructions.
However, the debug information will be affected. This option is valid when -Og, -O, -Os, or -Ot is specified.
If this option is omitted, this option outputs code giving precedence to debug information for branch instructions.

(d) -Wo,-Xlo

This option expands a loop under the condition of the version CA850 Ver. 2.02 or earlier.

(3) Machine-dependent optimization module (impr)

(a) -Wi,-D

This option reduces the memory capacity used during compiling.
However, the compilation speed slow down. Specify this option if too much memory is used so that the compiler is unable to operate normally.

(b) -Wi,-O4

This option analyzes the data flow strictly and performs the following optimization.

- Optimization of registers extending over a branch instruction
- Optimization of absolute value operations
- Optimization of a cmp instruction extending over a branch instruction

- Optimization of a return instruction extending over a branch instruction

However, the compilation speed slow down. Specify this option, in addition to optimization option -O, -Os, or -Ot, to analyze the data flown powerfully.

(c) -Wi,-P

This option suppresses optimization that aligns labels. As a result, the code size can be reduced.

(4) Assembler (as850)

See "B.2.3 Option".

(5) Linker (ld850)

See "B.3.2 Option".

[Example of use]

- To analyze the data flow strictly and perform the optimization, describe as:

```
C:\>ca850 -cpu f3719 -Wi,-O4 -Os main.c
```

Other

Other option is as follows.

- +Oc

+Oc

[Description format]

```
+Oc
```

- Interpretation when omitted
  None

[Function Description]

- This option performs advanced optimization.
- This function is valid by default if the V850E2 core device is specified as a device type.

[Example of use]

- To perform advanced optimization, describe as:

```
C:\>ca850 +Oc -Ot -Wi,-O4 main.c
```

B.1.5 Cautions

(1) Specifying multiple options

Some options become invalid if they are specified at the same time as certain other options. Of the following options, those on the right of the ">" symbol become invalid if they are specified with the options shown on the left of the ">" symbol.

- -E > -P
- -U > -D
- -E/-P > -G > -L > -O > -R > -S > -Wc > -a > -c > -l > -m > -o
  Since execution is terminated during preprocessing, the options related to the modules following the front end are invalid.
- -S > -L / -R / -W[a|l] / -a / -c / -l
  Since execution is terminated at the code generation module or the machine-dependent optimization module, the options related to the modules following the assembler are invalid.
- -V / -help
  Any option that is specified after this is invalid.Moreover, this option is specified, all the other options become invalid.
- -c > -L / -R / -Wl / -l
  Since execution is terminated at the assembler, the options related to the modules following the linker are invalid.
- -m > -G / -L / -O / -R / -S / -Wc / -a / -c / -l
  Since execution is terminated at the front end, the options related to the modules following the pre-optimizer are invalid.
- -Og / -O / -Os / -Ot > -a / -Fv
  If -Og, -O, -Os, or -Ot has been specified, an incorrect display may result.
- -Od / -Ob / -Og / -O / -Os / -Ot
  Any option that is specified after this is invalid.
- -w / -w[1|2]
  Any option that is specified before this is invalid.

(2) Command file

Instead of specifying options and file names for commands as command-line arguments, they can be specified in a command file. The C compiler treats the contents of a command file as if they were command-line arguments. In the command file, the arguments to be specified can be coded over several lines. However, options and file names must not be coded over more than one line. Command files cannot be nested.
In the command file, the following characters are treated as special characters.

" (double quotation mark)	The character string before the next " (double quotation mark) is treated as a contiguous character string.
# (sharp)	If specified at the beginning of a line, characters on that line before the end of the line are treated as a comment.
^ (circumflex)	The character immediately following this is not treated as a special character.

The special characters themselves are not included in the command line of the C compiler for which a command file is specified, but deleted.

Remark With the as850, ar850, hx850, dump850, dis850, and romp850, only " (double quotation mark) can be used.

- Example of command file

```
-Dtest          ... Describes #define test
-o object       ... Specifies an object file name
a.c             ... Specifies the file to be compiled
```

- Example of command file specification

```
C:\>type cfile
        -cpu 3201 -c -Os file.c <-contents of command file
C:\>ca850 @cfile  ... Same operation as ca850 -cpu 3201 -c -Os file.c
```

(3) Efficient use of optimization

"Optimization" is processing used to increase the execution speed of an application or to decrease the ROM capacity to be used. How optimization is performed differs depending on the level of optimization. If a high level of optimization is selected, the compilation speed may slow down and the probability of allocating C source lines to be deleted or changed and variables to registers increases. In the latter case, phenomena such as being unable to set breakpoints with the debugger may occur, and the debugging efficiency may be affected.
Below is an overview of the optimizations that can be specified with the -O option, and a guideline for efficient use of optimization.

Figure B-3. Optimization Processing and Parameters

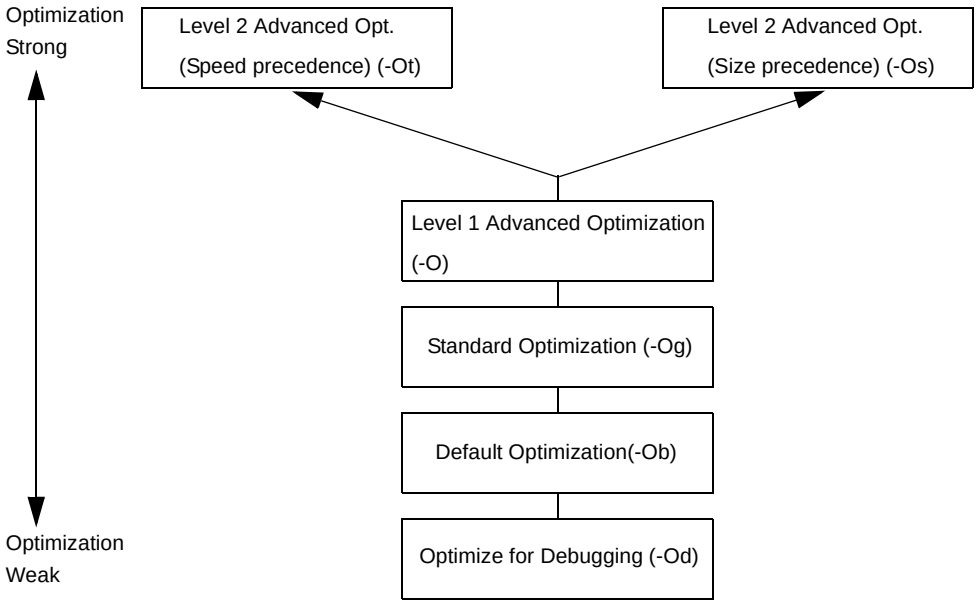


Table B-5. Optimization Processing and Items

Option: Optimization Function	Effect			
	Debug	Code Efficiency	Execution Speed	Compilation Time
-Od: Optimize for Debugging	Level 4	Level 1	Level 1	Level 3
-Ob: Default Optimization	Level 3	Level 2	Level 2	Level 3
-Og: Standard Optimization	Level 3	Level 3	Level 3	Level 3

Option: Optimization Function	Effect			
	Debug	Code Efficiency	Execution Speed	Compilation Time
-O: Level 1 Advanced Optimization	Level 2	Level 4	Level 4	Level 2
-Os: Level 2 Advanced Option (Size precedence)	Level 1	Level 5	Level 4	Level 2
-Ot: Level 2 Advanced Option (Speed precedence)	Level 1	Level 4	Level 5	Level 1

The meanings of the expressions in this table are as follows.

Debug	As the level of optimization increases, optimization that deletes C source lines and concentrates the same processing on one location occurs, and there is a tendency that the places where breakpoints can be set decrease. In addition, the probability of assigning a variable from the memory to a register improves. The level of optimization at which the tendency that many breakpoints can be set and the probability of allocating variables to registers is small is called level 4, and the level at which the tendency is the strongest is called level 1. Debugging can be executed even at level 1.
Code Efficiency	The ROM size efficiency is classified into levels 1 to 5. The option that minimizes the ROM size is -Os. This option takes a long compilation time. Use the -Og or -O option if the ROM capacity has a relatively wide margin.
Execution Speed	The execution speed is classified into levels 1 to 5. To reduce the ROM capacity of the entire module and improve the effective speed of only critical functions further, specify the -Ot option in file units.
Compilation Time	The compilation time is classified into levels 1 to 3. Options -O, -Os, and -Ot execute powerful optimization and therefore take a longer compilation time than the other options.

(a) -Od: Optimize for Debugging

Optimization is executed within a basic block[Note]. This is optimization using information that can be grasped in a basic block.

- Calculation of constants, deformation of expressions
- Recognition of common parts in a basic block
- Propagation of copy in a basic block

This optimization includes the followings.

This optimization is executed by default when compilation is executed. For example, an operation expression of only constants is replaced by the constants of the operation result during compilation.

The effect of this optimization is the weakest with the C compiler. This optimization is equivalent in level to the default optimization of CA850 Ver. 2.4x.

Note The longest array of instructions whose first instruction is always executed first. A branch occurs only from the last instruction of this array.

(b) -Ob: Default Optimization

Optimization in a basic block and allocation of automatic variables to coloring registers are performed.

- Automatic variables are allocated as registers.

  This optimization does not affect debugging.

This is the default optimization of the CA850. It deletes more unnecessary codes than -Od because register allocation is a high-level function.

(c) -Og: Standard Optimization

In addition to optimization in a basic block and allocation of coloring registers, the following optimization is performed by using the information that can be grasped in a function (only the representative operations are described).

- An instruction string that finds common operations and processes them all at once is output.
- An assignment statement whose value does not change in a loop is moved out of the loop.
  Step execution and breakpoints may not be set as intended by the user.
- Redundant assignment statements are deleted.
  The breakpoint of a deleted line cannot be set.
- External variables are allocated to registers.
  The read/write break to memory may not be correctly executed during debugging.
- Optimization that rearranges instructions by the C compiler to avoid register/flag hazards is performed.
  This optimization does not affect debugging.

This optimization is higher in compilation speed than the advanced optimization, and its code efficiency/ execution speed is intermediate in the optimization of the C compiler. The setting this option is recommended if the ROM capacity has a relatively wide margin.

(d) -O: Level 1 Advanced Optimization

In addition to the optimization performed by options up to -Og, the following optimization is performed (only the representative operations are described).

- Only a loop that is executed only once is expand to avoid the overhead of end condition judgment.
  This optimization does not affect debugging.
- Label alignment and 4-byte alignment at the beginning of a function are suppressed.
  This optimization does not affect debugging.
- A label not referenced is deleted.
  A breakpoint cannot be set to a label that is to be deleted.
- Unnecessary instructions are deleted.
  Breakpoints and step execution may not be set as intended by the user.
- Peep hole optimization (rearrangement of five or less instructions to an efficient instruction string) is performed.
  Breakpoints and step execution may not be set as intended by the user.

This optimization is equivalent to the object size priority option -Os of the CA850 Ver. 2.4x.
This option does not perform inline expansion of a static function that is referenced only once, which is performed with the CA850 Ver. 2.4x.

(e) -Os: Level 2 Advanced Option (Size precedence)

An optimization is executed until processing of -O can no longer be optimized. This option performs optimization giving priority to object size and is the most powerful option. It performs all optimization to not increase the code size of the optimization supported by the C compiler and reduces the size as much as possible.
Depending on the contents of the application, further optimization may be able to be reinforced by using the following options and functions, in addition to -Os.
Depending on the contents of the application, optimization may be able to be reinforced by using the following options and functions, in addition to the above option.

- Specifying -Wi,-O4
  The data flow is analyzed and optimization is reinforced. However, the compilation time tends to increase considerably.
- Using mask register
  In the case of an application that often uses mask codes for operations of unsigned char and unsigned short types, the mask register function can be used to reduce the code size.
  However, if the mask register function is used, there will be two less registers for register variables that can be used when in 32 register mode and two less empty registers when in the mode other than 32 register mode.
- Using section file
  If data is allocated to the internal memory or a section that is referenced by one instruction per gp/r0, the code size can be reduced and the execution speed can be increased. If data is not allocated to a section by program, it is allocated to [tidata.byte] / [tidata.word] / [sidata] / [sedata] / [sconst] / [sdata] by a section file (see "B.7.1 Section file") during compilation.

Of the optimization of the C compiler giving emphasis to the code size, this optimization minimizes the size.
This optimization is equivalent to the object size priority option -Os and optional optimization option -Ol of the CA850 Ver. 2.4x.
This option does not perform inline expansion of a static function that is referenced only once, which is performed with the CA850 Ver. 2.4x.

(f) -Ot: Level 2 Advanced Option (Speed precedence)

This option performs optimization, giving priority to the execution speed. It is used to shorten the execution time, even at the expense of the size, in applications such as data processing.
In addition to the optimization performed by options up to -O, this option executes the following optimization of suppressing.

- 4-byte alignment of a label
- 4-byte alignment at the beginning of a function

In addition, it also executes the followings.

- Tail recursion optimization
- Inline expansion
- Loop expansion

If a return statement at the end of a function calls the function itself, tail recursion optimization converts that function into a loop and reduces the stack used for function calling.
Inline expansion expands the body of a function at the part calling the function, increasing the possibility of optimization, and preventing the overhead for the calling.
Loop expansion expands the loop body two or more times to increase the possibility of optimization and prevent the overhead for conditional judgment and branch.
Inline expansion and loop expansion increase the object size and improve the execution speed.
When -Ot is specified and a function including an asm statement defining a label is used, the same label is defined at the part of function definition and inline expansion. In this case, a label multiple definition error occurs. The function specified by #pragma block_interrupt, #pragma interrupt, #pragma rtos_task, or #pragma text is not subject to inline expansion. In this case, no message is output.
If a function including an asm statement on which inline expansion is not expected to be executed is used, such as manipulation of a stack frame, an execution error may occur because an illegal function frame manipulation takes place.

Caution If the size is increased too much by the Level 2 advanced option (speed precedence), adjust inline expansion and loop expansion by using the options "-Wp,-G" and "-Wo,-Ol". To execute inline expansion only on a specific function, regardless of the option, use #pragma

inline. This can give priority to the execution speed of only a specific function, while "size priority" is specified.

Depending on the contents of the application, optimization may be able to be reinforced by using a mask register in the same manner as when -Os is specified.
In addition, optimization speed can be reinforced by using the following function.

- Expanding strcpy(), strcmp()
  If the option -Xi, which executes "expansion of strcpy/strcmp" for an application that often uses the character string copy function strcpy(), is specified, the execution time is shortened. However, the size increases.
- Specifying -Wp,-r
  An unnecessary function may be generated as a result of inline expansion that has merged source files. If the "-Wp,-r" option is specified in this case, the unnecessary functions may be deleted, and the size may be reduced.

Of the optimization of the C compiler giving emphasis to the execution speed, the execution speed of this option is the highest. This optimization is equivalent to the object speed priority option -Ot and optional optimization option -Ol of the CA850 Ver. 2.4x.
As explained above, the C compiler has several levels and items of optimization. To specify optimization, the following criteria must be noted.

- Giving priority to size
- Giving priority to the execution speed at the expense of size

Most optimization functions reduce the size and improve the execution speed at the same time. Whether emphasis is given to the size or execution speed is determined depending on whether some functions are used or not.

(4) Effects of optimization on debugging

Note with caution that optimization can have the following kinds of effects when using the source debugger.

- As a result of deformation of an expression by optimization (propagation of copy and recognition of common part expression), "variable reference" does not take place where the read/write event of a variable appears in the source program, and the event may not occur as expected by the user.
- When a statement has been made common, deleted, or rearranged, step execution and breakpoints may not be set as intended by the user.
- The live range of a variable (range in which the variable can be referenced in the program) and position of a variable (position on a register or memory) may be changed.
- Breakpoints cannot be set for statements that have been deleted.
- Transfer, splitting, or merging of statements may have rearranged the sequence of executable instructions[Note], so that lines between the lines which have been rearranged may be handled as a single line for which break points and step execution can no longer be set.

Note The address of an executable instruction within a line of source code may be smaller than the address of an executable instruction in a previous line or may be greater than the address of an executable instruction in a subsequent line.

- If the sequence of executable instructions for if-else statements has been rearranged or if loop expansion has caused a sequence of executable instructions to be rearranged, step execution may no longer be possible, as when a statement has been made common, deleted, or rearranged.
- The entire function is regarded as the valid range (scope) for all automatic variables. However, if the variables have been allocated to registers, they can be deleted or otherwise rendered invisible by optimization even when they are within the scope. This can occur when the variables are being used as "local variables" within the scope or have been assigned as local variables as a result of optimization.

Example

```
void f(void)
{
    int     a;      /* Valid within function */
        :
    /* address 1 */
        : /* "a" is used only within the range from address 1 to address 2. */
    /* address 2 */
        :
}
```

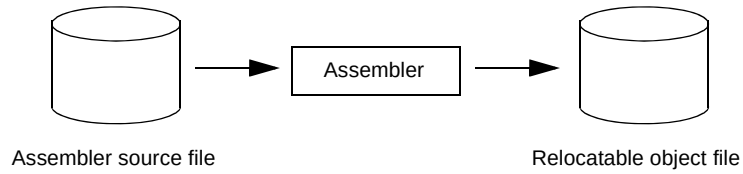
In the above example, the scope of "a" is the entire function f(). However, use of "a" is limited to section between address 1 and address 2. In this case, if "a" is allocated to a register and optimization causes it to be deleted from the stack frame, "a" will become invisible outside of the section between address 1 and address 2. This phenomenon occurs in order to make more efficient use of registers by making the register where "a" has been allocated (except for the section between address 1 and address 2) available for the allocation of other variables.

- During compilation, the processing of debug information uses a large amount of memory and therefore can cause an "out of memory" condition to occur.
- Sections that have been performed inline expansion are treated as a single unit, and cannot be stepped into.
- When loop expansion has been performed, the loop body is treated as a single unit, and cannot be stepped into. Additionally, the number of times the body unit is stopped is the number of loops after expansion, not before.
- If a register is allocated to an external variable, optimization debugging cannot be executed because the debug information of the specified external variable is deleted.

B.2 Assembler

The assembler (as850) assembles a specified assembly source file and creates a relocatable object file.

Figure B-4. Operation Flow of Assembler



B.2.1 I/O files

The assembler can specify the following files as input files.

file.s	Assembler source file (called the .s file)

The name of the relocatable object file generated by the assembler has extension .o instead of.s.

The file names supported by Windows can be specified, but "@" cannot be used at the head of a file name because it is regarded as a command option. The name of a file or folder that includes a space cannot be used. If the kanji code of the file is EUC, a file name or folder name in Japanese cannot be used.

If the relocatable object file created by the assembler includes an unresolved external reference, its relocation remains unresolved.

An executable object file resolving all relocations (called the "execution format") is created by linking the relocatable object file via the linker.

See "3.1 Assembler" for details about output lists.

B.2.2 Method for manipulating

This section explains how to manipulate the assembler.

(1) Command input method

The assembler is started from the ca850 under the default settings, but it can also be started in the following format.

Enter the following from the command prompt.

```
C:\>as850 [option] ... file-name
      [ ]:     Can be omitted
      ...:     Pattern in proceeding [ ] can be repeated
```

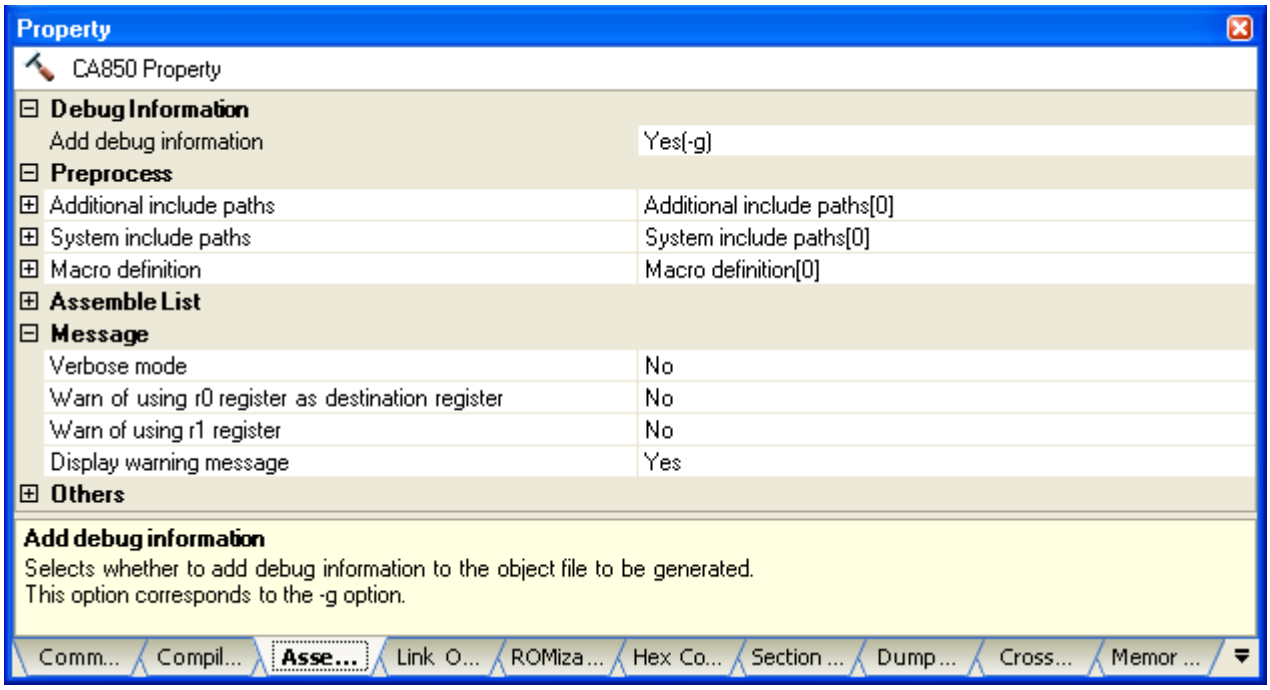
(2) Set options in CubeSuite+

This section describes how to set assemble options from CubeSuite+.

On CubeSuite+'s Project Tree panel, select the Build Tool node. Next, select the [View] menu -> [Property]. The Property panel opens. Next, select the [Assemble Options] tab.

You can set the various assemble options by setting the necessary properties in this tab.

Figure B-5. Property Panel: [Assemble Option] Tab



B.2.3 Option

This section explains assemble options.

Caution To pass the assemble options from the ca850 to the assembler without modification, "-Wa" must be specified with the ca850 (see "Each module").

The types and explanations for assemble options are shown below.

Table B-6. Assemble Options

Classification	Option	Description
File	-a	Generates an assemble list.
	+err_file	Adds and saves error messages to the file.
	-err_file	Overwrites and saves error messages to the file.
	-l	If the -a option is specified, an assemble list generated is saved.

Classification	Option	Description
Assembler	-D	Specifies the macro name to be defined.
	-G	Generates a machine language instruction on the assumption that the data that is less than the specified bytes is allocated to sections with the sdata or sbss attribute in response to external label access.
	-I	Specifies the folder where the file specified by the file input quasi directive is given precedence to searching.
	-m	Generates an object file that includes information noting use of the mask register function.
	-O	Performs optimization that rearranges instructions to avoid register/flag hazards.
	-v	Outputs the execution status of the assembler to the standard error output in detail.
	-w	Specifies the level, output, and suppression of a warning message.
	-Xfar_jump	Specifies far jump for branch instructions (jarl, jr) that do not include 22/32.
Device	-X256M	Treats the memory space as having 256 MB.
	-bpc	Sets the higher address of the programmable peripheral I/O register.
Warning message control	-woff	Suppresses a warning message of the specified number.
Other	-cn	Embeds the magic number common to V850 core.
	-cnv850e	Embeds the magic number common to V850Ex core.
	-cnv850e2	Embeds the magic number common to V850E2 core.
	-cpu	Specifies the target device.
	-F	Specifies the folder where device files are stored.
	-g	Outputs debug information.
	-o	Specifies the name of the object file to be assembled and output.
	-p	Outputs code that avoids CPU faults.
	-V	Outputs the version information of the assembler to the standard error output.
	-zf	Performs assembly processing on the flash/external ROM side.
	@	Handles the specified file as a command file.

Table B-7. Mark Used in Option Descriptions

[V850E2]	Option dedicated to V850E2 core
[V850E]	Option dedicated to V850Ex core

File

The options of preprocessing for the assembler source file are as follows.

- -a
- +err_file
- -err_file
- -l

-a

[Description format]

```
-a
```

- Interpretation when omitted
  No assemble list is generated.

[Function Description]

- This option generates an assemble list.
- If the -l option is not specified, an assemble list generated is output to the standard output.
- When the -O option (optimization option) is specified, a part of the assemble list may be incorrectly output due to instruction rearrangement.

[Example of use]

- To generate an assemble list, describe as:

```
C:\>as850 -cpu f3719 -a main.s
```

+err_file

[Description format]

```
+err_file=file
```

- Interpretation when omitted
  None

[Function Description]

- This option adds and saves error messages to file *file*.

[Example of use]

- To add and save error messages to the file "err", describe as:

```
C:\>as850 -cpu f3719 +err_file=err main.s
```

-err_file

[Description format]

```
-err_file=file
```

- Interpretation when omitted
  None

[Function Description]

- This option overwrites and saves error messages to file *file*.

[Example of use]

- To overwrite and save error messages to the file "err", describe as:

```
C:\>as850 -cpu f3719 -err_file=err main.s
```

-l

[Description format]

```
-l file
```

- Interpretation when omitted
  If the -a option is specified, an assemble list generated is output to the standard output.

[Function Description]

- The assemble list generated when the -a option is specified is placed in a file with the name *file*.
- If the -a option is not specified, this option is invalid.

[Example of use]

- To save the assemble list in the file (asm), describe as:

```
C:\>as850 -cpu f3719 -a -l asm main.s
```

Assembler

The options of assembler for the assembler source file are as follows.

- -D
- -G
- -I
- -m
- -O
- -v
- -w
- -Xfar_jump

-D

[Description format]

```
-Dname[=def]
```

- Interpretation when omitted
  None

[Function Description]

- This option specifies the macro name to be defined.
- If =*def* is omitted, *def* is regarded as 1. This option assumes that ".set *name*, *def*" is entered before the assembler source program.

[Example of use]

- To assume that ".set sample, 256" is entered before the assembler source program, describe as:

```
C:\>as850 -cpu f3719 -Dsample=256 main.s
```

-G

[Description format]

```
-Gnum
```

- Interpretation when omitted
  it is assumed that *num* = ∞.

[Function Description]

- This option generates a machine language instruction on the assumption that all data that is less than *num* bytes is allocated to sections with the sdata or sbss attribute in response to external label access.
- The range that can be specified as *num* is 0 to 32767 in decimal numbers.
- This option generates an assembler instruction on the assumption that data which sdata is specified in quasi directive ".option sdata" is allocated to sections with the sdata or sbss attribute, regardless of the size of the data.
- When activating from the ca850, the -G*num* option specified in the ca850 activation is passed.

[Example of use]

- To generate a machine language instruction on the assumption that the data up to 16 bytes is allocated to the sdata or sbss section, describe as:

```
C:\>as850 -cpu f3719 -G16 main.s
```

-I

[Description format]

```
-I dir
```

- Interpretation when omitted
  The folder where the source file is placed, the folder where the C source file is placed, and the current folder are searched in that order.

[Function Description]

- This option specifies the folder where the file specified by the file input quasi directive (.include/.binclude) is searched prior to the folder where the source files are placed.
- If the file was not found in the specified folder or if this option is omitted, the folder where the source file is placed, the folder where the C source file is placed, and the current folder are searched in that order.

[Example of use]

- To specify the folder where the file specified by the file input quasi directive (.include/.binclude) is searched from the folder (D:\head), describe as:

```
C:\>as850 -cpu f3719 -I D:\head main.s
```

-m

[Description format]

```
-m
```

- Interpretation when omitted
  The mask register function is invalid.

[Function Description]

- This option generates an object file that includes information noting use of the mask register function.
- When this function is used, the assembler outputs codes, assuming that an 8-bit mask value, 0xff, is set to r20 and a 16-bit mask value, 0xffff, is set to r21.
- Mask values must be set to the mask registers (r20 and r21) by a user program such as the startup routine.
- To decide whether the mask register function is to be used or not, the following points must be thoroughly considered.
  - Is it a program that outputs many mask codes?
  - When in 32-register mode, two registers for register variables are used as mask registers: Does this have any effect?
  - When in the mode other than 32-register mode, two empty registers are used as mask registers: Does this have any effect?

[Example of use]

- To generate an object file that includes information noting use of the mask register function, describe as:

```
C:\>as850 -cpu f3719 -m main.s
```

-O

[Description format]

```
-O
```

- Interpretation when omitted
  The instruction rearranging optimization is invalid.

[Function Description]

- This option performs optimization that rearranges instructions to avoid register/flag hazards.
- If this option and -g option (debug information output) are specified at the same time, this option is ignored and the -g option is valid.
- If the -p option (CPU faults avoidance option) is specified at the same time when the target device of the V850 core is specified or if a V850 core common object is created, this option is ignored and the -p option is valid.
- If the -p option is specified at the same time when the target device of the V850E/V850E1/V850ES core is specified or if a V850E/V850E1/V850ES core common object is created, this option and the -p option are valid.

[Example of use]

- To perform optimization that rearranges instructions to avoid register/flag hazards, describe as:

```
C:\>as850 -cpu f3719 -O main.s
```

-v

[Description format]

```
-v
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs the execution status of the assembler to the standard error output in detail.

[Example of use]

- To output the execution status of the assembler to the standard error output in detail, describe as:

```
C:\>as850 -cpu f3719 -v main.s
```

-w

[Description format]

```
-w
-wstring+
-wstring-
```

- Interpretation when omitted
  No warning messages are suppressed.

[Function Description]

- The -w option does not output a warning message in the following cases.
  - If r1 has been specified as the source register or the destination register
  - If r0 has been specified as the destination register
  - If r20 or r21 has been specified as the destination register when using the mask register function
- -w*string*+ and -w*string*- specify outputting or suppressing a warning message for each parameter regardless of whether the -w option is specified. A warning message is output when "+" has been specified or is suppressed when "-" has been specified.
- The following character strings can be specified as *string*.

r0	If r0 has been specified as the destination register
r1	If r1 has been specified as the source register or the destination register

- An error occurs if neither "+" nor "-" has been specified.

[Example of use]

- To output a warning message of the specified number, describe as:

```
C:\>as850 -cpu f3719 -w main.s
```

- To output a warning message when r0 has been specified as the destination register, describe as:

```
C:\>as850 -cpu f3719 -wr0+ main.s
```

-Xfar_jump

[Description format]

```
-Xfar_jump
```

- Interpretation when omitted
  If 22/32 is not described in the branch instruction, it is the ordinary branch instruction (not a far jump).

[Function Description]

[V850E2]

- When a V850E2 core is specified as the device type for the assembler, this option specifies far jump for branch instructions (jarl, jr) that do not include 22/32.
- To change the setting in instruction units, explicitly describe jarl22/jarl32 or jr22/jr32.
- The jmp instruction is not affected by the -Xfar_jump option.

[Example of use]

- To specify far jump for branch instructions (jarl, jr) that do not include 22/32, describe as:

```
C:\>as850 -cpu 3500 -Xfar_jump main.s
```

Device

The options related to the device of assembler for the assembler source file are as follows.

- -X256M
- -bpc

-X256M

[Description format]

```
-X256M
```

- Interpretation when omitted
  The memory space is treated as having 64 MB and the addresses are resolved.

[Function Description]

[V850E]

- Treats the memory space as having 256 MB.
- Set this option in accordance with the chipset to be used.
- The physical address space of the V850Ex core has 256 MB in many cases. When creating an application that uses a space between 64 MB and 256 MB, specify this option.

[Example of use]

- To treat the memory space as having 256 MB, describe as:

```
C:\>as850 -cpu f3719 -X256M main.s
```

-bpc

[Description format]

```
-bpc=num
```

- Interpretation when omitted
  The higher address of the programmable peripheral I/O register is treated as 0.

[Function Description]

- This option sets the higher address of the programmable peripheral I/O register.
- In *num*, specify only the part of address from which the highest bit of the BPC register is removed.
- If the target device has programmable peripheral I/O register functions (such as V850E/IA1) and you want to set the variable address portion (= value set in BPC register), the value must be determined when assembling the application. If this option is specified, assembly is performed using the specified value.
- When this option is specified, be sure to specify a value. A binary, octal, decimal, or hexadecimal number can be used for the value.
- If an invalid value is specified, or if a value outside the range that can be set in the BPC register is specified, a warning message is output and this option is ignored.
- One value is set for an entire application. If you specify "-Xbpc" or "-bpc" when setting options by file, make the values the same between files.
- This option is not needed to be specify for files that do not use the programmable peripheral I/O register.
- If this option is specified for a target device that does not have programmable peripheral I/O register functions or when assembling as a common for V850 core and V850Ex core, a warning message is output and this option is ignored.
- This option is for determining the address of the programmable peripheral I/O register when assembling and does not actually reflect a value in the BPC register.
  For operation, it is necessary to set a value in the BPC register separately using a startup module or the like.
  See "CubeSuite+ V850 Coding" about a sample of the startup routine. Also, a sample appears (commented out) in the startup module included in the package.
- The assembler outputs the .bpc section which is the special reserved section when the programmable peripheral I/O register is referenced, regardless of whether this option is specified or omitted.
  This section is used for checking when linking. The .bpc section is a special reserved section for information and is never loaded into memory. Therefore, it need not be specified in a link directive like a normal section.

[Example of use]

- If the target device is V850E/IA1, the following option setting treats the start address of the programmable peripheral I/O register area to be shifted 14 bits to the left, or "0x48d0000".

```
C:\>as850 -cpu 3116 -bpc=0x1234 main.s
```

Specify the following descriptions in the startup module to make the variable portion of the start address of the programmable peripheral I/O register "0x1234" and set the flag 0x8000 that enables the use of this function.

```
mov     0x9234,r10      -- 0x1234 | 0x8000 = 0x9234
st.h    r10, BPC
```

Warning message control

The warning message control options are as follows.

- -woff

-woff

[Description format]

```
-woff=num
```

- Interpretation when omitted
  None

[Function Description]

- This option suppresses a warning message of the number specified by *num*.
- 3029, 3030, or 3031 can be specified as *num*.
- When the W3029 warning message is suppressed, specify "-woff=3029".
- *num* cannot be omitted.
- If a warning number not provided in the C compiler is specified, a warning message is output.

[Example of use]

- To suppress the W3029 warning message, describe as:

```
C:\>as850 -cpu f3719 -woff=3029 main.s
```

Other

Other option is as follows.

- -cn
- -cnv850e
- -cnv850e2
- -cpu
- -F
- -g
- -o
- -p
- -V
- -zf
- @

-cn

[Description format]

```
-cn
```

- Interpretation when omitted
  The magic number defined by the specified target device is embedded.

[Function Description]

- This option embeds the common magic number common to V850 core into the object to be generated as the magic number. This enables the object to be used as a common object within the V850 core.

[Example of use]

- To embed the magic number common to V850 core into the object, describe as:

```
C:\>as850 -cn main.s
```

-cnv850e

[Description format]

```
-cnv850e
```

- Interpretation when omitted
  The magic number defined by the specified target device is set.

[Function Description]

[V850E]

- This option sets the common magic number common to V850Ex core into the object to be generated as the magic number. This enables the object to be used as a common object within the V850Ex core.

[Example of use]

- To embed the magic number common to V850Ex core into the object, describe as:

```
C:\>as850 -cnv850e main.s
```

-cnv850e2

[Description format]

```
-cnv850e2
```

- Interpretation when omitted
  The magic number defined by the specified target device is set.

[Function Description]

[V850E2]

- This option sets the common magic number common to V850E2 core into the object to be generated as the magic number. This enables the object to be used as a common object within the V850E2 core.

[Example of use]

- To embed the magic number common to V850E2 core into the object, describe as:

```
C:\>as850 -cnv850e2 main.s
```

-cpu

[Description format]

```
-cpu devicename
```

- Interpretation when omitted
  This option cannot be omitted (except when specifying -cn, -cnv850e, or -cnv850e2).

[Function Description]

- This option specifies the target device.
- This option takes precedence over quasi directive ".option cpu".
- If a target device is specified by this option or quasi directive ".option cpu" and then the -cn/-cnv850e/-cnv850e2 option is specified, a core common object including information peculiar to the target device can be created.
- If neither quasi directive ".option cpu" nor -cn/-cnv850e/-cnv850e2 option is specified, and if this option is omitted, assemble is stopped.

[Example of use]

- To specify UPD70F3719 as the target device, describe as:

```
C:\>as850 -cpu f3719 main.s
```

-F

[Description format]

```
-F devpath
```

- Interpretation when omitted
  The folder where device files are stored is regarded as the standard folder.

[Function Description]

- This option specifies the folder where device files are stored.

[Example of use]

- To search the folder where device files are stored from folder D:\dev, describe as:

```
C:\>as850 -cpu f3719 -F D:\dev main.s
```

-g

[Description format]

```
-g
```

- Interpretation when omitted
  Symbol information for the source debugger is not output.

[Function Description]

- This option outputs debug information.
- Specify this option to debug the program (e.g. to perform assembler source debugging using the debugger).
- When the optimization option (-O) is specified at the same time, this option is ignored if there are sections for debug information in the source file. If sections for debug information do not exist, the optimization option (-O) is ignored and this option is valid. In other words, this option takes precedence if there is no debug information.

[Example of use]

- To output debug information, describe as:

```
C:\>as850 -cpu f3719 -g main.s
```

-o

[Description format]

```
-o ofile
```

- Interpretation when omitted
  The object file name will be the source file name with the extension ".s" replaced by ".o".

[Function Description]

- This option specifies *ofile* as the name of the object file to be assembled and output.

[Example of use]

- To specify test.o as the name of the object file to be assembled and output, describe as:

```
C:\>as850 -cpu f3719 -o test.o main.s
```

-p

[Description format]

```
-p[num]
```

- Interpretation when omitted
  This option does not output code that avoids CPU faults.

[Function Description]

- This option outputs code that avoids CPU faults.
- Specify the type of the code to be output (1 to 10 or 4a) as *num*. 1 to 4 and 4a are valid for the V850 core, and 5 to 10 are valid for the V850E/ES core.
- If *num* is omitted, the following codes are identified from the device file and output.
- If the target device is the V850E/ES core or if "V850E/ES core common" is specified as the magic number by the assemble option (-cnv850e), code 5 to 10 is output.
  If the target device is the V850, code 1 to 3 or 4a is output.
- If "V850 core common" is specified as the magic number by the assemble option (-cn), code 1 to 3 and 5 to 10 is output.
  See "(2) Options for avoiding CPU faults" for details about the code output due to this option.

[Example of use]

- To output code 4a to avoid CPU faults, which inserts a nop instruction immediately after the first load instruction in relation to the combination of "load instruction (ld.[b|h|w]/sld.[b|h|w]) + load store instruction (ld.[b|h|w]/sld.[b|h|w]/sst.[b|h|w]/st.[b|h|w])", describe as:

```
C:\>as850 -cpu f3719 -p4a main.s
```

-V

[Description format]

```
-V
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs the version information of the assembler to the standard error output and terminates processing.

[Example of use]

- To output the version information of the assembler to the standard error output, describe as:

```
C:\>as850 -cpu f3719 -V main.s
```

-zf

[Description format]

```
-zf
```

- Interpretation when omitted
  Assembly processing is performed on the boot/internal ROM side for assembler source files that use the flash/external ROM relink function.

[Function Description]

- This options performs assembly processing on the flash/external ROM side when the flash/external ROM relink function has been used for the assembler source file.
- This option is not needed to be specify for assembler source files that does not use the flash/external ROM relink function. If this option is specified, the function will not be changed.No warning messages are output.
- See "B.3.3 Boot-flash relink function" for details about the flash/external ROM relink function.

[Example of use]

- To perform assembly processing on the flash/external ROM side when the flash/external ROM relink function has been used for the assembler source file, describe as:

```
C:\>as850 -cpu f3719 -zf main.s
```

@

[Description format]

```
@cfile
```

- Interpretation when omitted
  Command files are assumed not to exist.

[Function Description]

- This option handles *cfile* as a command file.
- Instead of specifying options and file names for commands as command-line arguments, they can be specified in a command file.
- On Windows, the length of a character string specified as options for commands is limited. If many options are set and some of the options cannot be recognized, create a command file and specify this option.
- See "(2) Command file" for details about a command file.

[Example of use]

- To handle "command" as a command file, describe as:

```
C:\>as850 @command main.s
```

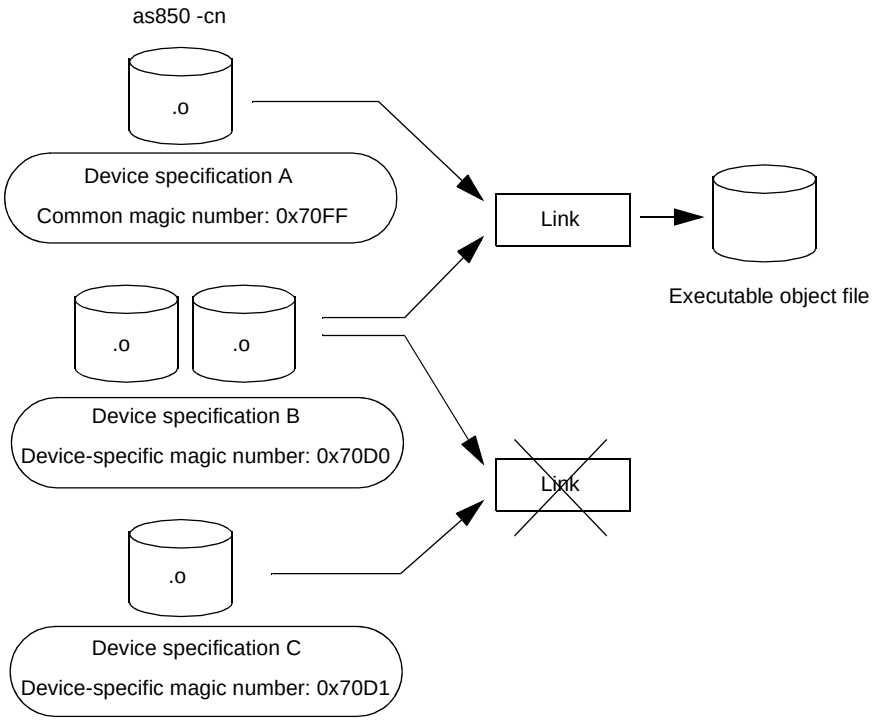
B.2.4 Cautions

(1) Magic number

Information indicating the target device for an object is automatically embedded into an object created by the assembler. This information is called a "magic number". A device-specific magic number is embedded if only a particular type of device is the target device; if an entire core can serve as target devices, a "common magic number" is embedded.

An object that has been assembled by the assembler when the -cn option has been specified contains a common magic number and therefore can be linked to other objects for which a different device type has been specified as long as the specified device belongs to the same core (the linker does not output an error when they are linked). As a result, any object that is created after the -cn option has been specified can be used as an object common to any device in the specified device's core.

Figure B-6. Image of Creating Common Object with Assembler

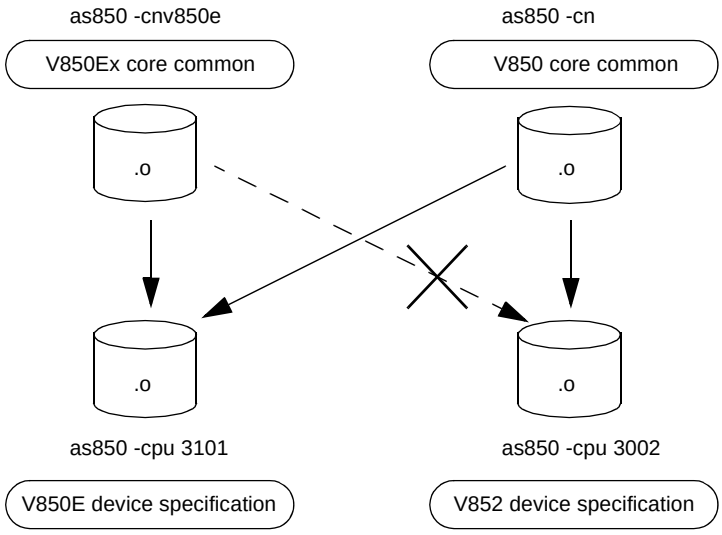


(a) Cautions

- Magic numbers common to cores and device-specific magic numbers are defined for each device file to establish associations among the device core. The assembler references the device files and embeds the magic numbers.
- Object files that operate device-specific peripheral function registers, etc., should not be used as common files among cores.
- If a target device is specified by the -cpu option or .option quasi directive and then the -cn/-cnv850e/-cnv850e2 option is specified, a core common object including information peculiar to the target device can be created. However, an object having device-specific information different from that of the target device does not operate correctly. Check in advance that the device-specific information can be used with the intended target device.
- The V850Ex core is upwardly compatible with the V850 core. Source files that are used with the V850 core can be used with the V850Ex core. In this cases, specify the "-cn" option or the "-cnv850e" option before creating an object. The object common to V850 core that is created with "-cn" can be linked with a V850Ex core object. By contrast, an object that is created with "-cnv850e" cannot be linked with a V850 core object.

- The V850E2 core is upwardly compatible with the V850/V850Ex core. Source files that are used with the V850/V850Ex core can be used with the V850E2 core. In this cases, specify the "-cn" option or the "-cnv850e" option before creating an object. The object common to V850/V850Ex core that is created with "-cn" can be linked with a V850E2 core object. By contrast, an object that is created with "-cnv850e" cannot be linked with a V850/V850Ex core object.

Figure B-7. Example of Assembler CPU Core Compatibility (V850Ex Core and V850 Core)



(2) Options for avoiding CPU faults

The C compiler provides the -Xv850patch option for the ca850 and the -p option for the assembler to avoid faults from the V850 core and V850E/ES core CPU. When starting the assembler from the ca850, if the -Xv850patch option is specified in the ca850, the -p option having the same *num* value is automatically set by the assembler to the assembler source file output by the ca850.

Specify the type of the code to be output (1 to 10 or 4a) as *num*. 1 to 4 and 4a are valid for the V850 core, and 5 to 10 are valid for the V850E/ES core only. If *num* is omitted, the following codes are identified from the device file and output.

- If the target device is the V850E/ES core or if "V850E/ES core common" is specified as the magic number by the assemble option (-cnv850e), code 5 to 10 is output.
- If the target device is the V850 core, code 1 to 4 or 4a is output.
- If "V850 core common" is specified as the magic number by the assemble option (-cn), code 1 to 10, or 4a is output.

Cautions are shown below.

- To determine whether or not a fault that has occurred is from the CPU being used, see the CPU's documentation.
- If the -p option and assembler optimization option (-O) are specified at the same time when the target device of the V850 core is specified or if a V850 core common object is created, -p takes priority and -O is ignored.
- If the -p option and assembler optimization option (-O) are specified at the same time when a target device of the V850E/ES core is specified or if a V850Ex/ES core common object is created, both -p and -O are valid.
- If a code pattern that generates a fault covers different sections, this option's function becomes invalid.
- Only the -Xv850patch=11 option is handled by the ca850.
- The faults between CPU core and the -p option is as follows (for the newest version µPD70(F)3xxx, not including maintenance or obsolete products).
  To determine whether or not the failure affects the CPU being used, see the CPU's documentation.

Table B-8. Faults Between CPU Core and -p Option

CPU Core	-p1	-p2	-p3	-p4	-p4a	-p5	-p6	-p7	-p8	-p9	-p10
V850 core	OK	OK	OK	OK	OK	---	---	---	---	---	---
V850E/MS1	---	---	---	---	---	OK	---	---	A	---	A
V850E1 core	---	---	---	---	---	---	OK	OK	---	OK	---
V850ES core	---	---	---	---	---	---	---	---	---	---	---
V850E2 core	---	---	---	---	---	---	---	---	---	---	---

Remark OK: Affected
A: Corrected (for the newest version µPD70(F)3xxx, not including maintenance or obsolete products)
---: Not affected

The types and meanings of *num* are as follows.
See the user's manual of relevant device's architecture for the instructions and registers.

(a) 1 (-Xv850patch=1 -> -p1)

Inserts a nop instruction immediately after the first ld.w in relation to the combination of "ld.w instruction + (st.[b|h|w]/sst.[b|h|w]/ld.[b|w]/sld.[b|w] instruction) + branch instruction".

Example

`ld.w`
`sst.w`
`jarl`
	`ld.w`
	`nop`
	`sst.w`
	`jarl`

(b) 2 (-Xv850patch=2 -> -p2)

Inserts a nop instruction between the load/store instruction and branch instruction in relation to the combination of "ld.w/sld.w/st.w/sst.w instruction + branch instruction".

Example

`ld.w`
`jarl`
	`ld.w`
	`nop`
	`jarl`

If the pattern of *num*=1 is processed at the same time, the pattern of *num*=2 is searched and processed first. An unnecessary nop instruction does not need to be inserted.

(c) 3 (-Xv850patch=3 -> -p3)

Inserts the clr1 instruction in relation to the corresponding interrupt control register immediately before the reti instruction.

Example

reti	clr15, P0IC0 reti

(d) 4 (-Xv850patch=4 -> -p4)

Inserts a nop instruction immediately after the first load instruction in relation to the combination of "load instruction (ld.[b|h|w]/sld.[b|h|w]) + load store instruction (ld.[b|h|w]/sld.[b|h|w]/sst.[b|h|w]/st.[b|h|w])" (inserted when the peripheral I/O register has been accessed in the input file).

Example

ld.w ld.w	ld.w nop ld.w

(e) 4a (-Xv850patch=4a -> -p4a)

Inserts a nop instruction immediately after the first load instruction in relation to the combination of "load instruction (ld.[b|h|w]/sld.[b|h|w]) + load store instruction (ld.[b|h|w]/sld.[b|h|w]/sst.[b|h|w]/st.[b|h|w])" (inserted regardless of whether the peripheral I/O register is accessed or not).

Example

ld.w ld.w	ld.w nop ld.w

-p4 sets patch 4 in cases where peripheral I/O access occurs in an input file.
-p4a sets patch 4 regardless of whether or not peripheral I/O access occurs.

(f) 5 (-Xv850patch=5 -> -p5)

Inserts a nop instruction in relation to the multiplication instruction immediately after it without any conditions.

Example

mulh jarl	mulh nop jarl

(g) 6 (-Xv850patch=6 -> -p6)

Inserts a nop instruction immediately after the load instruction in relation to the combination of "load instruction (ld.[b|h|w]/sld.[b|h|w]) + jr/jarl/jcond (bcond)".

Example

sld.bu jarl	sld.bu nop jarl

(h) 7 (-Xv850patch=7 -> -p7)

Inserts a nop instruction immediately after the callt instruction. It also inserts the "mov r31, r0" instruction immediately before the switch instruction and reti instruction.

Example

switch	mov r31, r0 switch

(i) 8 (-Xv850patch=8 -> -p8)

Inserts a nop instruction between the consecutive sld instructions.

Example

sld.b sld.b	sld.b nop sld.b

(j) 9 (-Xv850patch=9 -> -p9)

Inserts a nop instruction immediately after the sld instruction, if instructions (A), (B), and (C) below exist in a row.

Example

add sld and	add ... (A) sld.b ... (B) nop and ... (C)

<1> (A)

Of 2-byte instructions mov, not, satsubr, satsub, satadd, zxb, zxh, sxh, or, xor, and, subr, sub, add, shr, sar, and shl, instructions that write back to a register other than r0 and r30

Example

```
add     0x1, r10
```

Including the instructions that describe a .set symbol with LABEL, expression, or definition after reference, and that are expanded to the above instructions.
The example below is not a CPU bug pattern but is subject to patching.

Example

```
addi    SYM, r10, r10
.set    SYM, 0x123
```

<2> (B)

The sld instruction that writes back to a register different from those to which the instructions in (A) write back

Example

```
sld.b   %LABEL, r11
```

<3> (C)

An instruction that loads a value to the register to which the instructions (A) write back

Example

```
add     r11, r10
```

Including the instructions that describe a .set symbol with LABEL, expression, or definition after reference, and that load a value to the register to which the instructions (A) write back.

Example

```
        addi    LABEL2-LABEL1, r10, r12
LABEL1:
        -- (omitted)
LABEL2:
```

In this example, if the relative values of LABEL2 and LABEL1 exceed the range that can be expressed by 16 bits, the instructions are expanded as follows:

```
mov     LABEL2-LABEL1, r12
and     r10, r12
```

Instruction (B) is immediately followed by the move instruction, and the value of r10 is not loaded. In other words, this example is not of a CPU bug pattern but is subject to patching.

(k) 10 (-Xv850patch=10 -> -p10)

Inserts a nop instruction immediately after the store instruction in relation to the combination of "store instruction (sst.[b|h|w]/st.[b|h|w]) + jcond(bcond)".

Example

`sst.b`
`br`
	`sst.b`
	`nop`
	`br`

(l) No *num* specification (-Xv850patch -> -p)

Outputs each code in the combination of 1 to 3 and 5 to 10, judged by the device file (see the descriptions above).

If this option is specified when creating an object that does not require a corresponding patch, no patch is set.
The correspondence between created objects and options is shown below.

Table B-9. Correspondence between Created Objects and -p Options

Created Objects	-p1	-p2	-p3	-p4	-p4a	-p5	-p6	-p7	-p8	-p9	-p10
Specific to V850 device	P	P	P	P	P	N	N	N	N	N	N
Specific to V850E/ES device	N	N	N	N	N	P	P	P	P	P	P
Specific to V850E2 device	N	N	N	N	N	N	N	N	N	N	N
V850 core common	P	P	P	P	P	P	P	P	P	P	P
V850E/ES core common	N	N	N	N	N	P	P	P	P	P	P
V850E2 core common	N	N	N	N	N	N	N	N	N	N	N

Remark P: Patched
N: No patched

B.3 Linker

Generally, an application program is divided into several source files and coded. Source files written in C language activate the compiler (ca850) or assembler (as850) and source files written in an assembly language activate the assembler (as850) to output object files.

The linker (ld850) resolves the addresses of these object files in accordance with the information of the link directive and device files and generates one executable object file, i.e., a load module file.

If there is external reference that is not resolved when the linker links object files, the linker searches the specified archive file (library file) to resolve the external reference. It then links only the object files necessary for resolving and generates executable object files. The linker can also generate relocatable object files when the -r option is specified.

Figure B-8. Operation Flow of Linker

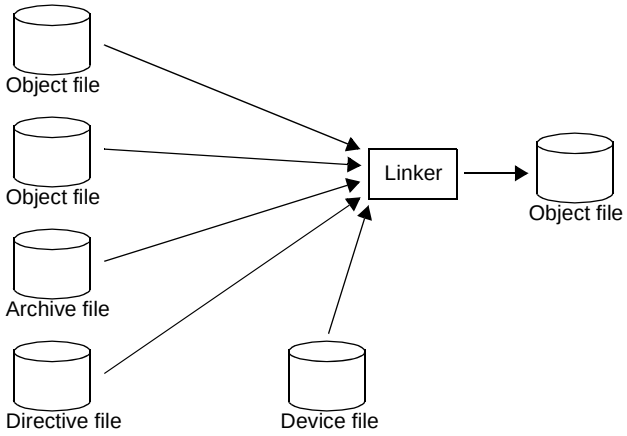
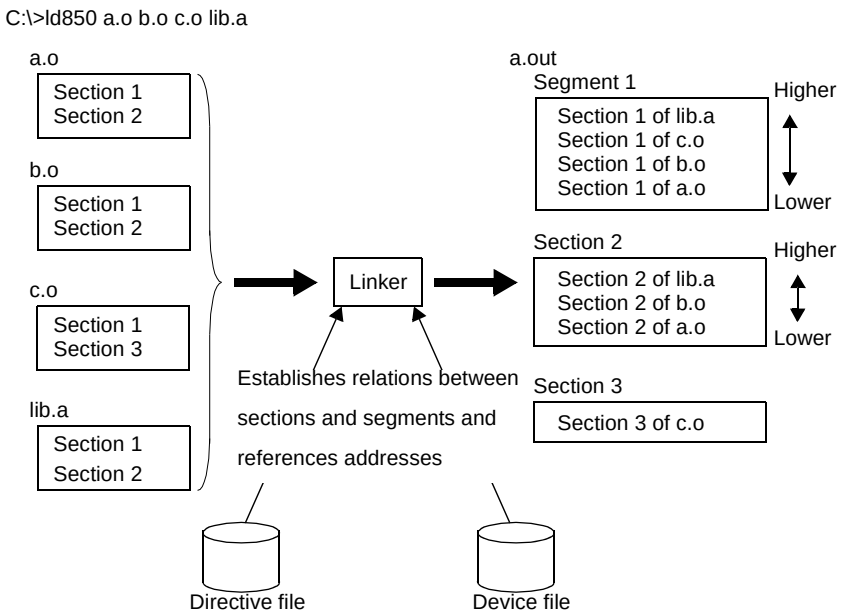


Figure B-9. Linker Operation Image (Example)



The ca850 internally activates the as850 and linker as drivers.

When the ca850 is activated, a load module can be generated. Therefore, there is no need to be aware of activating the as850 and linker.

Figure B-10. Batch Processing

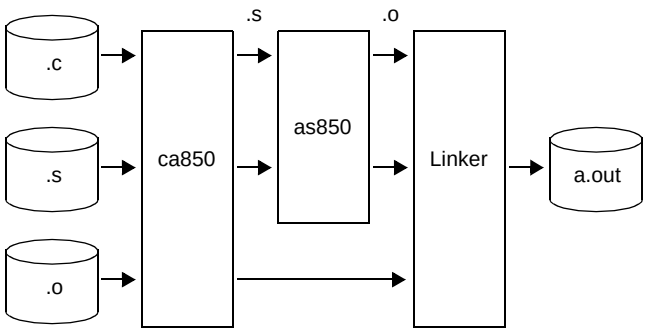
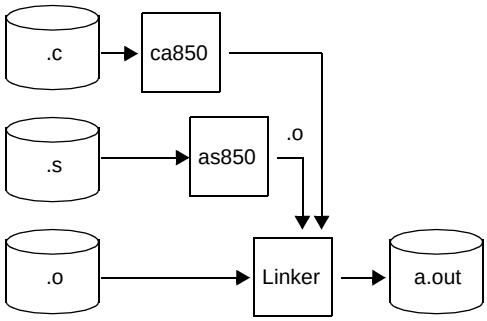


Figure B-11. Modular Processing

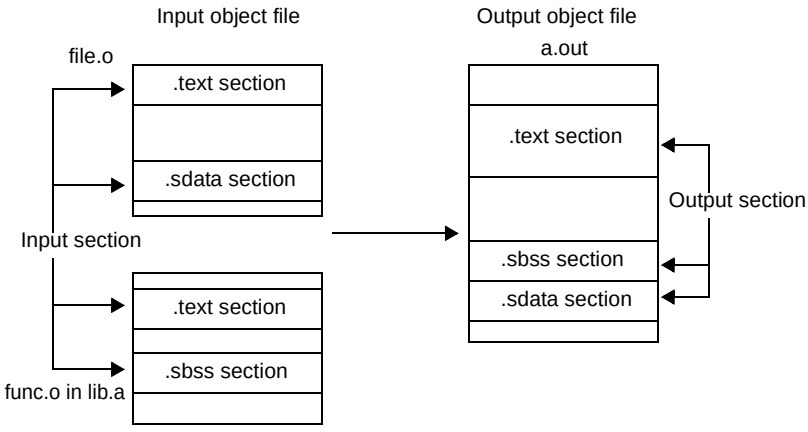


(1) Link procedure

The link procedure is described below.

(a) The linker links a section (input section) that is included in a specified object file according to a link directive and device file to create an output section consisting of output object files (see "CubeSuite+ V850 Coding" for details).

Figure B-12. Creation of Output Section

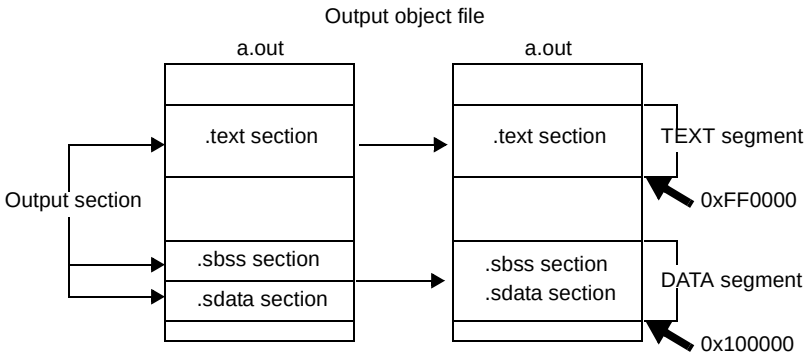


(b) The linker links the output section created in the step (a) according to the link directive and creates a segment[Note].

Note A segment is the minimum unit for loading a program to memory, and it is reflected in the program header of the created object file.

(c) The linker allocates the segment created in the step (b) to the target machine's memory space according to the link directive and device file.

Figure B-13. Allocation to Memory Space



(d) The linker resolves unresolved external references in the output section.

(e) The linker creates the following three types of symbols according to the symbol directive in the link directive[Note].

- Text pointer symbol having the value set to the text pointer (tp)
- Global pointer symbol having the value set to the global pointer (gp)
- Element pointer symbol having the value set to the element pointer (ep)

Note These symbols are used to set appropriate values to the text pointer (tp), global pointer (gp), and element pointer (ep) before executing the codes created by the C compiler (such as in the startup module).
Although the user can specify a value for the element pointer, if it is omitted then the linker will read the peculiar value for the target device (start address of internal RAM) from the specified device file, and set it to the element pointer symbol.

(f) The linker creates reserved symbols. These reserved symbols include the following.

- Start address of each output section
- Start address (with 4-byte alignment) of segment exceeding each output section
- Start address (with 4-byte alignment) of segment exceeding the created executable object file

See "(3) Reserved symbols" for details about reserved symbols.

B.3.1 Method for manipulating

This section explains how to manipulate the linker.

(1) Command input method

Enter the following from the command prompt.

```
C:\>ld850 [option] ... file-name [file-name or option] ...
      [ ]:     Can be omitted
      ...:     Pattern in proceeding [ ] can be repeated
```

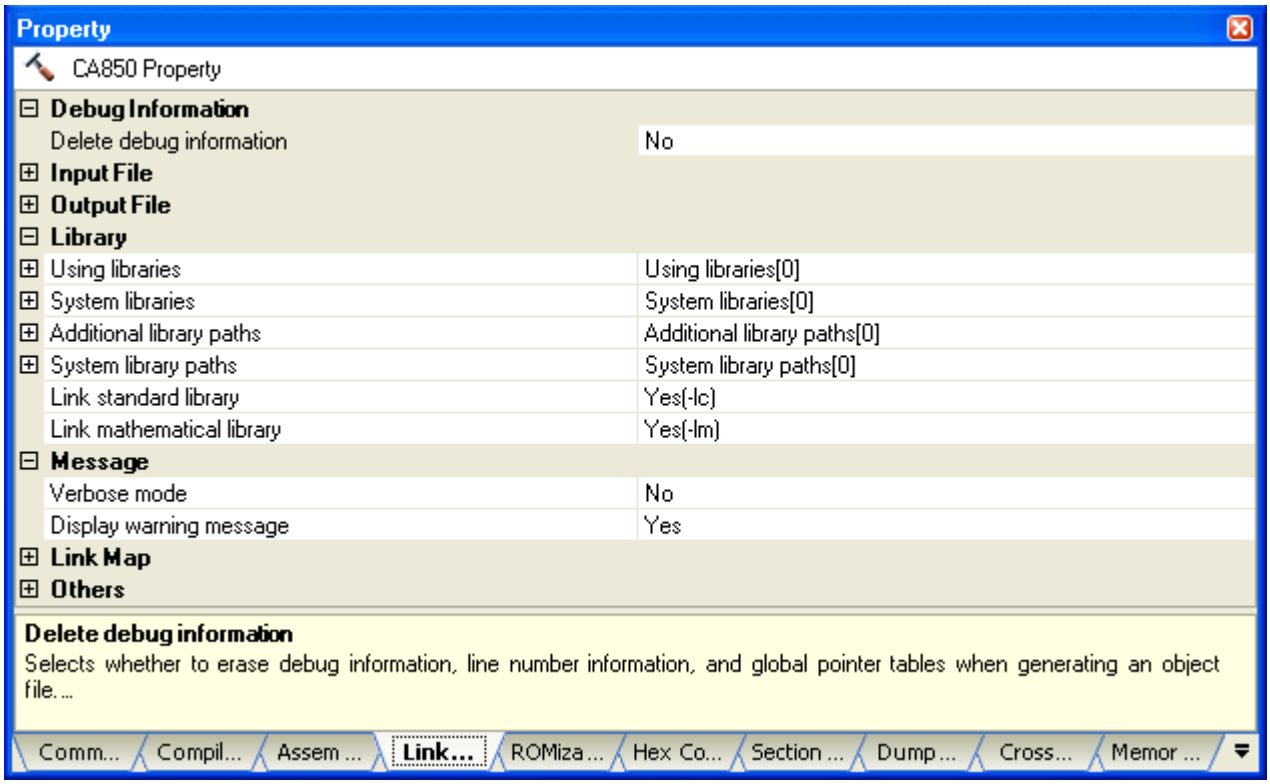
(2) Set options in CubeSuite+

This section describes how to set link options from CubeSuite+.

On CubeSuite+'s Project Tree panel, select the Build Tool node. Next, select the [View] menu -> [Property]. The Property panel opens. Next, select the [Link Options] tab.

You can set the various link options by setting the necessary properties in this tab.

Figure B-14. Property Panel: [Link Option] Tab



B.3.2 Option

This section explains link options.

The types and explanations for link options are shown below.

Table B-10. Link Options

Classification	Option	Description
Input file	-D	Performs linking according to the specified link directive in link directive file.
	-Xolddir	Selects the compatibility of the format of the link directive file with old versions.
Output file	+err_file	Adds and saves error messages to the file.
	-err_file	Overwrites and saves error messages to the file.
	-o	Specifies the name of the object file to be generated.
	-m	Outputs a link map that indicates allocation of the input and output sections to the memory space.
	-mo	Outputs a link map that indicates allocation of the input and output sections to the memory space in the format of products older than CA850 Ver. 2.60.
Library	-L	Searches the archive file (library file) specified by the -l option from the specified folder, standard folder in that order.
	-lc	Links the standard library of the compiler (libc.a).
	-lm	Links the mathematical library of the compiler (libm.a).
	-l	References the specified archive file when resolving an unresolved external symbol reference.
Flash	-ext_table	Generates an object file for the flash/external ROM relink function using the value specified as the start address value of the branch table.
	-zf	Generates the flash area object file from the specified object file as the boot area object file.
Device	-X256M	Treats the memory space as having 256 MB.
	-Xsid	Sets the security ID of an on-chip flash memory device.
	-Xob=none	Suppress the option byte that is generated by default.

Classification	Option	Description
Linker	-A	Outputs as the standard output the information that can be used as a yardstick for the sdata/sbss data allocation option that is specified for the ca850 and as850.
	-B	Performs linking in the 2-pass mode.
	-E	Outputs a warning message, not an error message, and continues linking if an illegalities is found during relocation processing.
	-M	Outputs a message for all multi-defined external symbols and stops link processing.
	-T	Does not check the size and alignment condition when linking an external symbol.
	-Ximem_overflow=warning	Controls checking when the internal ROM/RAM overflows.
	-e	Regards the specified symbol value as the entry point address value for the object file to be generated.
	-f	Specifies the filling value for align holes between sections of the generated object.
	-mc	Checks whether or not the files that use the mask register function are mixed with files that do not use this function.
	-rc	Outputs detailed information when register modes are mixed for all input object files.
	-rescan	Re-references the library file specified by the -l option.
	-rom_less	Does not check for the allocation to the internal ROM area.
	-s	Generates an object file in which the debug information, line number information, and global pointer table have been removed.
	-t	Does not check the size and alignment condition of the symbol when linking an undefined external symbol.
	-v	Outputs the execution status of the linker in detail.
	-w	Does not output a warning messages.
Other	-F	Searches a device file from the specified folder.
	-V	Outputs the version information of the C compiler to the standard error output.
	-cpu	Reads the device file for the target device specified.
	-fc	Checks whether or not the old function calling and the calling specification of the current version are mixed for all input object files.
	-help	Outputs option descriptions to the standard error output.
	-mask_reg	References the library for a mask register function.
	-r	Generates a relocatable object file.
	-ro	Generates a relocatable object file in the old mapping mode (CA850 Ver. 2.30 or earlier).
	-reg	References the corresponding register mode library.
	@	Handles the specified file as a command file.

Table B-11. Mark Used in Option Descriptions

[V850E2]	Option dedicated to V850E2 core
[V850E]	Option dedicated to V850Ex core

Input file

The options related to the input file are as follows.

- -D
- -Xolddir

-D

[Description format]

```
-D dfile
```

- Interpretation when omitted
  The default link directive is used.

[Function Description]

- This option performs linking according to the link directive in link directive file *dfile*.
- The length of *dfile* must be no more than 127 characters including the path specification or no more than 14 characters when not including the path specification.
- The extension is necessary. The extension ".dir" is recommended.
- See "CubeSuite+ V850 Coding" for details about the link directive file.

[Example of use]

- To perform linking according to the link directive in the link directive file (link.dir), describe as:

```
C:\>ld850 -D link.dir main.o
```

-Xolddir

[Description format]

```
-Xolddir[=version]
```

- Interpretation when omitted
  None

[Function Description]

- This option selects the compatibility of the format of the link directive file with old versions.
- "V240", "V250", or "V260" can be specified as *version*. If *version* is omitted, it is assumed that "V240" have been specified.
- If this option is not specified, the latest link directive file format is supported.

When V240 is specified	Section precedence layout function OFF, segment sort OFF (equivalent to CA850 Ver. 2.40)
When V250 is specified	Section precedence layout function ON, segment sort OFF (equivalent to CA850 Ver. 2.50)
When V260 is specified	Section precedence layout function ON, segment sort ON (equivalent to CA850 Ver. 2.60)

[Example of use]

- To specify that the format of the link directive is equivalent to CA850 Ver. 2.40, describe as:

```
C:\>ld850 -Xolddir=V240 main.o
```

Output file

The options related to the output file are as follows.

- +err_file
- -err_file
- -o
- -m
- -mo

+err_file

[Description format]

```
+err_file=file
```

- Interpretation when omitted
  None

[Function Description]

- This option adds and saves error messages to file *file*.

[Example of use]

- To add and save error messages to the file "err", describe as:

```
C:\>ld850 +err_file=err main.o
```

-err_file

[Description format]

```
-err_file=file
```

- Interpretation when omitted

  None

[Function Description]

- This option overwrites and saves error messages to file *file*.

[Example of use]

- To overwrite and save error messages to the file "err", describe as:

```
C:\>ld850 -err_file=err main.o
```

-o

[Description format]

```
-o ofile
```

- Interpretation when omitted
  It is assumed that a.out has been specified as the name of the object file to be generated.

[Function Description]

- This option specifies *ofile* as the name of the object file to be generated.

[Example of use]

- To specify test.out as the name of the object file to be generated, describe as:

```
C:\>ld850 -o test.out main.o
```

-m

[Description format]

```
-m[=mapfile]
```

- Interpretation when omitted
  No link map is output.

[Function Description]

- This option outputs a link map that indicates allocation of the input and output sections to the memory space to *mapfile*.
- If *mapfile* is omitted, the link map is output to the standard output.
- See "3.2 Linker" for details about the link map.

[Example of use]

- To output a link map that indicates allocation of the input and output sections to the memory space to the standard output, describe as:

```
C:\>ld850 -m main.o
```

-mo

[Description format]

```
-mo[=mapfile]
```

- Interpretation when omitted
  No link map is output.

[Function Description]

- This option outputs a link map that indicates allocation of the input and output sections to the memory space to *mapfile* in the format of products older than CA850 Ver. 2.60.
- If *mapfile* is omitted, the link map is output to the standard output.
- See "3.2 Linker" for details about the link map.

[Example of use]

- To output a link map that indicates allocation of the input and output sections to the memory space to the standard output in the format of products older than CA850 Ver. 2.60, describe as:

```
C:\>ld850 -mo main.o
```

Library

The options related to libraries are as follows.

- -L
- -lc
- -lm
- -l

-L

[Description format]

```
-Ldir
```

- Interpretation when omitted
  The archive file (library file) specified by the -l option is searched from the standard folder.

[Function Description]

- If the -l option is specified with this option (or after this option in the case of the command line), the archive file (also called library file) specified by the -l option is searched from folder "dir", the standard folder in that order. The -l option specified after this option is subject to searching.
- The linker handles the folder where the CA850 is installed, the folder at the position of CubeSuite+\CA850\V*x.xx*[Note]\lib850, and the folder at the position of lib850\r*XY* (*XY*=[32|26|22]) as the standard folders of libraries.

Note V*x.xx* is the version of the C compiler.

[Example of use]

- To search the standard library of the compiler (libc.a) to be linked from folder D:\lib, the standard folder in that order, describe as:

```
C:\>ld850 -LD:\lib main.o -lc
```

-lc

[Description format]

```
-lc
```

- Interpretation when omitted
  The standard library of the compiler (libc.a) is not linked.

[Function Description]

- This option links the standard library of the compiler (libc.a).

[Example of use]

- To link the standard library of the compiler (libc.a), describe as:

```
C:\>ld850 main.o -lc
```

-lm

[Description format]

```
-lm
```

- Interpretation when omitted
  The mathematical library of the compiler (libm.a) is not linked.

[Function Description]

- This option links the mathematical library of the compiler (libm.a).
- This option set with the -lc option at the same time because the mathematical library also references the functions in the standard library.
- The mathematical library supplied by the C compiler references standard library libc.a. Therefore, when activating from the command line, specify standard library reference specification "-lc" after mathematical library reference specification "-lm".

[Example of use]

- To link the mathematical library of the compiler (libm.a), describe as:

```
C:\>ld850 main.o -lm -lc
```

-l

[Description format]

```
-lstring
```

- Interpretation when omitted
  No archive file is linked.

[Function Description]

- When resolving an unresolved external symbol reference, this option references archive file lib*string*.a.
- If two or more archive files are specified by this option, the files are searched in the order of their specification.
- Use no more than 64 characters to specify *string*.
- When this option has been specified, the linker references the specified archive files only about unresolved external references at the time they are specified. Therefore, when activating from the command line, specify this option after specifying the object file that will reference the specified archive files.

[Example of use]

- To reference the archive file (libtest.a) when resolving an unresolved external symbol reference, describe as:

```
C:\>ld850 main.o -ltest
```

Flash

The options related to the flash ROM are as follows.

- -ext_table
- -zf

-ext_table

[Description format]

```
-ext_table address
```

- Interpretation when omitted
  An object file for the flash/external ROM relink function is not generated.

[Function Description]

- This option creates an object file for the flash/external ROM relink function using the value specified by 8-digit hexadecimal number *address* as the start address value of the branch table (see "B.3.3 Boot-flash relink function").
- When specifying the boot area, the branch to the flash area side is processed.
  At this time, the process is the branch to the branch table and the address is specified by this option.
- When specifying the flash area, a branch table having the branch instruction to the previous branch destination is created at the address specified by this option.
- The address value specified by this option must be the same as the value that is used when creating an object file in the boot area/flash area. If a different value is specified, operation faults occur. No error checking is done.
- The address value specified by this option must be within the ROM area used as the flash area. No error checking is done because it is not possible to determine which area contains the specified address.
- When creating an object file in the flash area, this option automatically creates the .ext_table section having a size of "(the maximum ID value[Note] + 1) x (Entry size of branch table)" and starting with the specified address value. Although this section does not require an allocation can specification in the directive file, you must leave enough space for allocation.

Note This is the value specified by the .ext_func quasi directive in the assembler source file.

- This option can not be specified together with the -r option. Operation faults occur if a relocatable object file that has been generated using the -r option is input.
- See "B.3.3 Boot-flash relink function" for details about the flash/external ROM relink function.

[Example of use]

- To generate the boot area object file with 0x10000 as the start address of the branch table, describe as:

```
C:\>ld850 -ext_table 0x100000 boot.o
```

-zf

[Description format]

```
-zf bootfile
```

- Interpretation when omitted
  An object file for the flash/external ROM relink function is not generated.
  However, the boot area object file is generated when -ext_table is specified.

[Function Description]

- This option generates the flash area object file from the specified object file as the boot area object file when using the flash/external ROM relink function.
- Specify the object file that is specified via flash/external ROM relink function and created as the boot area object file.
- Specify an object file output by the linker. Note that, if you specify an object that was output by the ROMization processor, an invalid object will be generated.
- The -ext_table option must be specified in order to use this option.

[Example of use]

- Generate the flash area object file with 0x10000 as the start address of the branch table.
  To specify boot.out as the name of the boot area object file, describe as:

```
C:\>ld850 -zf boot.out -ext_table 0x100000 flash.o
```

Device

The options related to the device are as follows.

- -X256M
- -Xsid
- -Xob=none

-X256M

[Description format]

```
-X256M
```

- Interpretation when omitted
  The memory space is treated as having 64 MB and the addresses are resolved.

[Function Description]

[V850E]

- Treats the memory space as having 256 MB.
- Set this option in accordance with the chipset to be used.
- The physical address space of the V850Ex core has 256 MB in many cases. When creating an application that uses a space between 64 MB and 256 MB, specify this option.

[Example of use]

- To treat the memory space as having 256 MB, describe as:

```
C:\>ld850 -X256M main.o
```

-Xsid

[Description format]

```
-Xsid=id
```

- Interpretation when omitted
  -Xsid=0xffffffffffffffffffff (when a device with a security ID is specified)

[Function Description]

- This option sets the security ID of an on-chip flash memory device.
- It cannot be used if a device not supporting the security ID function is used.
- Specify the ID in a hexadecimal number of 10 bytes or less (including the first 0x).
  If the specified value less than 10 bytes, the higher bits are filled with 0. If the value exceeds 10 bytes, an error is output.
- If specification of this option or the security ID written in assembly language (using .section "SECURIYI_ID") is omitted for a device supporting the security ID function, it is assumed that "0xffffffffffffffffffff" has been specified.
- If the security ID is set using a method other than the above, the linker judges that the security ID is duplicated with the security ID that is generated by the linker, and outputs the following error.

```
F4264: start address(0x00000070) of section "SECURITY_ID" overlaps previous section
"section name" ended before address (0xXXXXXXXX).
```

  In such a case, specify the +Xsid option to suppress security ID generation by the linker.
- If an object for a device not supporting the security ID function is specified when the linker is executed, a warning message is output and the specification is ignored.

[Example of use]

- To set security code "0x112233445566778899aa" (setting 0x11 to address 0x70, 0x22 to address 0x71, 0x33 to address 0x72, 0x44 to address 0x73, 0x55 to address 0x74, 0x77 to address 0x76, 0x88 to address 0x77, 0x99 to address 0x78, and 0xaa to address 0x79), describe as:

```
C:\>ld850 -Xsid=0x112233445566778899aa main.o
```

-Xob=none

[Description format]

```
-Xob=none
```

- Interpretation when omitted
  The option byte is generated (when a device with an option byte is specified).

[Function Description]

- This option suppresses the option byte that is generated by default.
- Only the default generation by the default value registered in the device file is suppressed.
- When the option byte is specified by using .section "OPTION_BYTES" in the assembler source file, the .section "OPTION_BYTES" specification takes precedence, regardless of this option's specification.
- If this option is specified for a device that does not have a option byte function, this option is ignored without outputting a message.

[Example of use]

- To suppress the option byte that is generated by default, describe as:

```
C:\>ld850 -Xob=none main.o
```

Linker

The linker options are as follows.

- -A
- -B
- -E
- -M
- -T
- -Ximem_overflow=warning
- -e
- -f
- -mc
- -rc
- -rescan
- -rom_less
- -s
- -t
- -v
- -w

-A

[Description format]

```
-A
```

- Interpretation when omitted
  Information that can serve as a yardstick for determining the value of *num* of the -G*num* option is not output.

[Function Description]

- This option outputs as the standard output the information that can be used as a yardstick for the sdata/sbss data allocation option (*num* of the -G*num* option) that is specified for the ca850 and as850 when a source file is compiled or assembled.
- When using the numerical value indicated by *OK*, data with a size less than that value is allocated to the sdata/sbss area.
- When activating from the ca850, the -A option specified in the ca850 activation is passed.
- See "(1) Using -A option" for details.

[Example of use]

- To output as the standard output the information that can be used as a yardstick for the sdata/sbss data allocation option (*num* of the -G*num* option) that is specified for the ca850 and as850, describe as:

```
C:\>ld850 -A main.o
```

-B

[Description format]

```
-B
```

- Interpretation when omitted
  Linking is performed in the 1-pass mode.

[Function Description]

- This option performs linking in the 2-pass mode.
- The 2-pass mode is slower than the 1-pass mode, but it is able to process larger sized files.

[Example of use]

- To perform linking in the 2-pass mode, describe as:

```
C:\>ld850 -B main.o
```

-E

[Description format]

```
-E
```

- Interpretation when omitted
  If an illegalities is found during relocation processing, the linker outputs the following message and stops linking.

[Function Description]

- If any of the following illegalities is found during relocation processing
- The result of address calculation of an unresolved external reference is illegal
- The relationship with the section to be allocated is illegal
  This option outputs a warning message, not an error message, and continues linking.
- The value of address calculation judged as an illegality is not assigned to the unresolved external reference judged as an error and the original value remains.

[Example of use]

- To output a warning message and continue linking when the result of address calculation of an unresolved external reference is illegal during relocation processing, describe as:

```
C:\>ld850 -E main.o
```

-M

[Description format]

```
-M
```

- Interpretation when omitted

  A message is output for the first multi-defined external symbol and stops link processing.

[Function Description]

- This option outputs a message for all multi-defined external symbols and stops link processing.

[Example of use]

- To output a message for all multi-defined external symbols and stops link processing, describe as:

```
C:\>ld850 -M main.o
```

-T

[Description format]

```
-T
```

- Interpretation when omitted
  The size is checked, and if a size difference is detected, a warning message is output and link processing is continued.
  At this time, the symbol size of the file in which the symbol is defined is valid.

[Function Description]

- This option does not check the size and alignment condition when linking an external symbol.

[Example of use]

- Not to check the size and alignment condition when linking an external symbol, describe as:

```
C:\>ld850 -T main.o sub.o
```

-Ximem_overflow=warning

[Description format]

```
-Ximem_overflow=warning
```

- Interpretation when omitted

  A warning message is output when overflowing and linking is stopped.

[Function Description]

- This option controls checking when the internal ROM/RAM overflows.
- This option outputs a warning message when overflowing and continues linking.

[Example of use]

- To control checking when the internal ROM/RAM overflows, describe as:

```
C:\>ld850 -Ximem_overflow=warning main.o
```

-e

[Description format]

```
-e symbol
```

- Interpretation when omitted
  The entry point address value is determined according to the following rules.
- If symbol "__start" exists, it is used.
- _ _ If "__start" does not exist, the start address of the text attribute section that is allocated to the lowest address area in the generated object file is used.
- If the text attribute section does not exist, "0" is used.

[Function Description]

- This option regards symbol value *symbol* as the entry point address value for the object file to be generated.
- If the specified symbol cannot be found, the linker outputs a message and stops linking.
- The symbol name cannot include blank spaces.

[Example of use]

- To regard symbol value "_main" as the entry point address value, describe as:

```
C:\>ld850 -e _main main.o
```

-f

[Description format]

```
-f num
```

- Interpretation when omitted
  -f 0x0000

[Function Description]

- This option specifies the filling value for align holes between sections of the generated object, with 4-digit hexadecimal numbers (2 bytes).
- When using this option, specify the -B option to perform linking in the 2-pass mode.
- The first 0x can be omitted.
- Specification by this option takes precedence over the filling value specification in the link directive.
- If the value does not occupy all 4 digits, it is assumed that 0 are used to fill the empty digit(s).
- If the hole size is less than 2 bytes, only the required number of digits are fetched and initialized from the specified filling value (starting from the lowest value).

[Example of use]

- To specify 0xffff as the filling value for align holes between sections of the generated object, describe as:

```
C:\>ld850 -B -f 0xffff main.o
```

-mc

[Description format]

```
-mc
```

- Interpretation when omitted
  Whether or not the files that use the mask register function are mixed with files that do not use this function is not checked.

[Function Description]

- This option checks whether or not the files that use the mask register function are mixed with files that do not use this function when linking the object files generated from the C source files.
- Linking is stopped if they are mixed.

[Example of use]

- To check whether or not the files that use the mask register function are mixed with files that do not use this function when linking the object files, describe as:

```
C:\>ld850 -mc main.o sub.o
```

-rc

[Description format]

```
-rc
```

- Interpretation when omitted
  Detailed information is not output when register modes are mixed for all input object files.

[Function Description]

- This option outputs detailed information when register modes are mixed for all input object files.
- If this option is specified with the -w option, this option is ignored.

[Example of use]

- To output detailed information when register modes are mixed for all input object files, describe as:

```
C:\>ld850 -rc main.o sub.o
```

-rescan

[Description format]

```
-rescan
```

- Interpretation when omitted
  The library file specified by the -l option is not re-referenced.

[Function Description]

- This option re-references the library file specified by the -l option.
- When this option is specified, symbols that are unresolved through the link sequence of the library can be prevented.

[Example of use]

- To re-reference the archive files (libtest1.a, libtest2.a), describe as:

```
C:\>ld850 -rescan main.o -ltest1 -ltest2
```

-rom_less

[Description format]

```
-rom_less
```

- Interpretation when omitted
  When the application allocation overlaps the addresses of the internal ROM area, a message is output and linking is stopped.

[Function Description]

- This option does not check for the allocation to the internal ROM area.
  When the application allocation overlaps the addresses of the internal ROM area, a warning message is not output.
- Specify this option when the application is created in the ROM-less mode.

Caution Checking of the overflow of the internal ROM is not supported when the single-chip mode is selected. Invalidate checking of the overflow of the internal ROM and check the overflow on the link map.

[Example of use]

- Not to check for the allocation to the internal ROM area, describe as:

```
C:\>ld850 -rom_less main.o
```

-s

[Description format]

```
-s
```

- Interpretation when omitted
  The input object includes the debug information, line number information, and global pointer table, the object file that includes those information is generated.

[Function Description]

- This option generates an object file in which the debug information, line number information, and global pointer table have been removed.

[Example of use]

- To generate an object file in which the debug information, line number information, and global pointer table have been removed, describe as:

```
C:\>ld850 -s main.o
```

-t

[Description format]

```
-t
```

- Interpretation when omitted
  The symbol size and alignment condition are checked, and if a difference is detected, a warning message is output and link processing is continued.

[Function Description]

- This option does not check the size and alignment condition of the symbol when linking an undefined external symbol.
- The linker supports multiple definitions of undefined external symbols.
  Multiple-defined undefined external symbols are allocated to the .sbss or .bss section after linking. In this case, if the size of the linked symbol or alignment condition are different, then the size will be the largest size of the linked symbols, and the alignment condition will be on the lowest common multiple of the alignment condition of the linked symbols.

[Example of use]

- Not to check the size and alignment condition of the symbol when linking an undefined external symbol, describe as:

```
C:\>ld850 -t main.o
```

-v

[Description format]

```
-v
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs the execution status of the linker in detail. The list of objects to be linked, etc. is displayed.

[Example of use]

- To output the execution status of the linker in detail and display the list of objects to be linked, etc., describe as:

```
C:\>ld850 -v main.o
```

-w

[Description format]

```
-w
```

- Interpretation when omitted
  No warning messages are suppressed.

[Function Description]

- This option does not output a warning messages.
- Only messages for fatal errors are output.

[Example of use]

- To output only messages for fatal errors, describe as:

```
C:\>ld850 -w main.o
```

Other

Other options are as follows.

- -F
- -V
- -cpu
- -fc
- -help
- -mask_reg
- -r
- -ro
- -reg
- @

-F

[Description format]

```
-F devpath
```

- Interpretation when omitted
  The device file is searched from the standard folder.

[Function Description]

- This option searches a device file from folder *devpath* when the linker is started by itself.
- When activating from the ca850, use the ca850's -devpath option to specify the path of the device file.

[Example of use]

- To search a device file from folder "D:\dev" when the linker is started by itself, describe as:

```
C:\>ld850 -F D:\dev main.o
```

-V

[Description format]

```
-V
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs the version information of the linker to the standard error output and terminates processing.

[Example of use]

- To output the version information of the linker to the standard error output, describe as:

```
C:\>ld850 -V
```

-cpu

[Description format]

```
-cpu devicename
```

- Interpretation when omitted
  The device file for the target device specified when the .o file is generated.

[Function Description]

- This option reads the device file for the target device specified by *devicename*.

[Example of use]

- To specify UPD70F3719 as the target device, describe as:

```
C:\>ld850 -cpu f3719 main.o
```

-fc

[Description format]

```
-fc
```

- Interpretation when omitted
  Only the object file generated from the C source file are checked.

[Function Description]

- This option checks whether or not the old function calling and the calling specification of the current version are mixed for all input object files.
- The old function calling specification is not supported by the current version.

[Example of use]

- To check whether or not the old function calling and the calling specification of the current version are mixed for all input object files, describe as:

```
C:\>ld850 -fc main.o sub.o
```

-help

[Description format]

```
-help
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs option descriptions to the standard error output.

[Example of use]

- To output option descriptions to the standard error output, describe as:

```
C:\>ld850 -help
```

-mask_reg

[Description format]

```
-mask_reg
```

- Interpretation when omitted
  The library that does not use a mask register function referenced.

[Function Description]

- This option references the library for a mask register function.
- Use the -Xmask_reg option when activating from the ca850.
- The library for a mask register function is the library when in the 32-register mode. When the 22-register mode or 26-register mode is specified, the following warning message is output and any subsequent specification is ignored.

```
W4857: "-reg22" option is illegal when "-mask_reg" option is specified, ignored "-reg22"
option.
```

[Example of use]

- To reference the library for a mask register function, describe as:

```
C:\>ld850 -mask_reg main.o
```

-r

[Description format]

```
-r
```

- Interpretation when omitted
  If an unresolved external reference remains, the following message is output and linking is stopped. In this case, an object file (load module file) is not generated.

```
F4452:  undefined symbol.
        symbol referenced in "file"
```

[Function Description]

- This option generates a relocatable object file.
- If this option is specified with the -ro option, this option is ignored.
- If this option is specified, a message is not output and linking is completed normally even if an unresolved external reference remains after completing linking.
- If an object file generated by the linker is specified as the target for relinking by the linker, specify this option when generating the target object file for relinking.

[Cautions]

- If this option is specified, the link directive is valid only for the type and attribute in the mapping directive section and is otherwise ignored.
- If this option is specified, any reserved symbol is not created.
- The specification of the -r option has changed from CA850 Ver.2.30 or earlier.
  When using the mapping method of an old version, use the -ro option instead of the -r option.

[Example of use]

- To generate a relocatable object file, describe as:

```
C:\>ld850 -r main.o
```

-ro

[Description format]

```
-ro
```

- Interpretation when omitted
  The relocatable object file is generated.

[Function Description]

- This option generates a relocatable object file in the old mapping mode (CA850 Ver. 2.30 or earlier).
- If this option is specified with the -r option, the -r option is ignored.

[Example of use]

- To generate a relocatable object file in the old mapping mode (CA850 Ver. 2.30 or earlier), describe as:

```
C:\>ld850 -ro main.o
```

-reg

[Description format]

```
-regnum
```

- Interpretation when omitted
  -reg32

[Function Description]

- This option references the corresponding register mode library.
- 22, 26, or 32 can be specified as *num*.
  A blank space cannot be entered after -reg.

[Example of use]

- To reference the 22-register mode library.

```
C:\>ld850 -reg22 main.o
```

@

[Description format]

```
@cfile
```

- Interpretation when omitted
  Command files are assumed not to exist.

[Function Description]

- This option handles *cfile* as a command file.
- On Windows, the length of a character string specified as options for commands is limited. If this option is specified, you do not need to take string restrictions into account because the option string will be output to the command file. If many options are set and some of the options cannot be recognized, create a command file and specify this option.
- See "(2) Command file" for details about a command file.

[Example of use]

- To handle "command" as a command file, describe as:

```
C:\>ld850 @command
```

B.3.3 Boot-flash relink function

(1) Relink function

Some systems are equipped with flash area or detachable ROM.
To upgrade the version of the program, the contents of the flash area may be rewritten or the detachable ROM may be replaced with a new ROM.
When changing the program even partially, basically the project itself is reorganized or "rebuilt". However, it would be convenient if the allocation to be upgraded was limited to the flash area or external ROM and if it was not necessary to reorganize the project. The boot area is fixed to the internal ROM. If a function is called between the flash area to be rewritten and the boot area, and if the start address of the function is changed as a result of modifying the function in the flash area, the function cannot be called correctly.
The "boot-flash relink function" (hereafter referred to as the "relink function") is used to prevent this and enable functions to be called correctly.
This function is realized as follows.

(a) A "branch table" where instructions to branch to the functions in the flash area are written is prepared in the flash area.

(b) When a function in the flash area is called from the boot area, execution jumps to the branch table in the flash area, and then the instruction used to branch to the intended function is executed and jump occurs.

This mechanism can be realized by the user. If the "relink function" is used, this can be done relatively easily.
To use this function, however, the functions to be called in the flash area must be determined when the boot area is created. This mechanism is used to call a function from the boot area even if the function is modified in the flash area.

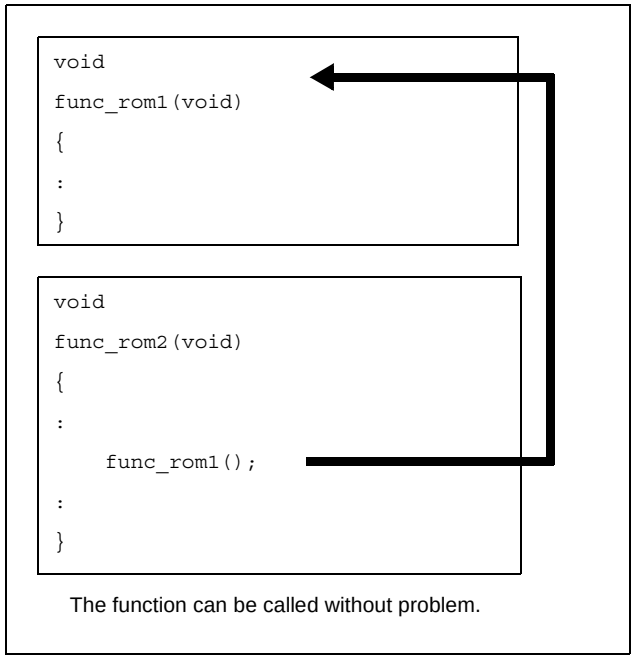
(2) Image of relink function

A function is called as shown below when the relink function is used.

(a) To call function in the boot area from the boot area

The function can be called without problem because addresses have been resolved before they are programmed to the boot area.

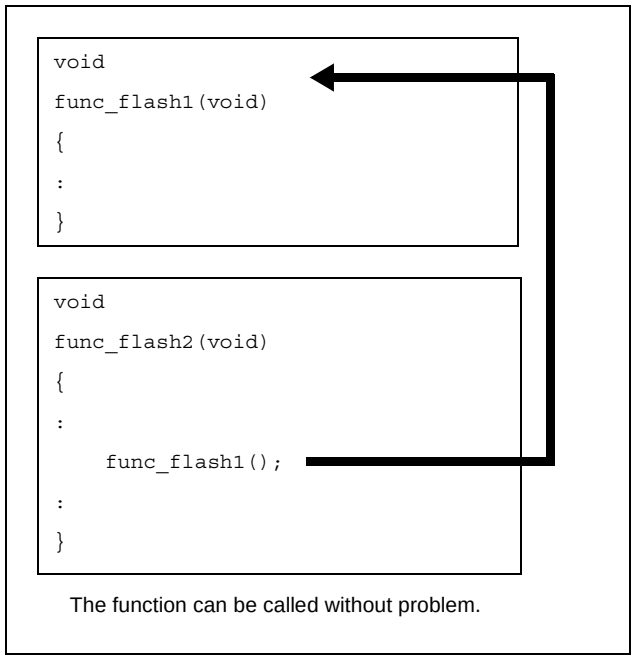
Figure B-15. In Boot Area



(b) To call function in the flash area from the flash area

The function can be called without problem because addresses have been resolved in the flash area.

Figure B-16. In Flash Area

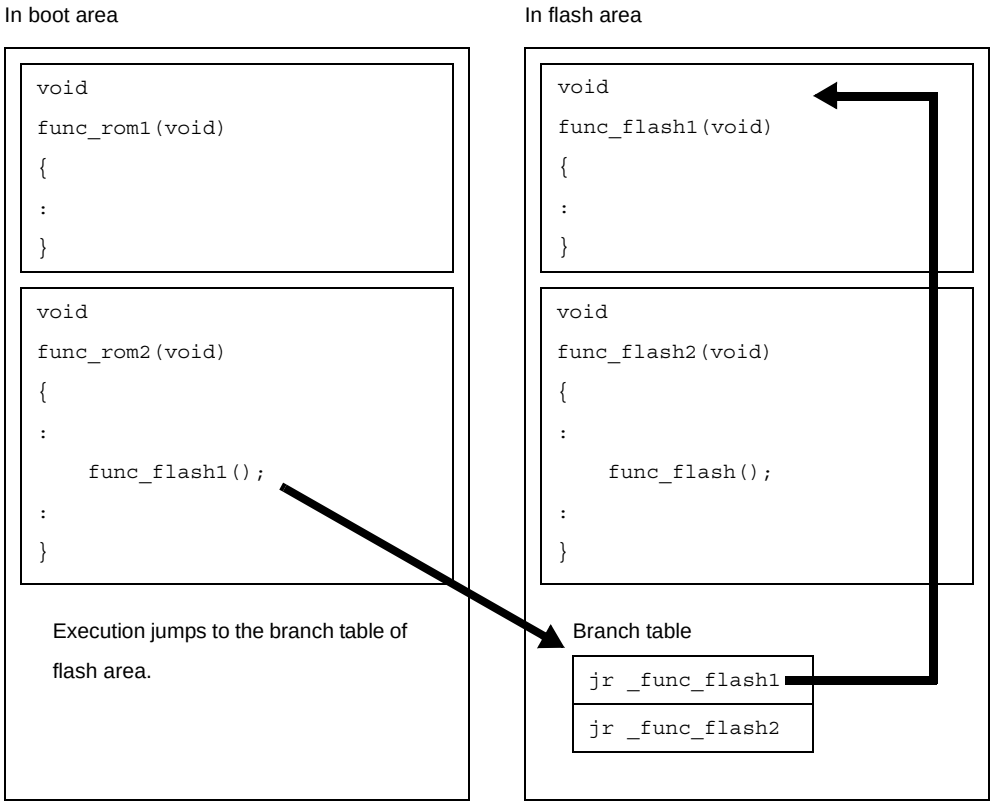


(c) To call function in the flash area from the boot area

When a function in the flash area is called from the boot area, the address of the function cannot be known from the boot area because the function size, etc., have been changed in the flash area. In other words, a function in the flash area cannot be directly called. To solve this, execution jumps to the branch table in the flash area.

Execute the jump instruction from that table to the relevant function and jump to the intended function.

Figure B-17. From Boot Area to Flash Area



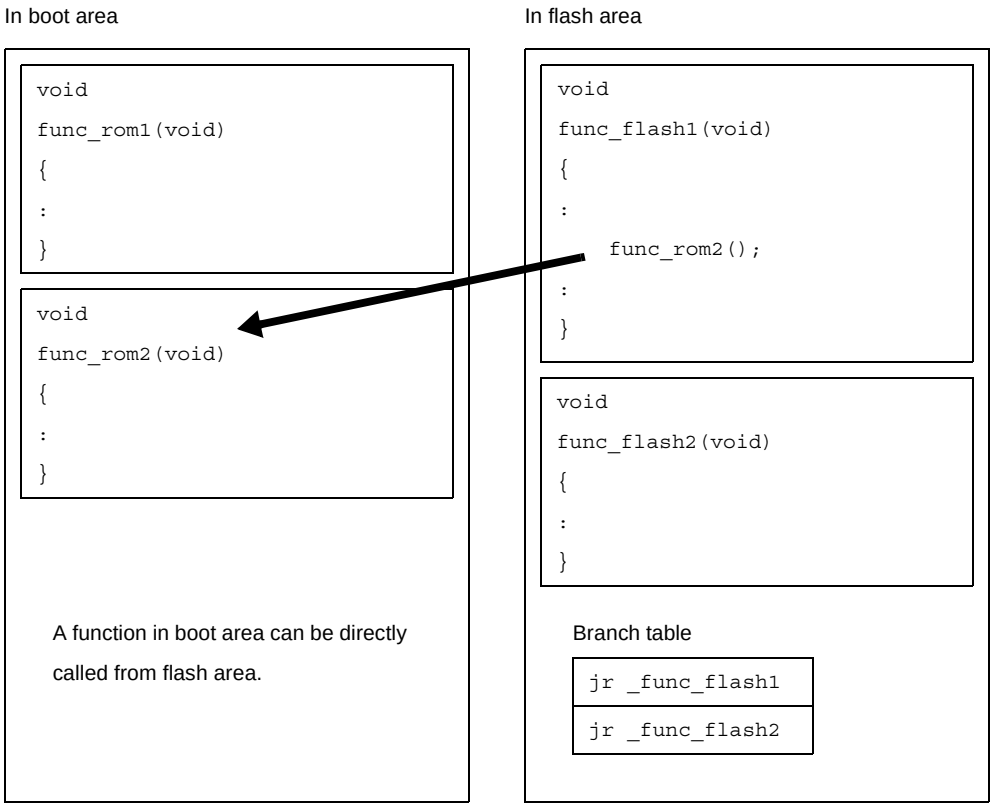
In the same manner as functions, this is relevant to referencing external variables.

A global variable defined in the flash area cannot be referenced from the boot area. Therefore, an external variable of the same name can be defined in both the boot area and flash area. Each of these external variables is referenced only from the respective areas.

(d) To call function in the boot area from the flash area

When a function in the boot area is called from the flash area, the contents of the boot area are not changed. Therefore, a function in the boot area can be directly called from the flash area.

Figure B-18. From Flash Area to Boot Area



In the same manner as functions, this is relevant to referencing external variables. A global variable defined in the boot area cannot be referenced from the flash area.

(3) Realizing relink function

This section describes specifically how to realize the relink function.

(a) Project of CubeSuite+

To realize the relink function, a boot area and flash area must be separately created. This means that only the flash area is modified after the boot area has been created (after a program has been stored in ROM). When creating a project with CubeSuite+, therefore, divide the projects as follows.

- Project to be allocated to the boot area
- Project to be allocated to the flash area (project that may be modified in the future)

In addition, separately prepare a startup routine and link directive file for each project.

(b) .ext_func quasi directive

When calling a function in the flash area from the boot area, the name of the function to be called (label name) and ID number are assigned to the boot area by using the .ext_func quasi directive. The format of the .ext_func quasi directive is as follows.

```
.ext_func function-name, ID-number
```

Specify a positive number as the ID number. The different ID number must not be specified for the same function name or the same ID number must not be specified for the different function names.
When a function name in the flash area is specified in the boot area by using the .ext_func quasi directive, a branch table (ext_table) is created. The address of this ext_table is specified by the user.

Specify the address as follows, by using link option "-ext_table", when a load module of the boot area and a load module of the flash area are created.

```
-ext_table address-to-be-specified
```

When execution branches to the body of a function, the actual function address is obtained by referencing the offset of the ID number from the beginning of the created branch table, and then execution branches.

The example is shown below.

```
func_flash0()
func_flash1()
func_flash2()
```

If the above three C functions are allocated to the flash area and they are called from the boot area, describe as follows in the boot area using the assembler.

```
.ext_func _func_flash0, 0
.ext_func _func_flash1, 1
.ext_func _func_flash2, 2
```

To make this description in a C source file, use the #pragma asm - #pragma endasm directives or __asm(). When the #pragma asm - #pragma endasm directives are used, the example is as follows.

```
#pragma asm
        .ext_func _func_flash0, 0
        .ext_func _func_flash1, 1
        .ext_func _func_flash2, 2
#pragma endasm
```

It is recommended to describe these .ext_func quasi directives in one file and include this file in all source files by using the .include quasi directive (or #include directive when describing in C language), in order to prevent missing descriptions or the occurrence of contradictions, i.e., to prevent the error of specifying the different ID numbers for the same function name or specifying the same ID number for the different function names.
If a file using the #pragma asm - #pragma endasm directives is included as above, the compiler outputs the following message but ignore this (or set by "Individual Warnings" not to output this message).

```
W2244: '#pragma asm' used out of function is not supported completely.
```

An image of relink function is shown below.

Assembly Source Described by User	Assembler Image after Linking
[ext_table.inc] .ext_func _func_flash0, 0 .ext_func _func_flash1, 1 .ext_func _func_flash2, 2	

<table>
<tr><th>Assembly Source Described by User</th><th>Assembler Image after Linking</th></tr>
<tr><td>

```
[rom.s]
        .include "ext_table.inc"
        .extern _func_flash0
        .extern _func_flash1
        .extern _func_flash2
        jarl    _func_flash0, lp
        jarl    _func_flash1, lp
        jarl    _func_flash2, lp
```

</td><td>

```
[rom.out]
        .extern __ext_table_head
        jarl    __ext_table_head+0x4*0,lp
        jarl    __ext_table_head+0x4*1,lp
        jarl    __ext_table_head+0x4*2,lp
```

</td></tr>
<tr><td>

```
[flash.s]
        include "ext_table.inc"
        .globl  _func_flash0
        .globl  _func_flash2
_func_flash0:
                :
        jmp     [lp]

        .globl  _func_flash1
_func_flash1:
                :
        jmp     [lp]

_func_flash2:
                :
        jmp     [lp]
```

</td><td>

```
[flash.o]
#(branch table)
        .section ".ext_table", text
        .globl  __ext_table_head
        .extern _func_flash0
        .extern _func_flash1
        .extern _func_flash2
__ext_table_head:
        jr      _func_flash0
        jr      _func_flash1
        jr      _func_flash2
```

```
#(function body)
        .globl  _func_flash0
_func_flash0:
                :
        jmp     [lp]

        .globl  _func_flash1
_func_flash1:
                :
        jmp     [lp]

        .globl  _func_flash2
_func_flash2:
                :
        jmp     [lp]
```

</td></tr>
</table>

If the .ext_func quasi directive is specified as shown above, a table is created with the symbol ext_table, and the first symbol of this table is "__ext_table_head".
Code "jarl__flash0, lp" in the boot area is an offset from __ext_table_head, and obtains the address of _func_flash0 and jumps to the function body by the jarl instruction.

(c) Startup routine

Separately prepare a startup routine for the boot area and a startup routine for the flash area. Each startup routine must perform the following processing.

- Setting tp, gp, and ep values in the boot area
- Calling the _rcopy function to initialize the RAM area to be used for the boot area
- Branching from the boot area to the startup routine of the flash area
- Calling the _rcopy function to initialize the RAM area to be used for the flash area
- Moving to the processing of the flash area

If tp, gp, and ep are not used in the boot area, the values may be set in the flash area. When the default value data is copied by using the _rcopy function, the load module must be "ROMized" by the ROMization processor. Prepare rompcrt.o having the first symbol of the rompsec section and execute linking by specifying link option "-lr". By using the packing section created as a result, copy data with a default value by using the _rcopy function (see "B.4 ROMization Processor").

It is recommended to use the same address values in the boot area and flash area for the tp, gp, and ep values. These values may be different, but in this case the values must be set each time control has been transferred between an instruction code in the boot area and one in the flash area.

Boot Area	Flash Area

`__start:`
 	
`mov #__tp_TEXT, tp`
`mov #__gp_DATA, gp`
`mov #__ep_DATA, ep`
 	
`:`
 	
`# To main function in the boot area`
`# It is not necessary to stick to the name "main function"`
`jarl _main, lp`
 	
`.ext_func _flash_start 3`
`jr __flash_start`
	`.ext_func _flash_start 3`
	`jr __flash_start`
	
	`__flash_start:`
	
	`:`
	
	`# To main function in the flash area`
	`jarl _main, lp`

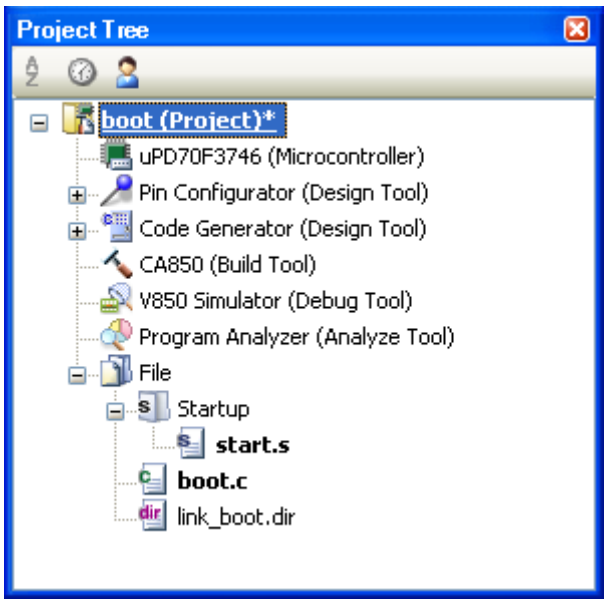
`extern unsigned long _S_romp;`
 	
`void main(void)`
`{`
`_rcopy(&_S_romp, -1);`
`:`
`}`
	`extern unsigned long _S_romp;`
	
	`void main(void)`
	`{`
	`_rcopy(&_S_romp, -1);`
	`:`
	`}`

(d) How to create the projects specifically

<1> Create the boot area project

Create a project for the boot area and add the build target files to the project.
Add the startup routine to the Startup node.

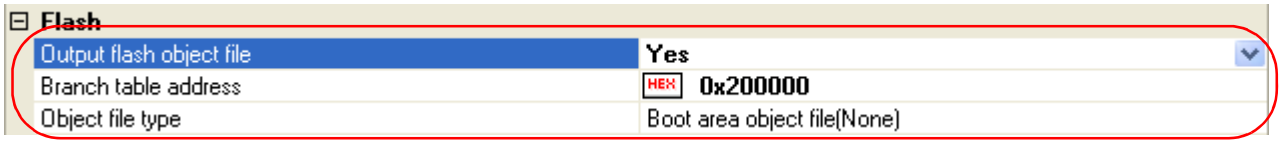
Figure B-19. Boot Area Project



<2> Set the build options for the boot area project

Select the build tool node on the project tree and select the [Common Options] tab on the Property panel.
Set the build options in the [Flash] category.
If you select [Yes] on the [Output flash object file] property, the [Branch table address] property and [Object file type] property are displayed.

Figure B-20. [Output flash object file], [Branch table address], and [Object file type] property in Boot Area

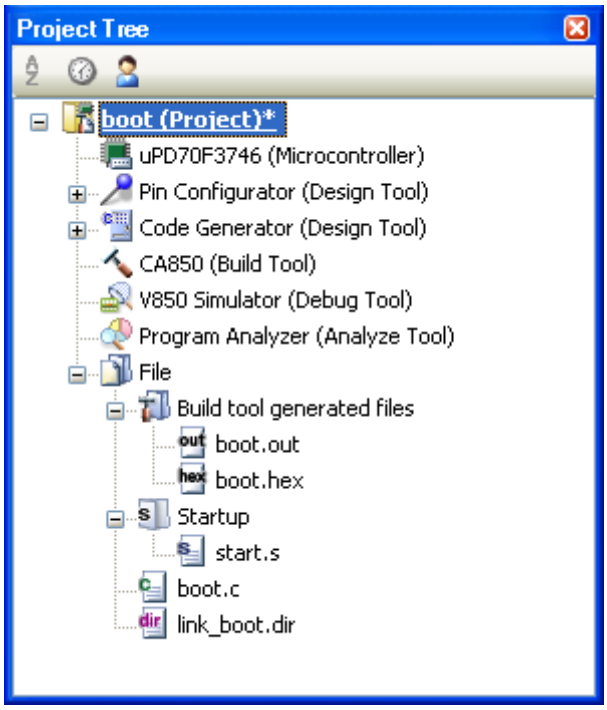


Specifies the start address of the branch table (address in the flash area) in the [Branch table address] property.The range that can be specified for the value is 0x0 to 0xffffffff (hexadecimal). "0x0" is set by default.
Also, select [Boot area object file(None)] on the [Object file type] property.

<3> Run a build of the boot area project

When you run a build of the boot area project, a load module file is created.

Figure B-21. Created Files for Boot Area

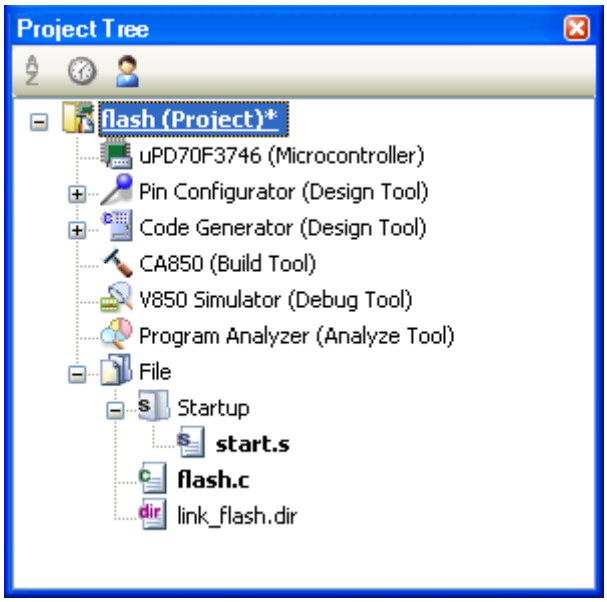


<4> Create the flash area project

Create a project for the boot area and add the build target files to the project.

Add the startup routine to the Startup node.

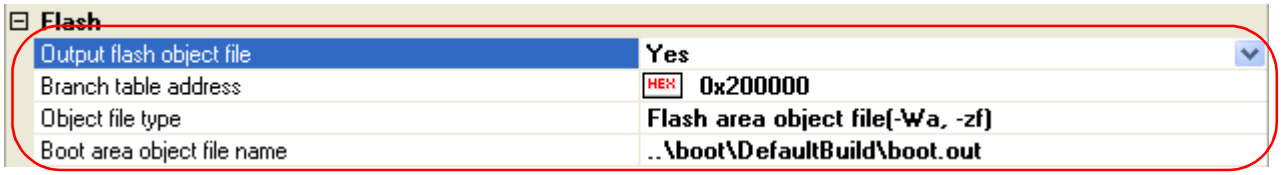
Figure B-22. Flash Area Project



<5> Set the build options for the flash area project

Select the build tool node on the project tree and select the [Common Options] tab on the Property panel.
Set the build options in the [Flash] category.
If you select [Yes] on the [Output flash object file] property, the [Branch table address] property and [Object file type] property are displayed.

Figure B-23. [Output flash object file], [Branch table address], [Object file type], and [Boot area object file name] Property



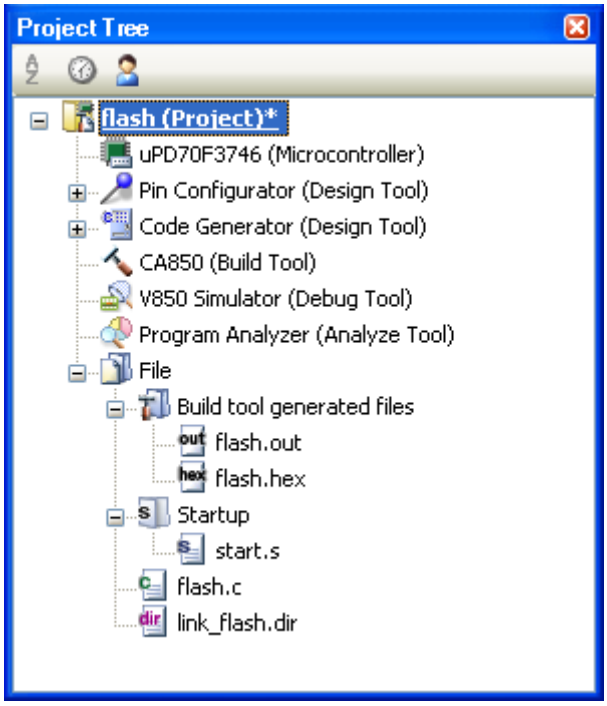
Specifies the start address of the branch table (same as the address specified in the boot area project) in the [Branch table address] property.
If you select [Flash area object file(-Wa, -zf)] on the [Object file type] property, the [Boot area object file name] property are displayed. Specify the boot area object file.

Caution Specify an object output by the linker. An error occurs if an object output by the ROMization processor is specified.

<6> Run a build of the flash area project

When you run a build of the flash area project, a load module file which implements the relink function is created.

Figure B-24. Created Files for Flash Area



(e) Describing a link directive file

Each of the boot area and flash area projects has a link directive file. The following points should be noted when describing a link directive file.

- Even if the address of a section placed in the RAM area overlaps in the boot area and flash area, the linker does not output an error because the projects are different. In other words, the addresses can overlap. For the RAM area that must be referenced simultaneously in the boot area and flash area, addresses must be specified so that they do not overlap.
- It is recommended to use the same address values in the boot area and flash area for the tp, gp, and ep values. These values may be different, but in this case the values must be set each time control has been transferred between an instruction code in the boot area and one in the flash area.
- A link directive file related to the branch table (ext_table) does not have to be described. It is automatically allocated to an address specified by the link option "-ext_table".
  However, the following points must be noted.
  - If a vacant area of the size of the branch table is at the address specified by -ext_table, the link directive file is allocated as is. The other segments are not affected. This is the most ideal case.
  - If a vacant area of the size of the branch table is not at the address specified by -ext_table, an error occurs. This applies, for example, if a code has been already allocated to the address specified by -ext_table in a TEXT segment for which an address is specified. The example is as follows.

Address specification of the branch table

```
-ext_table 0x500
```

Link directive file (part)

```
TEXT : !LOAD ?RX V0x400 {
        .text = $PROGBITS ?AX .text;
};
```

(Size of TEXT segment is 0x100 bytes or more)

An error occurs during linking because the branch table cannot be allocated to address 0x500. Change the value specified by -ext_table.

- If another segment is allocated to the address specified by -ext_table before the relink function is used but the address of that segment is not specified in the link directive file, the branch table is allocated to the address specified by -ext_table and the original segment is moved behind the branch table.
  However, If the segment overlaps a segment for which an address is specified as a result of moving, an error occurs.

Address specification of the branch table

```
-ext_table 0x500
```

Link directive file (part)

```
TEXT : !LOAD ?RX {
        .text = $PROGBITS ?AX .text;
};
```

(It is assumed that the TEXT segment is allocated from address 0x500 as a continuation from the segment ahead of the TEXT segment.)

At this time, the branch table is allocated to address 0x500 because no address is specified for the TEXT segment, and the TEXT segment is allocated behind the branch table.

(f) .ext_ent_size directive

When an actual function is called from the branch table in the flash memory, jr branch instructions are output as follows by default.

```
__ext_table_head:
        jr      _func_flash0
        jr      _func_flash1
        jr      _func_flash2
```

However, the jr instruction can branch only within a 22-bit range (±1MB) because of a restriction of the architecture. To branch in the entire 32-bit space, additionally specify the .ext_ent_size quasi directive. The format of the .ext_ent_size quasi directive is as follows.

```
.ext_ent_size Entry-size-of-table
```

The value that can be specified as the entry size is "4", "8", or "10". "Entry size of table" above means "instruction size necessary for one branch processing".
The default entry size is "4". In this case, a 4-byte instruction is allocated as follows.

```
jr      _flash_func0    -- 4-byte instruction
```

If "8" is specified, a total of 8 bytes of instructions are allocated, as follows.

```
mov     #_flash_func0, r1       -- 6-byte instruction
jmp     [r1]                    -- 2-byte instruction
```

If "10" is specified, a total of 10 bytes of instructions are allocated, as follows.

```
movhi   hi1(#_flash_func0), r0, r1      -- 4-byte instruction
movea   lo(#_flash_func0), r1, r1       -- 4-byte instruction
jmp     [r1]                            -- 2-byte instruction
```

Note that an 8-byte instruction can be used only when the V850Ex/V850E2 core is used (because only the V850Ex/V850E2 core supports this instruction set).
Specify "10", when the V850 is used. When creating an object common to the V850/V850Ex/V850E2 core (when using the -cn option), always specify "10".

(g) Library

If a library function is called from the boot area or flash area, the library is linked to the object on the calling side. For example, even if a library is linked to the flash area, the same library is linked to the boot area if the same library function is called from the boot area. When a library function is called, therefore, a function does not have to be specified by the .ext_func quasi directive for the library function because branching does not take place between the boot area and flash area.
However, in a special case where the library linked to the boot area branches to a function in the flash area, a function must be specified by the .ext_func quasi directive.
For the "standard library" and "mathematical library" of the CA850 package, a function does not have to be specified by using the .ext_func quasi directive.

(h) Interrupt handler

Describe the part that calls an interrupt handler in the area where the address of the interrupt handler exists. In the following case, an interrupt handler function name must also be specified by the .ext_func quasi directive.

- Interrupt handler address is in the boot area.
- Interrupt handler body is in the flash area.

Assembly Source Described by User	Assembler Image after Linking
[ext_table.inc] `.ext_func _int_flash0, 0`	

[rom.s]
`.include "ext_table.inc"`
`.extern _int_flash0`
`.section "INT00", text`
`jr _int_flash0`
	[rom.out]
	`.section "INT00", text`
	`jr __ext_table_head+0x4*0,lp`

<table>
<tr><th>Assembly Source Described by User</th><th>Assembler Image after Linking</th></tr>
<tr><td rowspan="2">[flash.s]
.include "ext_table.inc"
.globl _int_flash0
_int_flash0:
:
reti</td><td>[flash.o]
#(branch table)
.section ".ext_table", text
.globl __ext_table_head
.extern _int_flash0
__ext_table_head:
jr _int_flash0</td></tr>
<tr><td>#(handler body)
.globl _int_flash0
_int_flash0:
:
reti</td></tr>
</table>

B.3.4 Supplementary information

This section describes the supplementary points related to the linker.

(1) Using -A option

This section describes how to use the -A option.

With CubeSuite+, on the Property panel, from the [Link Options] tab, in the [Other] category, set the [Display GP information] property to [Yes(-A)].

(a) Function

This option displays the information that serves as a yardstick for the value to be set to *num* of the -G*num* option that can be specified for the ca850 and as850 when a source file is compiled or assembled. The information is output via standard output, if ca850 or as850 has been activated with the -A option specified on the command line. With CubeSuite+, If [Yes(-A)] in the [Display GP information] property is selected, the information is output on the Output panel.

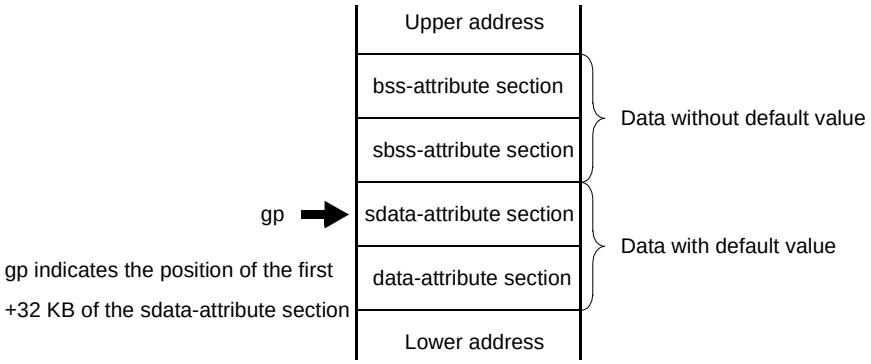
The -G*num* option allocates data of less than *num* bytes to the .sdata or .sbss section.

The ca850 and as850 output codes in compliance with the following rule for the data allocated to the sdata, sbss, data, and bss areas.

The ca850 or as850 first tries to allocate the data to the sdata-attribute section or sbss-attribute section, which are areas that can be accessed with a single instruction from the gp register (data with a default value is allocated to the sdata-attribute section and data without a default value is allocated to the sbss-attribute section).

Because these areas are accessed by a code that uses gp and a 16-bit displacement for access, data can be allocated only in a range of +32 KB from gp. If the data does not fit in these areas, the ca850 or as850 tries to allocate the data to the data-attribute section or bss-attribute section, which are areas that can be accessed with two instructions from the gp register (data with a default value is allocated to the data-attribute section and data without a default value is allocated to the bss-attribute section). In these areas, the address of the access area is first generated, and a code using gp and a 32-bit displacement for access is generated. Consequently, the entire 4 GB space can be accessed.

Figure B-25. Memory Allocation Image of gp Offset Reference Section



Therefore, the execution efficiency and object efficiency are enhanced if more data is allocated to the sdata-attribute or sbss-attribute section, which can be accessed with a single instruction.

To allocate data, the user can intentionally specify the allocation location by using the #pragma section directive in the case of a C source or by using the .section quasi directive in the case of an assembly language source.

If a threshold value of the size of the data to be allocated to the sdata-attribute or sbss-attribute section is prepared and if data of a size less than the threshold value can be allocated to the sdata-attribute or sbss-attribute section, more data can be allocated without having to modify the source program. This specification is made by the -G*num* option of the ca850 or as850. The value specified as *num* of this option is the data size, so it would be convenient to have information that can be used as a yardstick.
The -A option outputs this information.
If the -A option is specified for the linker, it outputs information that can serve as a yardstick for determining the value of *num* of the -G*num* option.

(b) Explanation of output information

An example of the information output when this option is specified when an executable object file is generated without the -r option, and an example of the information output when this option is specified when a relocatable object file is generated with the -r option are shown below.

Examples 1. The output information for the executable object file

```
        ******** LINK EDITOR GP INFORMATION ********
   (1)        (2)           (3)           (4)            (5)         (6)
GP SYMBOL    SECTION      SECTION      SECTION          GP
NAME         NAME         SIZE(REAL)   SIZE(ASSUMED)    NUMBER
_gp_DATA
             .sdata       0x000af10
                                       0x00002000       4           *OK*
                                       0x00003450       8           *OK*
                                       0x00004430       12          *OK*
                                       0x000050a8       16          *OK*
                                       0x00007b40       20          *OK*
                                       0x0000a010       24
                                       0x0000af10       32
             .sbss        0x00012050
                                       0x00000050       4           *OK*
                                       0x00002050       16          *OK*
                                       0x00007050       512         *OK*
                                       0x00010050       1024
```

2. The output information for the relocatable object file

```
        ******** LINK EDITOR GP INFORMATION ********
   (1)        (2)           (3)           (4)            (5)         (6)
GP SYMBOL    SECTION      SECTION      SECTION          GP
NAME         NAME         SIZE(REAL)   SIZE(ASSUMED)    NUMBER
*(NOT AVAILABLE)
             .sdata       0x000af10
                                       0x00002000       4           *OK*
                                       0x00003450       8           *OK*
                                       0x00004430       12          *OK*
                                       0x000050a8       16          *OK*
                                       0x00007b40       20          *OK*
                                       0x0000a010       24
                                       0x0000af10       32
             .sbss        0x00012050
                                       0x00000050       4           *OK*
                                       0x00002050       16          *OK*
             *GpCommon*   0x00010000
                                       0x00005000       512         *OK*
                                       0x00010000       1024
```

Item Number	Description
(1)	Name of global pointer symbol This is the name of the global pointer symbol used for linking. If the created object file is a relocatable file, "*(NOT AVAILABLE)*" is displayed.
(2)	Section name This is the name of the sdata-attribute section or sbss-attribute section to which data are allocated. Because a relocatable object file cannot determine allocation of an undefined external symbol to a section, the linker internally creates a virtual section "*GpCommon*" and temporarily allocates the data to this section.
(3)	Actual size of section This is the actual size of the section that is considered for use as the area for the hole generated by data alignment.
(4)	Assumed size of section This is the size of the section that is assumed if the ca850 is started with the -G*num* option (with the value shown in the column at the right to this column specified as *num*). Because the calculation of this size assumes an alignment condition of more than 4 bytes without taking the actual alignment condition into consideration, the value shown in this column does not necessarily agree with the actual size of the created section.
(5)	Value of *num* of -G*num* option assumed This is the value of the -G*num* option *num* upon starting the ca850 and the as850 that is assumed as a result of calculating the "assumed size of section" shown on the column to the left of this column.

Item Number	Description
(6)	Judgement result This is the result of the judgment[Note] as to whether or not the size of the section is within a range of 15 bits (0x0 to 0x7fff) if the ca850 is started with the -G*num* option with the value shown in the column at the left to this column (specified as *num*). If the size is within this range, "*OK*" is displayed; if it is not, nothing is displayed.

Note Usually the sections to which data is allocated are allocated from the lower address in the order of data/sdata/sbss/bss attribute sections in the C compiler. The global pointer (gp) is assumed to be set in the startup module, etc. so as to indicate the start address of the sdata-attribute section + 32 KB. If the result is OK in this judgement, the sdata/sbss attribute sections are assumed to be allocated to a memory range that can be referenced using 16-bit displacement.

(c) Cautions

The information output by this option is only a yardstick, and the judgment result may not be correct, such as in the following cases:

- If allocation of a section that creates a hole is specified by a link directive, etc.
- If a direct address is specified for a global pointer symbol.
- If data is allocated to the .sdata/.sbss section by the #pragma section directive.

(d) Example

```
C:\>ld850 -A file1.o file2.o
```

file1.o and file2.o are linked and information that can be used as a yardstick for setting the *num* value of the -G*num* option that can be specified for the ca850 or the as850 when compiling or assembling is output via standard output.

(2) Archive file

An archive file is created by linking two or more object files with the archiver.

When an archive file is specified, the linker searches the archive file for unresolved external references[Note 1] and links only the necessary object files.

The archive file can be also specified via the link directive's mapping directive. If the archive file is also specified in the mapping directive, it is searched for unresolved external references at that time and only the necessary object files[Note 2] are linked.

Notes 1. The archive file includes a symbol table of the symbols belonging to the archiver's object files, and the archive file is repeatedly searched as long as unresolved external references remain unresolved.

2. Object file that defines a referenced symbol.

(3) Reserved symbols

During link-related processing, the linker creates reserved symbols whose values include the start address of each output section, the start address beyond the end of each output section, and the start address beyond the end of a created executable object file.

If the user defines a symbol having the same name as any of these reserved symbols, the linker uses the defined symbol, and does not create its own symbol.

A symbol having a name made by prefixing "__s" to the name of the output section is used as a reserved symbol that has the start address of a section as a value.

If this section name begins with ".", "." is taken out and "__s" is prefixed to make it a symbol name. A symbol name with "__e" prefixed to the name of that output section is used as a reserved symbol that has the start address beyond the end of a section as a value.
If this section name begins with ".", "." is taken out and "__e" is prefixed to make it a symbol name. __end is used as a reserved symbol having a start address beyond the end of a created executable object file.
The default link directive used by the linker uses the following reserved sections as output sections.

Table B-12. Reserved Section

.text, .pro_epi_runtime, .data, .sdata, .sbss, .bss, .sconst, .const, .sedata, .sebss, .sidata, .sibss, .tidata, .tibss, .tidata.byte, .tibss.byte, .tidata.word, .tibss.word

Therefore, the linker normally creates the following reserved symbols.

Table B-13. Special Symbols in Ordinary Object File

__end, __ebss, __econst, __edata, __epro_epi_runtime, __esbss, __esconst, __esdata, __esebss, __esedata, __esibss, __esidata, __etext, __etibss, __etibss.byte, __etibss.word, __etidata, __etidata.byte, __etidata.word, __sbss, __sconst, __sdata, __spro_epi_runtime, __ssbss, __ssconst, __ssdata, __ssebss, __ssedata, __ssibss, __ssidata, __stibss, __stibss.byte, __stibss.word, __stidata, __stidata.byte, __stidata.word

Caution Of the above symbols, only those for which a section exists in the executable file after link processing are generated. The linker behaves as if no section exists if a section that is actually allocated does not exist even if a mapping directive is described in the link directive file.

(4) May not be allocated to the expected sections

Even if a directive file specifies an object file or archive file to be allocated to a section, the object file or archive file may not be allocated to the expected sections, depending on how the file name is described. In such cases, see the link map (-m) and specify the directive file with the file name displayed on the link map and with the identical name including the path name, and then relink.

(5) V850 core and V850Ex core

The V850Ex is upwardly compatible with the other V850 core microprocessors. Source programs that are used with the V850 core can be used with the V850Ex. In this case, create the V850 core object file as an object file common to the core with the as850 option.
An object file created as "common to V850Ex" cannot link with a non-V850Ex and non-V850E2 object file.
See "(1) Magic number" for details.

(6) V850 core and V850E2 core

The V850E2 is upwardly compatible with the other V850 core microprocessors. Source programs that are used with the V850 core can be used with the V850E2. In this case, create the V850 core object file as an object file common to the core with the as850 option.
An object file created as "common to V850E2" cannot link with a non-V850E2 object file.
See "(1) Magic number" for details.

(7) Mathematics library

An error such as an undefined symbol error may be output even when a mathematics library function is used in a program and a mathematics library (libm.a) is linked during linking. This relates to the linking sequence with the standard libraries. Since this sequence must comply with the ANSI standard, the standard libraries should be linked last. Note this with caution, especially when starting the linker from the command line. Specifically, describe the options in the order of the -lm and the -lc.

(8) main function

If linking is performed without creating a main function, an error message may be output to indicate that the _main symbol is an undefined symbol. This may occur when the user links the default startup routine (crtN.o or crtE.o[V850E]) rather than a user-specified startup routine, or when the crtN.s or crtE.s that are provided with the package are used as they are for assembly and linkage. The error is due to the "jarl _main, lp" code that is written following crtN.s or crtE.s. If the main function is not needed, overwrite this code then use the reassembled object as the startup routine. In the case of an application that uses the real-time OS, main function does not exist normally. Use the startup routine provided as a sample of the real-time OS.

(9) Prologue/epilogue runtime library

The prologue/epilogue runtime library must be allocated to the special-purpose .pro_epi_runtime section. If it is not allocated there, the linker outputs the following message and stops linking.

```
F4286 : section ".pro_epi_runtime" must be specified in link directive.
```

If a link directive file has been specified, describe the mapping directive before the .text section.

```
.pro_epi_runtime = $PROGBITS ?AX .pro_epi_runtime;
.text = $PROGBITS ?AX;
```

If the .pro_epi_runtime section is placed after the .text section, it overlaps the allocation position of the default operation of the section that is packed during ROMization. Allocating the .pro_epi_runtime section before the .text section is recommended. If a link directive file has not been specified, link before the .text section.

(a) Cautions

- The prologue/epilogue runtime libraries are included in standard library libc.a.
- Unlike ordinary sections, the .pro_epi_runtime section has a fixed input section name and only the special-purpose section is allocated.
- If the .pro_epi_runtime section is placed after the .text section, it overlaps the allocation position of the default operation of the section that is packed during ROMization. Allocate the .pro_epi_runtime section before the .text section.
- The prologue/epilogue runtime libraries use the callt instruction when a device of the V850Ex/V850E2 core is used. Set CTBP in the startup routine.

(10) Linking for ROMization

For ROMization, the packing section area must be considered when coding the link directive. See "B.4 ROMization Processor" for details.

ROMization is not possible if the default link directive and the CONST segment are both used. Since the default link directive allocates the CONST segment immediately after the TEXT segment, the packed section (rompsec section) and the CONST segment become overlapped during the ROMization processor's default operation. Perform one of the following responses while considering the additional sample directive[Note] attached to the package.

Note v850def.dir, v850def2, or dirv850def3.dir stored in "*install-folder*\CubeSuite+\CA850\V*x.xx*\smp850\ca850".

v850def.dir	Sample using internal ROM/RAM and external RAM
v850def2.dir	Sample using only internal ROM/RAM
v850def3.dir	Sample using internal ROM/RAM, external RAM, and internal instruction RAM (such as V850E/ME2)

Memory allocation must suit the microprocessor being used. Allocate the CONST segment before the TEXT segment.

```
CONST : !LOAD ?R{
        .const = $PROGBITS ?A .const;
};

TEXT : !LOAD ?RX{
        .text = $PROGBITS ?AX;
};
```

Reserve a packed section area (see "B.4 ROMization Processor") after the TEXT segment and allocate the CONST segment after that reserved section.

```
TEXT : !LOAD ?RX{
        .text = $PROGBITS ?AX;
};

        [Packed section area]

CONST : !LOAD ?R V0x200000{ <- Address specification takes packed section into account
        .const = $PROGBITS ?A .const;
};
```

(11) Programmable peripheral I/O register

For an application program that uses programmable peripheral I/O register functions, the .bpc section (which is a reserved section) is output when assembling. If there is the .bpc section in a input object file to the linker, the linker checks values specified as BPC values. If values do not match between input object files, the linker outputs an error message like the following and suspends link processing.

```
F4457: input files have different BPC value.
0x00001234      file1.o
0x00001234      file2.o
0x00001235      file3.o
*(none)*        file4.o
```

In the above case, there is an error because the value set in file3.o is different.
Object that does not reference the programmable peripheral I/O register is not checked.
As in file4.o above, "*(none)*" is displayed.

If there are no errors in checking BPC values, a .bpc section is generated with section type SHT_PROGBITS, section attribute "none", and section size 0x4. The start address of the programmable peripheral I/O register area, which is the BPC value shifted a preset number of bits, is stored in the .bpc section.

Example If the BPC value is specified as "0x1234" when using the V850E/IA1, the start address of the programmable peripheral I/O register area is the value shifted 14 bits to the left, or "0x48d0000". In this case, the information in the .bpc section is as follows.

```
.bpc
  Address    00  01  02  03  04  05  06  07  -  08  09  0A  0B  0C  0D  0E  0F
0x00000000 : 00  00  8d  04                  -                              ...
```

- The processing above is performed without question when creating a relocatable object file and when creating an executable object file.
- The .bpc section is a special reserved section for information and is never loaded into memory. Therefore, it need not be specified in a link directive like a normal section.

(12) Option byte

Describe 6-byte data in the assembler source as follows in order to use the option byte function.

```
.section "OPTION_BYTES"
.byte   0b00000001      -- 0x7a
.byte   0b00000000      -- 0x7b
.byte   0b00000000      -- 0x7c
.byte   0b00000000      -- 0x7d
.byte   0b00000000      -- 0x7e
.byte   0b00000000      -- 0x7f
```

- If a device not having the option byte is specified, it is handled as an ordinary input section.
- If a device having the option byte is specified and if description of this section is omitted, the default value set in the device file is set.
- Be sure to describe 6 bytes for this section. If 6 bytes or less is described, the following message is output and linking is stopped.

```
F4112: illegal "section" section size.
```

- The default value of a bit that cannot be set must not be changed. If it is changed, the following message is output.

```
W4613: illegal flash mask option access (file:"file" address:num1 bit:num2)
```

B.4 ROMization Processor

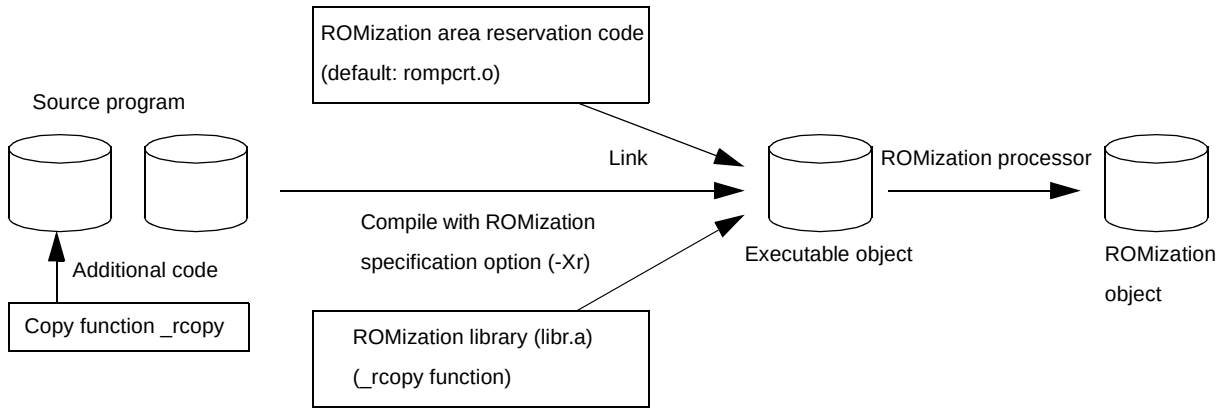
When a variable is declared globally within a program, the variable is allocated to the data-attribute section in RAM if the variable has a default value, or to the bss-attribute section if it does not have a default value. When the variable has a default value, that default value is also stored in RAM. In addition, program code may be stored in the internal RAM area to speed up applications.

In the case of an embedded system, if a debug tool such as an in-circuit emulator is used, executable modules can be downloaded and executed just as they are in the allocation image. But if you actually write the program to the ROM area of the target system and execute it, the default values in the data attributes section and the program code to be allocated to the RAM area must be loaded into RAM before execution.In other words, data that is residing in RAM must be deployed in ROM, and this means that data must be copied from ROM to RAM before the corresponding application is executed.

The ROMization processor (romp850) is a tool that takes default value information for variables in data-attribute sections as well as programs allocated to RAM and packs them into a single section. This makes it easy to load default value information and program into RAM by allocating this section to ROM, and calling the copy function provided by the CA850.

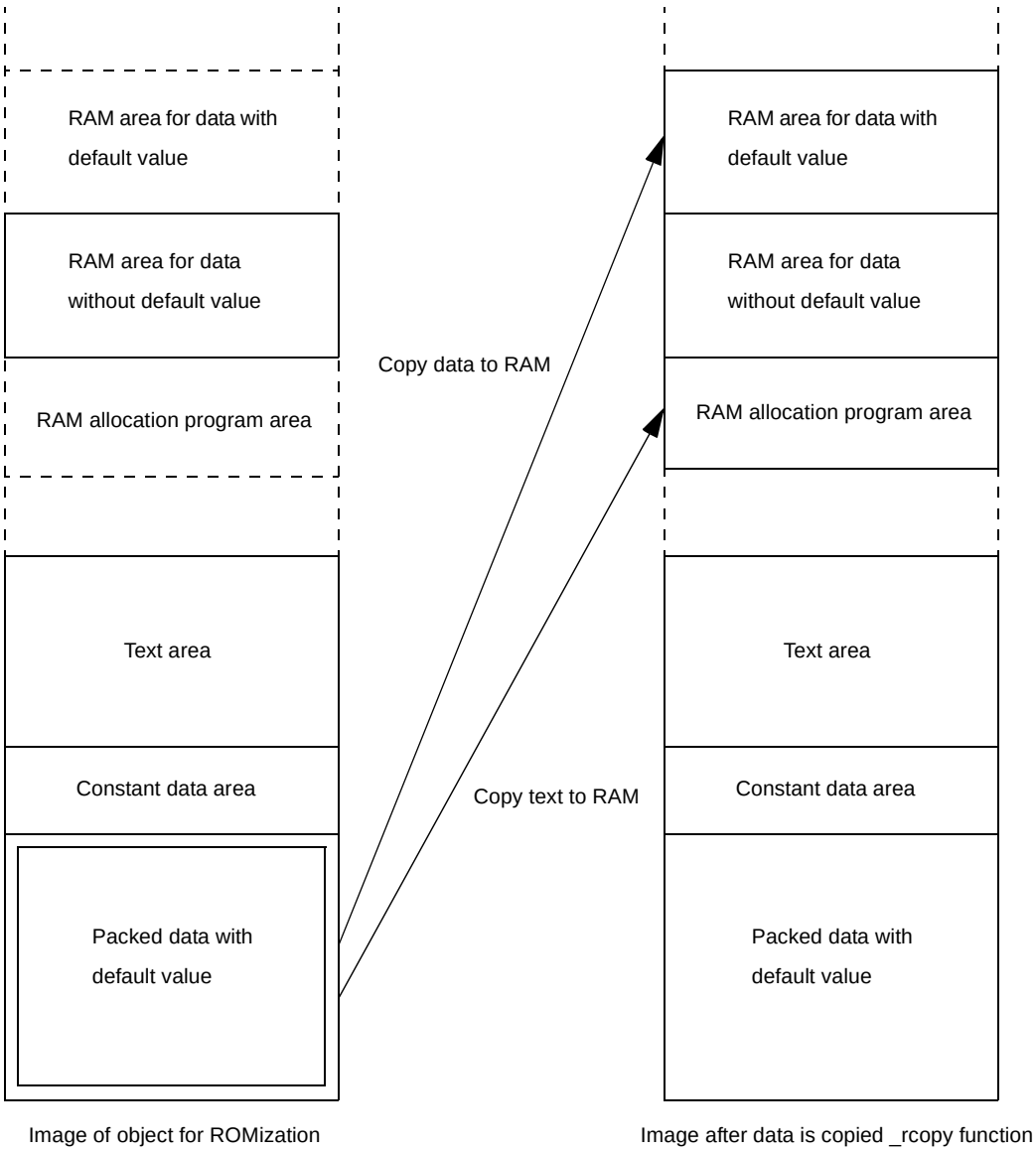
The following figure shows an outline of the operation flow in creating objects for ROMization.

Figure B-26. Creation of Object for ROMization



When ROMization objects are created as shown in the figure, execution of the _rcopy function copies the data to be allocated to RAM from the packed ROM. An image of this operation is shown below.

Figure B-27. Image of Before and After _rcopy Function Is Called



The default values for the section name and the section's start address (label name) required for the ROMization object are as follows.

- Name of packed section -> rompsec section
- Start address (label name) of rompsec section -> __S_romp

The function used to copy from the rompsec section to the RAM area is as follows.

- Copy function -> _rcopy, _rcopy1, _rcopy2, _rcopy4 function

This function is stored in the library "libr.a" which is in the lib850\r** folder.

__S_romp is a label that is defined by "rompcrt.o" in the lib850\r** folder (the corresponding source file is rompcrt.s). Using rompcrt.o as is causes the ROMization processor to create automatically a rompsec section immediately after the .text attributes (at the 4-byte aligned location).__S_romp becomes the label indicating the start address of that rompsec section.

In addition to this method for automatically creating a rompsec section, it is also possible to independently create and allocate a program corresponding to rompcrt.s. See "(2) Creating procedure (customize)" for details.

The actual ROMization works as follows: after creating this ROMization object, it converts it into a hex file, and writes it to ROM.

If the application does not include any data that requires packing, there is no need to create a ROMization object. Convert the object created by the linker into a hex file directly.

If the object files resolved for relocation include symbol information and debug information, the ROMization processor creates a ROMization object file without deleting them. Therefore, the debugger can debug the source even with a ROMization object file.

B.4.1 I/O files

The ROMization processor enables the following files to be handled as input file.

file1.out	Executable object output by the ld850

The output file is:

file2.out	Executable object for ROMization

The linker and the ROMization processor are both able to specify I/O file names. The default output file name is romp.out.

B.4.2 rompsec section

(1) Types of sections to be packed

The default data that can be packed as a rompsec section is "data allocated to sections having a write-enabled attribute". If a device with V850/V850E1 core is specified, sections allocated to the internal instruction RAM are also packed (they are not packed if a device with V850E2 cores is specified).In addition, any section that has either the text attribute or const attribute can be specified for packing by specifying the -t option.

Specific examples are listed below.

- The reserved sections listed in "Table B-14. Reserved Sections Packed by ROMization Processor"
- In an assembler program, sections generated with arbitrary names specifying a sdata or data attribute by the .section pseudo instruction, and sections allocated to the internal instruction RAM.

Table B-14. Reserved Sections Packed by ROMization Processor

`.data, .sdata, .sedata, .sidata, .tidata, .tidata.byte, .tidata.word`

Note, however, that if any user-specified sections with either the text attribute or const attribute are not packed and if the above-listed sections are not in an executable module, there is no need to create a ROMization object.

See the link map file to determine whether or not the sections listed in "Table B-14. Reserved Sections Packed by ROMization Processor".

It can be confirmed that a rompsec section is created in place of a .data section, .sdata section, sections allocated to an internal RAM (including interrupt handler sections), and the like, by referencing the object file which is created by the ROMization processor via the dump tool.

(2) Size of rompsec section

This section describes the memory area size to be reserved for the rompsec section.

When creating the ROMization module, note the size of the rompsec section as well as the address range and size of using CPU's internal ROM area and the target system's ROM area. Code the link directive file carefully to prevent the rompsec section from overlapping other sections. See "B.4.3 Creating object for ROMization" for specific code examples.

Formulas used to calculate the size of the rompsec section are shown below.

8 + 16 x (Number of sdata/data sections) + Size of sdata/data section
+ Padding size[Note]

For example, if .sdata and .data sections exist, the size of each is 1002 bytes and 1000 bytes, and the alignment condition of each section is 4 bytes, the size of the rompsec section is as follows.

8 + 16 x 2 + 1002 + 1000 + 2 = 2044 bytes

Note The size is 0 to 3 bytes per section, depending on the alignment condition of the section subject to ROMization.

(3) rompsec section and link directive

During ROMization, a rompsec section is added immediately after the .text section. Consequently, it is possible to allocate the rompsec section up to the end of ROM by allocating a .text section to the end of the ROM, or explicitly specifying the end of the ROM for the rompsec section.

- Link directive taking ROMization processing into consideration

```
# Allocates SCONST, CONST, and TEXT to internal ROM
SCONST : !LOAD ?R {
        .sconst = $PROGBITS ?A .sconst;
};

CONST : !LOAD ?R {
        .const = $PROGBITS ?A .const;
};

# Allocates .text to end of internal ROM
TEXT : !LOAD ?RX {
        .pro_epi_runtime = $PROGBITS ?AX .pro_epi_runtime;
        .text = $PROGBITS ?AX .text;
        rompsec = $PROGBITS ?AX .text { rompcrt.o };
};

# Allocates DATA to external RAM
DATA : !LOAD ?RW V0x100000 {
        .data = $PROGBITS ?AW;
        .sdata = $PROGBITS ?AWG;
        .sbss = $NOBIT ?AWG;
        .bss = $NOBIT ?AW;
};
```

```
# Allocates SIDATA to internal RAM
SIDATA : !LOAD ?RW V0xffe000 {
        .sidata = $PROGBITS ?AW .sidata;
        .sibss = $NOBIT ?AWG .sibss;
};

__tp_TEXT @ %TP_SYMBOL;
__gp_DATA @ %GP_SYMBOL &__tp_TEXT{DATA};
__ep_DATA @ %EP_SYMBOL;
```

If the rompsec section exceeds the internal ROM area, the following message is output and the processing is stopped.

```
F8425: rompsec section overflowed highest address of target machine.
```

By specifying the -rom_less option, the internal ROM area may be ignored.
By specifying the -Ximem_overflow=warning option, an error message can be changed to a warning message.
The above check is not performed if the rompsec section is allocated to the end of the external ROM area. Check the memory map information to see if the sections fit in ROM.
If it is necessary to allocate the rompsec section in the middle of ROM, check the area where the rompsec section is to be allocated as follows, from the size and allocation address of the rompsec section, and specify an appropriate address for the segment immediately after the rompsec section.

- Link directive taking ROMization processing into consideration (size considered)

```
# Allocates SCONST, CONST, and TEXT to internal ROM
SCONST : !LOAD ?R {
        .sconst = $PROGBITS ?A .sconst;
};

# Allocates .text in middle of internal ROM
TEXT : !LOAD ?RX {
        .pro_epi_runtime = $PROGBITS ?AX .pro_epi_runtime;
        .text = $PROGBITS ?AX .text;
        rompsec = $PROGBITS ?AX .text { rompcrt.o };
};

# rompsec between TEXT and CONST

# Allocates CONST to end of internal ROM by specifying address taking size into
consideration
CONST : !LOAD ?R Vx3f800 {
        .const = $PROGBITS ?A .const;
};

# Allocates DATA to external RAM
DATA : !LOAD ?RW V0x100000 {
```

```
        .data = $PROGBITS ?AW;
        .sdata = $PROGBITS ?AWG;
        .sbss = $NOBIT ?AWG;
        .bss = $NOBIT ?AW;
};

# Allocates SIDATA to internal RAM
SIDATA : !LOAD ?RW V0xffe000 {
        .sidata = $PROGBITS ?AW .sidata;
        .sibss = $NOBIT ?AWG .sibss;
};
__tp_TEXT @ %TP_SYMBOL;
__gp_DATA @ %GP_SYMBOL &__tp_TEXT{DATA};
__ep_DATA @ %EP_SYMBOL;
```

B.4.3 Creating object for ROMization

(1) Creating procedure (default)

This section describes a method that uses the ROMization area reservation code (rompcrt.o) that is provided as the default object.

(a) Call a copy function within the application.

The copy function should be activated early on, such as within the startup routine or at the start of the main function. _rcopy, _rcopy1, _rcopy2, and _rcopy4 are available as copy functions, and each of these has a different transfer size (the transfer size of _rcopy and _rcopy1 is the same). See "B.4.4 Copy function" for details about these.

In the following example, the _rcopy function is activated at the start of the main function.

Example Example of using copy function _rcopy

```
#define ALL_COPY(-1)

int _rcopy(unsigned long *, long);
extern unsigned long _S_romp;

void main(void)
{
        int     ret;

ret = _rcopy(&_S_romp, ALL_COPY);

                :
}
```

(b) During ROMization, a rompsec section is added immediately after the .text section.

By allocating the .text section to the end of ROM, the rompsec section up to the end of ROM can be allocated (see "(3) rompsec section and link directive").

(c) Specify the creation of object for ROMization by the compile option.

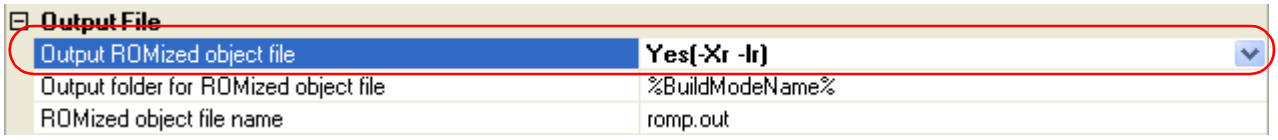
<1> From command line

Add compile option "-Xr".

<2> From CubeSuite+

On the Property panel, from the [ROMization Process Options] tab, in the [Output File] category, select [Yes(-Xr -lr)] on the [Output ROMized object file] property.

Figure B-28. [Output ROMized object file] Property



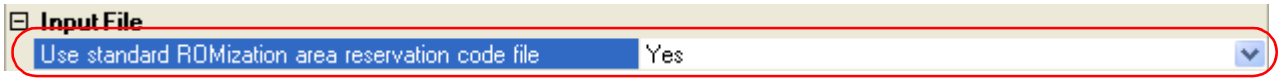
As a result, a code that indicates that label __S_romp indicates the first address that exceeds the end of the .text section in the object is generated.

(d) Specify ROMization process option.

<1> From CubeSuite+

On the Property panel, from the [ROMization Process Options] tab, in the [Input File] category, set the [Use standard ROMization area reservation code file] property to [Yes] (default).

Figure B-29. [Use standard ROMization area reservation code file] Property



(e) Compile and link.

By specifying the creation of object for ROMization for the ca850, the ROMization area reservation code "rompcrt.o" (that is in lib850\r**) and "libr.a" that stores the _rcopy function are automatically linked. At this time, the linking sequence is relevant.Because "rompcrt.o" must be linked at the end of a group of TEXT attributes, link it after the libraries specified by the -l option for linking if the linker has been activated from the command line. If CubeSuite+ is used, there is no need to be aware of "rompcrt.o" because it is automatically linked at the end of the TEXT attribute group.

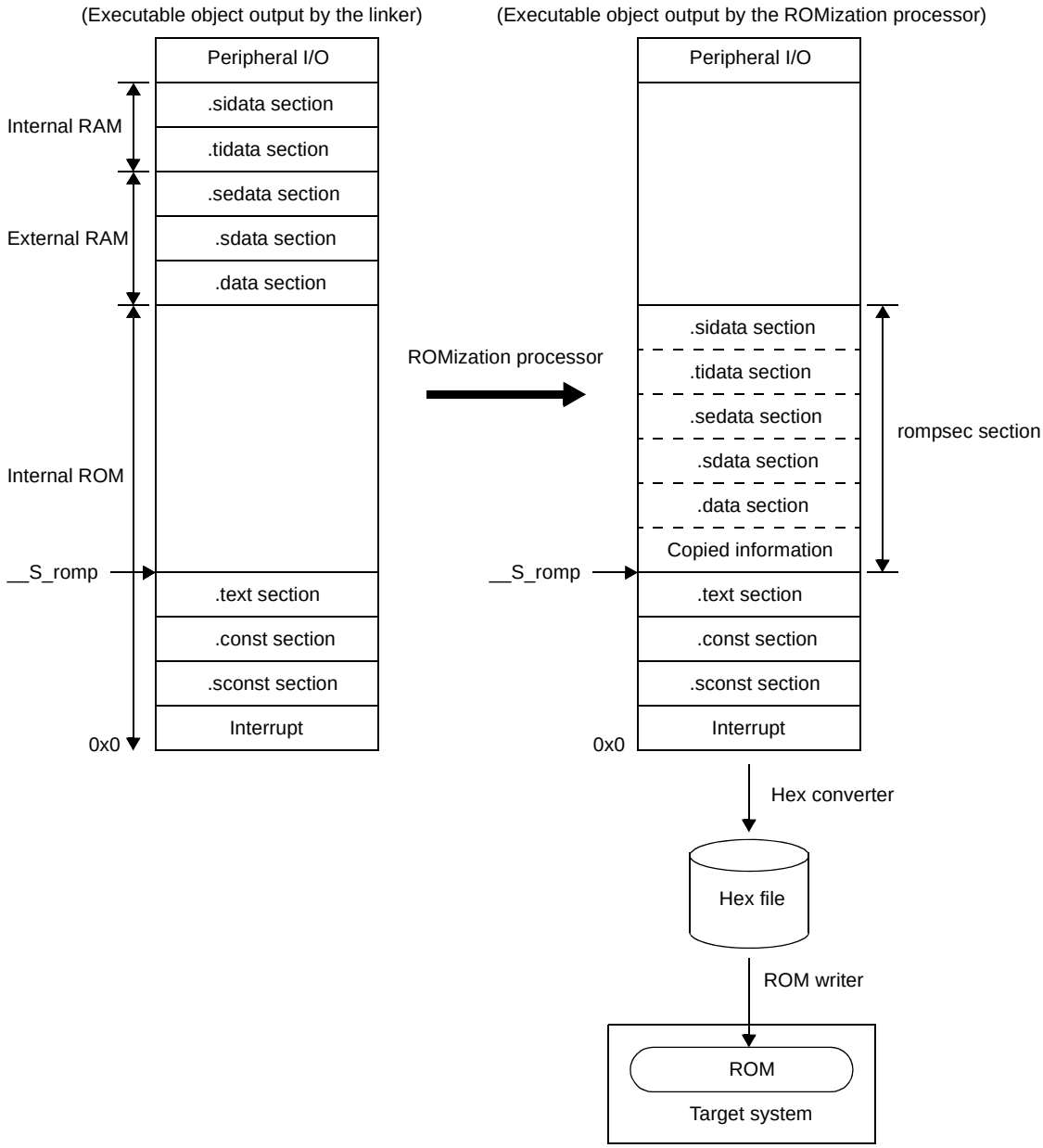
Caution If the linker's -rescan option is specified, the library is linked after rompcrt.o, and the ROMization processor may output an F8426 error. In such a case, explicitly secure a rompsec section area (see "(3) rompsec section and link directive").

(f) Activate the ROMization processor.

Generate a ROMization module from the executable module completed in (d), by using the ROMization processor.

If the creation of object for ROMization is specified with CubeSuite+, (d) and this is automatically performed, and a hex file is generated. If the commands has been activated from the command line, the ROMization processor is activated and a ROMization object is created after the C compiler to linker have been activated and an executable module has been generated. An image of the map is shown below.

Figure B-30. ROMization Image 1



(2) Creating procedure (customize)

This section describes the method for independently creating "rompcrt.o" corresponding to the ROMization area reservation code and determining the desired rompcrt section start address and allocation position.

(a) Enter code corresponding to the default ROMization area reservation code "rompcrt.s".

The file name is "rompack.s" and the name of the symbol indicating the start of the ROMization area is "__rompack". Also, the section containing this symbol is the "rompack section". In this case, the code in rompack.s appears as follows.

Example rompack.s

```
        .file           "rompack.s"
        .section        ".rompack",text
        .align          4
        .globl          __rompack, 4
__rompack:
```

(b) Call a copy function within the application.

The copy function should be activated early on, such as within the startup routine or at the start of the main function. _rcopy, _rcopy1, _rcopy2, and _rcopy4 are available as copy functions, and each of these has a different transfer size (the transfer size of _rcopy and _rcopy1 is the same). See "B.4.4 Copy function" for details about these.

In the following example, the _rcopy function is activated at the start of the main function.

Example Example of using copy function _rcopy

```
#define ALL_COPY (-1)

int _rcopy(unsigned long *, long);
extern unsigned long _rompack;

void main(void)
{
        int     ret;

        ret = _rcopy(&_rompack, ALL_COPY);
                :
}
```

(c) Define the created rompack section in a link directive.

The allocation location of the rompack section can be determined arbitrarily by specifying an address simultaneously.

To specify ROMPACK as the segment containing the rompack section and to allocate that segment to at address 0x3000, enter the following link directive.

Example Link directive specification example

```
TEXT:     !LOAD ?RX V0x1000 {
          .text = $PROGBITS ?AX .text;
};

ROMPACK: !LOAD ?RX V0x3000 {
          .rompack = $PROGBITS ?AX .rompack;
};
                  :
```

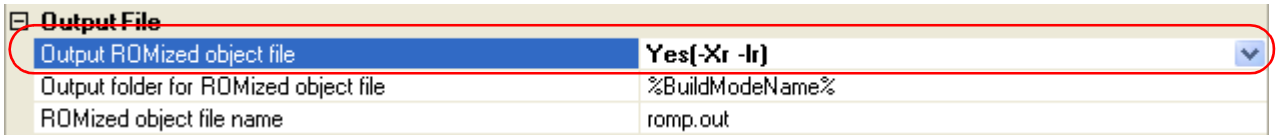
The rompack section's size is estimated using the formula described in "(2) Size of rompsec section" to avoid the ROMPACK segment's allocation address from overlapping with adjacent segments.

(d) Specify the creation of object for ROMization by the compile option.

- From command line
  Add compile option "-Xr".

- From CubeSuite+
  On the Property panel , from the [ROMization Process Options] tab, in the [Output File] category, select [Yes(-Xr -lr)] on the [Output ROMized object file] property.

Figure B-31. [Output ROMized object file] Property



This generates code that indicates the same address for label "rompack" as is specified for rompsec.

(e) Specify ROMization process option.

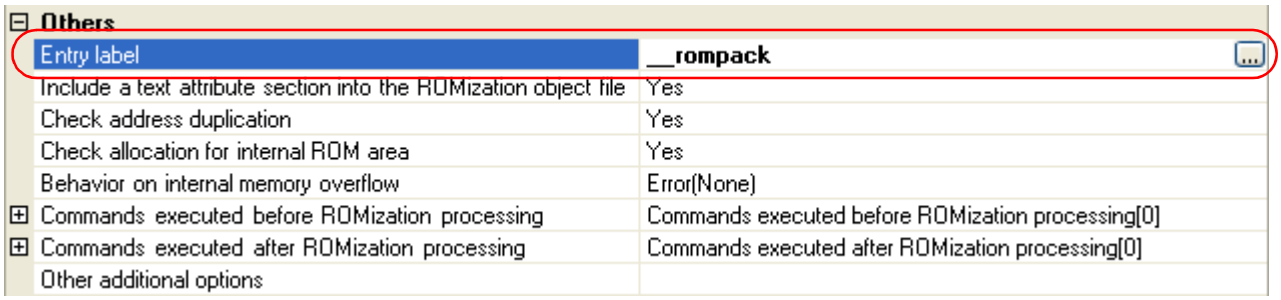
- From command line
  As a ROMization process option, specify "__rompack" for the "-b" option to specify the entry symbol for the ROMization area reservation code.

- From CubeSuite+
  On the Property panel , from the [ROMization Process Options] tab, in the [Input File] category, select [No] on the [Use standard ROMization area reservation code file] property. And then add "rompack.s" or "rompack.o" in the [ROMization area reservation code file name] property.

Figure B-32. [Use standard ROMization area reservation code file] and [ROMization area reservation code file name] Property

In the [Other] category, specify rompack section's start label "_rompack" in the [Entry label] property.

Figure B-33. [Entry label] Property



(f) Compile and link.

By specifying the creation of object for ROMization for the ca850, "libr.a" that stores the _rcopy function are automatically linked.

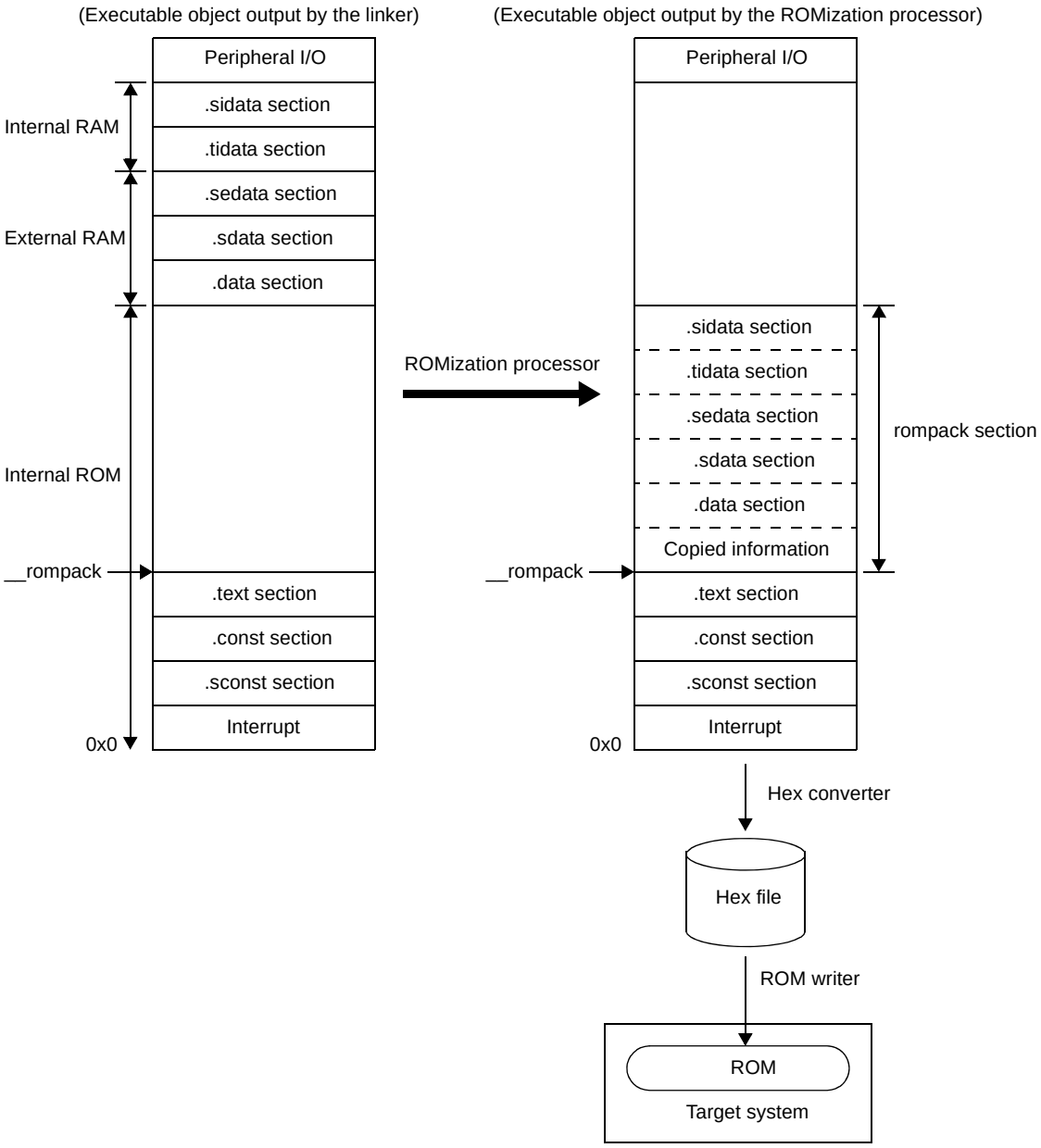
Caution If the linker's -rescan option is specified, the library is linked after rompcrt.o, and the ROMization processor may output an F8426 error. In such a case, explicitly secure a rompsec section area (see "(3) rompsec section and link directive").

(g) Activate the ROMization processor.

Generate a ROMization module from the executable module completed in (f), by using the ROMization processor.

If the creation of object for ROMization is specified with CubeSuite+, (f) and this is automatically performed, and a hex file is generated. If the commands has been activated from the command line, the ROMization processor is activated and a ROMization object is created after the C compiler to linker have been activated and an executable module has been generated. An image of the map is shown below.

Figure B-34. ROMization Image 2



B.4.4 Copy function

This section describes the copy routines (_rcopy) necessary for the program to be stored in ROM.

Table B-15. Copy Routines

Function Name	Function
_rcopy	Copies ROMization section (1-byte transfer)
_rcopy1	Copies ROMization section (1-byte transfer)
_rcopy2	Copies ROMization section (2-byte transfer)
_rcopy4	Copies ROMization section (4-byte transfer)

Use 1-byte, 2-byte, or 4-byte transfer, depending on the specification of the RAM at the transfer destination. The specification of each function is as follows.

_rcopy

[Overview]

- Copies default data or RAM text[Note] (1 byte).

Note Data section with default value which is to be allocated to RAM, and text section for internal RAM.

[Format]

```
int             _rcopy(&label, number)
unsigned long   label;
long            number;
```

[Description]

- _rcopy(*&label*, *number*) copies the default value data of section number *number* to be copied, or text to be allocated to RAM, to the RAM area 1 byte at a time, based on the information in the rompsec section allocated starting at the address following the address indicated by label. If -1 is specified as *number*, all sections in the rompsec section are copied. Section number *number* is a positive number that starts from 1.
- By default, sections are allocated in the order in which they appear in the input file. If sections to be allocated to the rompsec section are specified by the "-p" or "-t" option of the ROMization processor, they are allocated in the specified order.
- With CubeSuite+, on the Property panel, from the [ROMization Process Options] tab, in the [Section List] category, set the [Output ROMization section file] property to [Yes]. A C source header file that makes "number" and "label" correspond to each other by #define is generated, and *number* can be specified by a label name.
- See "B.4.5 Example of using copy function" for specific examples.

[Return value]

0	Normal completion (if copied correctly)
-1	Abnormal termination (if not copied correctly)

[Cautions]

- Data is not copied if the address indicated by *label* is not at the start of the rompsec section.
- _rcopy copies data in accordance with the information generated by the ROMization processor.
  When executing _rcopy, it is not possible to add an offset to the destination address.
- No data is copied if data may be overwritten as a result of copying.
- Specify a global label having an absolute value or an absolute address as the first argument of _rcopy, *label*. If any other value or address is specified, the result is not guaranteed.
- The _rcopy and _rcopy1 functions are identical. _rcopy is used to maintain compatibility with old versions.

_rcopy1

[Overview]

- Copies default data or RAM text[Note] (1 byte).

Note Data section with default value which is to be allocated to RAM, and text section for internal RAM.

[Format]

```
int             _rcopy1(&label, number)
unsigned long   label;
long            number;
```

[Description]

- _rcopy1(&label, number) copies the default value data of section number *number* to be copied, or text to be allocated to RAM, to the RAM area 1 byte at a time, based on the information in the rompsec section allocated starting at the address following the address indicated by label. If -1 is specified as *number*, all sections in the rompsec section are copied. Section number *number* is a positive number that starts from 1.
- By default, sections are allocated in the order in which they appear in the input file. If sections to be allocated to the rompsec section are specified by the "-p" or "-t" option of the ROMization processor, they are allocated in the order in which they are specified.
- With CubeSuite+, on the Property panel, from the [ROMization Process Options] tab, in the [Section List] category, set the [Output ROMization section file] property to [Yes]. A C source header file that makes "number" and "label" correspond to each other by #define is generated, and *number* can be specified by a label name.
- See "B.4.5 Example of using copy function" for specific examples.

[Return value]

0	Normal completion (if copied correctly)
-1	Abnormal termination (if not copied correctly)

[Cautions]

- Data is not copied if the address indicated by *label* is not at the start of the rompsec section.
- _rcopy1 copies data in accordance with the information generated by the ROMization processor. When executing _rcopy1, it is not possible to add an offset to the destination address.
- No data is copied if data may be overwritten as a result of copying.
- Specify a global label having an absolute value or an absolute address as the first argument of _rcopy1, *label*. If any other value or address is specified, the result is not guaranteed.
- The _rcopy1 and _rcopy functions are identical. _rcopy is used to maintain compatibility with old versions.

_rcopy2

[Overview]

- Copies default data or RAM text[Note] (2 byte).

Note Data section with default value which is to be allocated to RAM, and text section for internal RAM.

[Format]

```
int             _rcopy2(&label, number)
unsigned long   label;
long            number;
```

[Description]

- _rcopy2(&label, number) copies the default value data of section number *number* to be copied, or text to be allocated to RAM, to the RAM area 2 byte at a time, based on the information in the rompsec section allocated starting at the address following the address indicated by label. If -1 is specified as *number*, all sections in the rompsec section are copied. Section number *number* is a positive number that starts from 1.
- By default, sections are allocated in the order in which they appear in the input file. If sections to be allocated to the rompsec section are specified by the "-p" or "-t" option of the ROMization processor, they are allocated in the order in which they are specified.
- With CubeSuite+, on the Property panel, from the [ROMization Process Options] tab, in the [Section List] category, set the [Output ROMization section file] property to [Yes]. A C source header file that makes "number" and "label" correspond to each other by #define is generated, and *number* can be specified by a label name.
- See "B.4.5 Example of using copy function" for specific examples.

[Return value]

0	Normal completion (if copied correctly)
-1	Abnormal termination (if not copied correctly)

[Cautions]

- Data is not copied if the address indicated by *label* is not at the start of the rompsec section.
- _rcopy2 copies data in accordance with the information generated by the ROMization processor. When executing _rcopy2, it is not possible to add an offset to the destination address.
- No data is copied if data may be overwritten as a result of copying.
- Specify a global label having an absolute value or an absolute address as the first argument of _rcopy2, *label*. If any other value or address is specified, the result is not guaranteed.

_rcopy4

[Overview]

- Copies default data or RAM text[Note] (4 byte).

Note Data section with default value which is to be allocated to RAM, and text section for internal RAM.

[Format]

```
int             _rcopy4(&label, number)
unsigned long   label;
long            number;
```

[Description]

- _rcopy4(&label, number) copies the default value data of section number *number* to be copied, or text to be allocated to RAM, to the RAM area 4 byte at a time, based on the information in the rompsec section allocated starting at the address following the address indicated by label. If -1 is specified as *number*, all sections in the rompsec section are copied. Section number *number* is a positive number that starts from 1.
- By default, sections are allocated in the order in which they appear in the input file. If sections to be allocated to the rompsec section are specified by the "-p" or "-t" option of the ROMization processor, they are allocated in the order in which they are specified.
- With CubeSuite+, on the Property panel, from the [ROMization Process Options] tab, in the [Section List] category, set the [Output ROMization section file] property to [Yes]. A C source header file that makes "number" and "label" correspond to each other by #define is generated, and *number* can be specified by a label name.
- See "B.4.5 Example of using copy function" for specific examples.

[Return value]

0	Normal completion (if copied correctly)
-1	Abnormal termination (if not copied correctly)

[Cautions]

- Data is not copied if the address indicated by *label* is not at the start of the rompsec section.
- _rcopy4 copies data in accordance with the information generated by the ROMization processor. When executing _rcopy4, it is not possible to add an offset to the destination address.
- No data is copied if data may be overwritten as a result of copying.
- Specify a global label having an absolute value or an absolute address as the first argument of _rcopy4, *label*. If any other value or address is specified, the result is not guaranteed.

B.4.5 Example of using copy function

(1) To transfer all sections in 1-byte units

```
extern unsigned long _S_romp;


main()
{
        int     ret;3


        ret = _rcopy(&_S_romp, -1);
        /* -Xr specifies a global label having an absolute value. */
}
```

The label references an absolute address when the ca850's ROMization option has been specified as shown above. Therefore, describe as follows to call _rcopy() in an assembler source program.

```
.extern __S_romp, 4     -- Declared as an external label


-- Calls rcopy with absolute address of __S_romp as first argument and -1 as second
argument
mov     #__S_romp, r6
mov     -1, r7
jarl    __rcopy, lp
```

(2) To transfer sections 1 to 6 in 4-byte units and sections 7 to 11 in 1-byte units

```
extern unsigned long _S_romp;


main()
{
        int     ret, num;


        for(num = 1; num<=6; num++) {
                ret = _rcopy4(&_S_romp, num);
                if(ret == -1) {
                        /* Error processing */
                }
        }


        for(num = 7; num <= 11; num++) {
                ret = _rcopy1(&_S_romp, num);
                if(ret == -1) {
                        /* Error processing */
                }
```

```
        }
}
```

(3) Example 1 of incorrect specification

```
extern unsigned long _S_romp;
char *cp;

func()
{
        int     ret;

        /* First argument is gp relative value because copied to variable */
        cp = &_S_romp;
        ret = _rcopy(cp, -1);
}
```

(4) Example 2 of incorrect specification

```
extern unsigned long _S_romp;
int     i;

func()
{
        int     ret;

        /* First argument is gp relative value because copied to variable */
        i = 0x100;
        ret = _rcopy(i, -1);
}
```

- The section number to be specified as *number* is a positive number that starts from 1.
  The relationship between the section name and section number can be referenced from the memory map. When CubeSuite+ is used, on the Property panel, from the [ROMization Process Options] tab, in the [Section List] category, set the [Output ROMization section file] property to [Yes]. A C language header file in which correspondence between the section number and label is established can be created. In other words, a label can be used as *number*.
- If a section number or -1 is specified as *number*, nothing is copied.
- If two or more RAMs exist and two or more copy routines are used, and if -1 is specified as *number*, data cannot be correctly copied due to problems such as alignment of all sections.
  Do not specify -1 as *number*; specify a section number.
- If -1 is specified as *number*, data is copied in the order of section numbers.
  If there are any sections that are not copied during this operation due to one of the problems above, a value of -1 is returned.Sections following the section in which a problem has occurred are not copied.

B.4.6 Method for manipulating

This section explains how to manipulate the ROMization processor.

(1) Command input method

Enter the following from the command prompt.

```
C:\>romp850[option] ... file-name
      [ ]:     Can be omitted
      ...:     Pattern in proceeding [ ] can be repeated
```

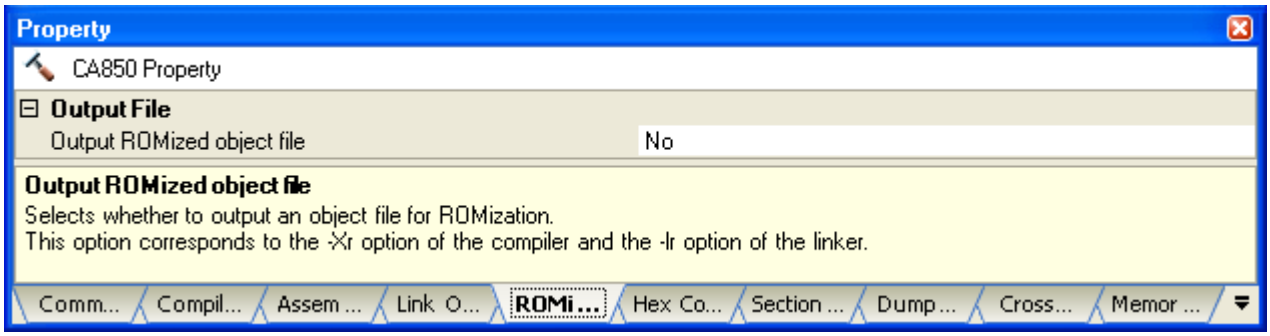
(2) Set options in CubeSuite+

This section describes how to set ROMization process options from CubeSuite+.

On CubeSuite+'s Project Tree panel, select the Build Tool node. Next, select the [View] menu -> [Property]. The Property panel opens. Next, select the [ROMization Process Options] tab.

You can set the various ROMization process options by setting the necessary properties in this tab.

Figure B-35. Property Panel: [Romization Process Option] Tab



B.4.7 Option

This section explains how to manipulate the ROMization processor.

The types and explanations for ROMization process options are shown below.

Table B-16. ROMization Process Options

Classification	Option	Description
File	+err_file	Adds and saves error messages to the file.
	-err_file	Overwrites and saves error messages to the file.
	-o	Specifies the name of the object file to be generated.

Classification	Option	Description
ROMization processor	-Ximem_overflow=warning	Controls checking when the internal ROM/RAM overflows.
	-b	Regards the specified label value as the start address of the rompsec section to be created.
	-d	Creates an object file that includes only a rompsec section.
	-i	Does not check for the duplicate addresses of the input file and output file.
	-m	Outputs the memory map of the object file to be created.
	-p	Inserts the contents of the data and sdata attribute sections and the corresponding address and size information into the rompsec section.
	-rom_less	Does not check a peripheral allocation error of the internal ROM for the rompsec section.
	-t	Inserts the contents of the text and const attribute sections and the corresponding address and size information into the rompsec section.
Other	-F	Searches a device file from the specified folder.
	-V	Outputs the version information of the C compiler to the standard error output.
	-help	Outputs option descriptions to the standard error output.
	@	Handles the specified file as a command file.

File

The options related to the file are as follows.

- +err_file
- -err_file
- -o

+err_file

[Description format]

```
+err_file=file
```

- Interpretation when omitted
  None

[Function Description]

- This option adds and saves error messages to file *file*.

[Example of use]

- To add and save error messages to the file "err", describe as:

```
C:\>romp850 +err_file=err a.out
```

-err_file

[Description format]

```
-err_file=file
```

- Interpretation when omitted

  None

[Function Description]

- This option overwrites and saves error messages to file *file*.

[Example of use]

- To overwrite and save error messages to the file "err", describe as:

```
C:\>romp850 -err_file=err a.out
```

-o

[Description format]

```
-o ofile
```

- Interpretation when omitted
  This option specifies romp.out as the name of the object file to be generated.

[Function Description]

- This option specifies *ofile* as the name of the object file to be generated.

[Example of use]

- To specify test.out as the name of the object file to be generated, describe as:

```
C:\>romp850 -o test.out a.out
```

ROMization processor

The ROMization processor options are as follows.

- -Ximem_overflow=warning
- -b
- -d
- -i
- -m
- -p
- -rom_less
- -t

-Ximem_overflow=warning

[Description format]

```
-Ximem_overflow=warning
```

- Interpretation when omitted
  A error message is output when overflowing and processing is stopped.

[Function Description]

- This option controls checking when the internal ROM/RAM overflows.
- This option outputs a warning message when overflowing and continues processing.

[Example of use]

- To control checking when the internal ROM/RAM overflows, describe as:

```
C:\>romp850 -Ximem_overflow=warning a.out
```

-b

[Description format]

```
-b label
```

- Interpretation when omitted
  Label value __S_romp is regarded as the start address of the rompsec section to be created.

[Function Description]

- This option specifies label value *label* as the start address of the rompsec section to be created.
- If the specified label does not exist in the object file or if the option is specified more than once, a message is output and processing is stopped.

[Example of use]

- To specify label value "__rompack" as the start address of the rompsec section to be created, describe as:

```
C:\>romp850 -b __rompack a.out
```

-d

[Description format]

```
-d
```

- Interpretation when omitted
  A section with the text attribute is included.

[Function Description]

- This option creates an object file that includes only a rompsec section; no text-attribute section is included in the file to be created.

[Example of use]

- To create an object file that includes only a rompsec section; no text-attribute section is included in the file to be created, describe as:

```
C:\>romp850 -d a.out
```

-i

[Description format]

```
-i
```

- Interpretation when omitted
  The linker checks for the duplicate addresses of the input file and output file and outputs the following message and stops linking if an illegalities is found.

[Function Description]

- This option does not check for the duplicate addresses of the input file and output file.

[Example of use]

- Not to check for the duplicate addresses of the input file and output file, describe as:

```
C:\>romp850 -i a.out
```

-m

[Description format]

```
-m[=mapfile]
```

- Interpretation when omitted
  No link map is output.

[Function Description]

- This option outputs to *mapfile* a memory map of the object file to be created.
- If *mapfile* is omitted, the link map is output to the standard output.

[Example of use]

- To output to "mapfile" a memory map of the object file to be created, describe as:

```
C:\>romp850 -m=map a.out
```

-p

[Description format]

```
-p section
```

- Interpretation when omitted
  The contents of all the data and sdata attribute sections and the sections allocated to the internal instruction RAM and the corresponding address and size information are inserted into the rompsec section.

[Function Description]

- This option inserts the contents of section *section* and the corresponding address and size information into the rompsec section.
- This option is related to data and sdata attribute sections.
- If this option is specified more than once, insertion to the rompsec section occurs according to the specified order.
- If the specified section does not exist in the object file, a message is output and processing is stopped.
- The section name cannot include blank spaces.

[Example of use]

- To insert the contents of the section (.sdata) and the corresponding address and size information into the rompsec section, describe as:

```
C:\>romp850 -p .sdata a.out
```

-rom_less

[Description format]

```
-rom_less
```

- Interpretation when omitted

  A peripheral allocation error of the internal ROM is not checked for the rompsec section.

[Function Description]

- This option does not check a peripheral allocation error of the internal ROM for the rompsec section.
- It is recommended to specify this option in the ROM-less mode.
- Checking of the overflow of the internal ROM is not supported when the single-chip mode is selected.
- Invalidate checking of the overflow of the internal ROM and check the overflow on the dump tool.

[Example of use]

- Not to check a peripheral allocation error of the internal ROM for the rompsec section, describe as:

```
C:\>romp850 -rom_less a.out
```

-t

[Description format]

```
-t section
```

- Interpretation when omitted
  The contents of the sections allocated to the internal instruction RAM and the corresponding address and size information are inserted into the rompsec section.

[Function Description]

- This option inserts the contents of section *section* and the corresponding address and size information into the rompsec section.
- This option is related to text and const attribute sections.
- If this option is specified more than once, insertion to the rompsec section occurs according to the specified order.
- If the specified section does not exist in the object file, a message is output and processing is stopped.
- Only sections having either a text or const attribute can be specified by this option. If any other attribute of section is specified, a message is output and processing is stopped.
- The section name cannot include blank spaces.
- If this option specifies a particular section of an input file linked specifying a device file with internal instruction RAM, sections allocated to unspecified internal instruction RAM will not be placed in the rompsec section, and will also be deleted from the output file.

[Example of use]

- To insert the contents of the section (.text) and the corresponding address and size information into the rompsec section, describe as:

```
C:\>romp850 -t .text a.out
```

Other

Other options are as follows.

- -F
- -V
- -help
- @

-F

[Description format]

```
-F devpath
```

- Interpretation when omitted
  The device file is searched from the standard folder.

[Function Description]

- This option searches a device file from folder *devpath*.

[Example of use]

- To search a device file from folder D:\dev, describe as:

```
C:\>romp850 -F D:\dev a.out
```

-V

[Description format]

```
-V
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs the version information of the ROMization processor to the standard error output and terminates processing.

[Example of use]

- To output the version information of the ROMization processor to the standard error output, describe as:

```
C:\>romp850 -V
```

-help

[Description format]

```
-help
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs option descriptions of the ROMization processor to the standard error output.

[Example of use]

- To output option descriptions to the standard error output, describe as:

```
C:\>romp850 -help
```

@

[Description format]

```
@cfile
```

- Interpretation when omitted
  Command files are assumed not to exist.

[Function Description]

- This option handles *cfile* as a command file.
- Instead of specifying options and file names for commands as command-line arguments, they can be specified in a command file.
- On Windows, the length of a character string specified as options for commands is limited. If many options are set and some of the options cannot be recognized, create a command file and specify this option.
- See "(2) Command file" for details about a command file.

[Example of use]

- To handle "command" as a command file, describe as:

```
C:\>romp850 @command
```

B.5 Hex Converter

The hex converter (hx850) inputs an executable object file output by the ROMization processor and converts the format of that file into a hex (hexadecimal) format.

If the application does not require the use of the ROMization processor (e.g. there are no default data in the application), then the executable object file output by the linker is input.

Figure B-36. Operation Flow of Hex Converter

B.5.1 I/O files

The hex converter enables the following files to be handled as input file.

file1.out	Executable object output by the ld850 or romp850

The following formats can be specified as hex format output.

(1) Intel hex format

- Intel expanded hex format

(2) Tektronix hex format

- Expanded Tektronix hex format

(3) Motorola hex format

- S type format (standard address)
- S type format (32-bit address)

Note Addresses of each line in the hex format are output in ascending order.

See "3.3 Hex Converter" for details about output lists.

B.5.2 Method for manipulating

This section explains how to manipulate the hex converter.

(1) Command input method

Enter the following from the command prompt.

```
C:\>hx850 [option] ... file-name
      [ ]:     Can be omitted
      ...:     Pattern in proceeding [ ] can be repeated
```

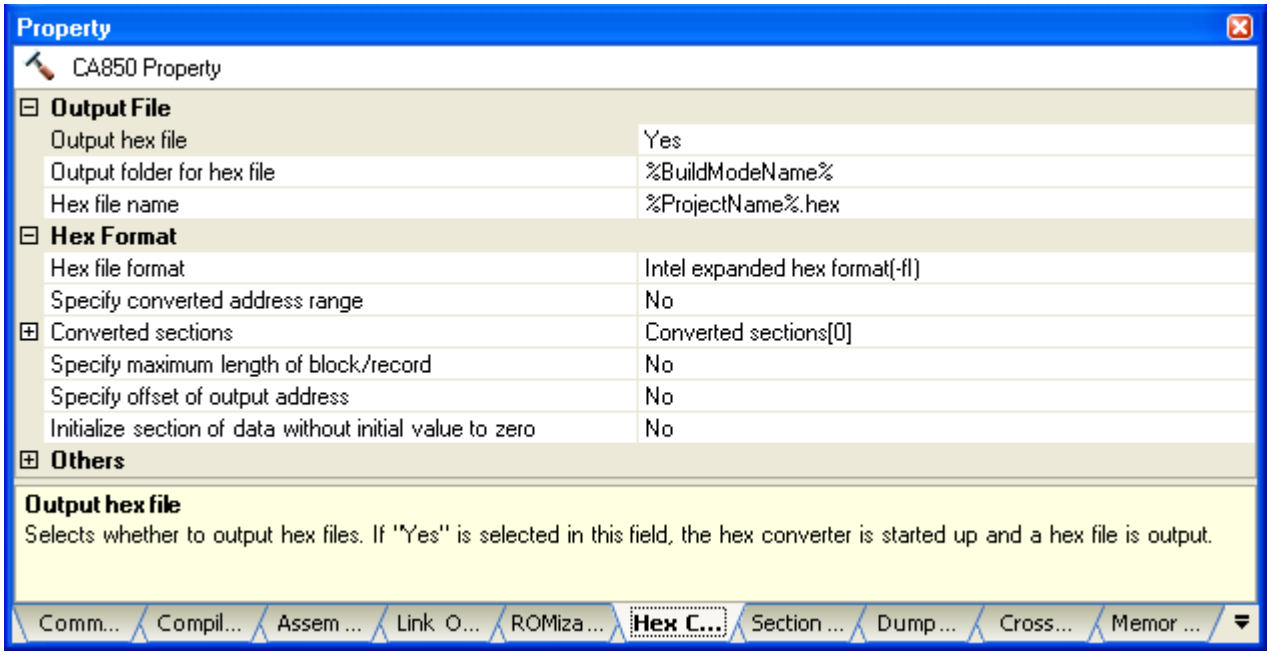
(2) Set options in CubeSuite+

This section describes how to set hex convert options from CubeSuite+.

On CubeSuite+'s Project Tree panel, select the Build Tool node. Next, select the [View] menu -> [Property]. The Property panel opens. Next, select the [Hex Convert Options] tab.

You can set the various hex convert options by setting the necessary properties in this tab.

Figure B-37. Property Panel: [Hex Convert Option] Tab



B.5.3 Option

This section explains hex converter.

The types and explanations for hex convert options are shown below.

Table B-17. Hex Convert Options

Classification	Option	Description
File	+err_file	Adds and saves error messages to the file.
	-err_file	Overwrites and saves error messages to the file.
	-o	Outputs the hex-converted result to the specified file.

Classification	Option	Description
Format	-b	Regards the specified value as the maximum block length.
	-d	Specifies the offset of the address to be output.
	-f	Specifies the hex format.
	-I	Converts and outputs code in the specified section.
	-S	Converts and outputs a symbol table.
	-U	Converts into hex format and outputs all the codes in the area specified by the specified address to the specified size.
	-x	When converts and outputs the symbol table, also converts and outputs local symbols.
	-rom_less	Disables use of the information of the internal ROM area defined by the device file when the -U option is specified.
	-z	Generates as many null characters (\0) as the size of a section for a section with the section type NOBITS and section attribute A.
Other	-F	Searches a device file from the specified folder.
	-V	Outputs the version information of the C compiler to the standard error output.
	@	Handles the specified file as a command file.

File

The options related to the file are as follows.

- +err_file
- -err_file
- -o

+err_file

[Description format]

```
+err_file=file
```

- Interpretation when omitted
  None

[Function Description]

- This option adds and saves error messages to file *file*.

[Example of use]

- To add and save error messages to the file "err", describe as:

```
C:\>hx850 +err_file=err -o a.hex a.out
```

-err_file

[Description format]

```
-err_file=file
```

- Interpretation when omitted

  None

[Function Description]

- This option overwrites and saves error messages to file *file*.

[Example of use]

- To overwrite and save error messages to the file "err", describe as:

```
C:\>hx850 -err_file=err -o a.hex a.out
```

-o

[Description format]

```
-o ofile
```

- Interpretation when omitted
  The hex-converted result to the file is output to the standard output.

[Function Description]

- This option outputs the hex-converted result to the file named *ofile*.

[Example of use]

- To output the hex-converted result to the file to the file (test), describe as:

```
C:\>hx850 -o test a.out
```

Format

The options related to the format are as follows.

- -b
- -d
- -f
- -I
- -S
- -U
- -x
- -rom_less
- -z

-b

[Description format]

```
-bnum
```

- Interpretation when omitted
  The default value for each hex format is used as the block length.

[Function Description]

- This option regards the value specified by *num* as the maximum block length (or, in the case of the Intel expanded hex format or Motorola S type hex format, the number of bytes of the code indicated in one data record).
- Specify a decimal number or a hexadecimal number that starts with 0x or 0X as *num*.

Table B-18. HEX Format Block/Record

HEX Format	Range of Specifiable Values	Default Value
Intel expanded	1 to 255 (0x01 to 0xff)	31 (0x1f)
Motorola S type	1 to 251 (0x01 to 0xfb)	80 (0x50)
Motorola S type (32-bit address)	1 to 250 (0x01 to 0xfa)	80 (0x50)
Extended tektronix	16 to 255 (0x10 to 0xff)	255 (0xff)

[Example of use]

- To specify 255 as the maximum number of bytes of the code indicated in one Intel expanded hex format data record, describe as:

```
C:\>hx850 -b255 -o a.hex a.out
```

-d

[Description format]

```
-dnum
```

- Interpretation when omitted
  The address to be output is not calculated as the offset.

[Function Description]

- This option regards the address to be output as the offset from *num*.
- Specify a decimal number or a hexadecimal number that starts with 0x or 0X as *num*.
- The range that can be specified for the value is 0H to 0xfffffffe.
- The address to be output is the offset value from the specified value.
- The default value is 0.

[Example of use]

- To regard the address to be output as the offset from 0x10000, describe as:

```
C:\>hx850 -d0x10000 -o a.hex a.out
```

-f

[Description format]

```
-fc
```

- Interpretation when omitted
  Intel expanded hex format is used.

[Function Description]

- This option uses of the hex format specified by character *c*.
- The meanings of character *c* are as follows.

I	Intel expanded
S	Motorola S type
s	Motorola S type (32-bit address)
T	Extended tektronix

- If the -fT and -U options are specified at the same time, -U is ignored.

[Example of use]

- To use the Motorola S type (32-bit address) format, describe as:

```
C:\>hx850 -fs -o a.hex a.out
```

-I

[Description format]

```
-Iname
```

- Interpretation when omitted
  All sections having the section type other than NOBITS and section attribute A are converted.

[Function Description]

- This option converts and outputs code in the section specified by section name *name*. In other words, the hex converter converts in section units, not in segment units.
- If a section (section having the section type NOBITS and section attribute A) is specified for the data for which no default value is specified, null characters (\0) are created corresponding to the section's size.
- The hex converter converts in section units, not in segment units.
- The section name cannot include blank spaces.
- If this option and -U option are specified at the same time, this option is ignored.

[Example of use]

- To convert and output code in the .text section, describe as:

```
C:\>hx850 -I.text -o a.hex a.out
```

-S

[Description format]

```
-S
```

- Interpretation when omitted
  No symbol table is converted and output.

[Function Description]

- This option converts and outputs a symbol table.
- This option is valid only when the expanded Tektronix hex format is specified (via the -fT option).
- If this option and -U option are specified at the same time, this option is ignored.

[Example of use]

- To convert and output a symbol table, describe as:

```
C:\>hx850 -fT -S -o a.hex a.out
```

-U

[Description format]

```
-U
-Unum
-Unum,start,size
-Ustart,size
```

- Interpretation when omitted
  All sections having the section type other than NOBITS and section attribute A are converted.

[Function Description]

- This option converts into hex format and outputs all the codes in the area specified by address *start* to size *size*.
- If *start* and *size* are omitted, all the codes in the internal ROM area defined by the device file are converted into hex format and output.
- Of the specified area, the unused area is filled with *num*. 1 or 2 can be specified as *num*. If *num* does not occupy 2 or 4 digits, it is assumed that 0 are used to fill the empty digit(s).
- The lower 1 byte of 2 bytes specified as *num* is allocated to the higher address and the higher 1 byte is allocated to the lower address.
- If *num* is omitted, the unused area is filled with 0xff.
- This option cannot be specified when the extended Tektronix hex format is specified.
- If this option is specified, the -I, -S, -x, and -Z options are ignored.

[Example of use]

- All the codes in the internal ROM area defined by the device file are converted into hex format and output. The unused area is filled with 0xff.

```
C:\>hx850 -U -o a.hex a.out
```

-x

[Description format]

```
-x
```

- Interpretation when omitted
  When this option converts and outputs the symbol table, it also converts and outputs only global symbols.

[Function Description]

- When this option converts and outputs the symbol table, it also converts and outputs local symbols.
- This option is valid only when the -S option is specified.
- If this option and -U option are specified at the same time, this option is ignored.

[Example of use]

- When this option converts and outputs the symbol table, it also converts and outputs local symbols.

```
C:\>hx850 -fT -S -x -o a.hex a.out
```

-rom_less

[Description format]

```
-rom_less
```

- Interpretation when omitted
  The information of the internal ROM area defined by the device file is used.

[Function Description]

- This option disables use of the information of the internal ROM area defined by the device file when the -U option is specified.
  It also disables output of a warning message if the area subject to hex conversion exceeds the internal ROM area.
- If this option and -U option are specified at the same time, *start*, *size* of the -U option must be specified.
- If this option and *start*, *size* of the -U option is omitted, the internal ROM area defined in the device file is converted.
  If the area subject to hex conversion exceeds the internal ROM area, a warning message is output.

[Example of use]

- To disable use of the information of the internal ROM area defined by the device file and specify the -U option, describe as:

```
C:\>hx850 -rom_less -U0xff,0x0,1000 -o a.hex a.out
```

-z

[Description format]

```
-z
```

- Interpretation when omitted
  All sections having the section type other than NOBITS and section attribute A are converted.

[Function Description]

- This option generates as many null characters (\0) as the size of a section for a section with the section type NOBITS and section attribute A (section for data for which no default value is specified, such as the .bss and .sbss section).
- If this option and -U option are specified at the same time, this option is ignored.

[Example of use]

- To generate as many null characters (\0) as the size of a section for a section with the section type NOBITS and section attribute A, describe as:

```
C:\>hx850 -z -o a.hex a.out
```

Other

Other options are as follows.

- -F
- -V
- @

-F

[Description format]

```
-F devpath
```

- Interpretation when omitted
  The device file is searched from the standard folder.

[Function Description]

- This option searches a device file from folder *devpath*.

[Example of use]

- To search a device file from folder D:\dev, describe as:

```
C:\>hx850 -F D:\dev -o a.hex a.out
```

-V

[Description format]

```
-V
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs the version information of the hex converter to the standard error output and terminates processing.

[Example of use]

- To output the version information of the hex converter to the standard error output, describe as:

```
C:\>hx850 -V
```

@

[Description format]

```
@cfile
```

- Interpretation when omitted
  Command files are assumed not to exist.

[Function Description]

- This option handles *cfile* as a command file.
- Instead of specifying options and file names for commands as command-line arguments, they can be specified in a command file.
- On Windows, the length of a character string specified as options for commands is limited. If many options are set and some of the options cannot be recognized, create a command file and specify this option.
- See "(2) Command file" for details about a command file.

[Example of use]

- To handle "command" as a command file, describe as:

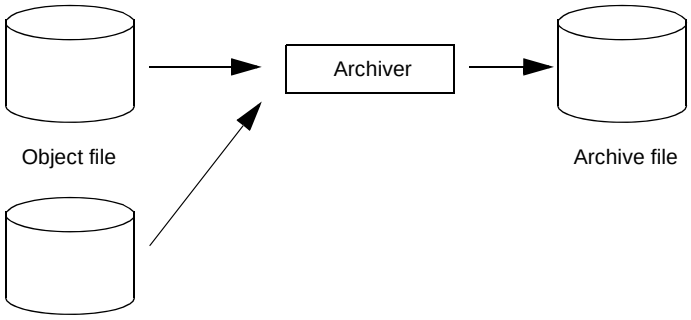
```
C:\>hx850 @command
```

B.6 Archiver

The archiver is a utility that couples specified relocatable object files and generates one archive file. Therefore, this utility is used to combine two or more objects to create a "library".

In the CA850, "ar850" is the archiver.

Figure B-38. Operation Flow of Archiver



The archive file generated by the archiver can be specified as an input file to the linker. If an archive file is specified, the ld850 searches the necessary objects from the specified archive file, and links only the objects found.

B.6.1 Method for manipulating

This section explains how to manipulate the archiver.

(1) Command input method

Enter the following from the command prompt.

```
C:\>ar850 [error-output-specification-option] key [option][member-name(Note)] archive-file-
name [member-name o file-name] ...

      [ ]:     Can be omitted

      ...:     Pattern in proceeding [ ] can be repeated
```

Note When files are linked within an archive file, they are called members. Each member's name is the same as its original file name.

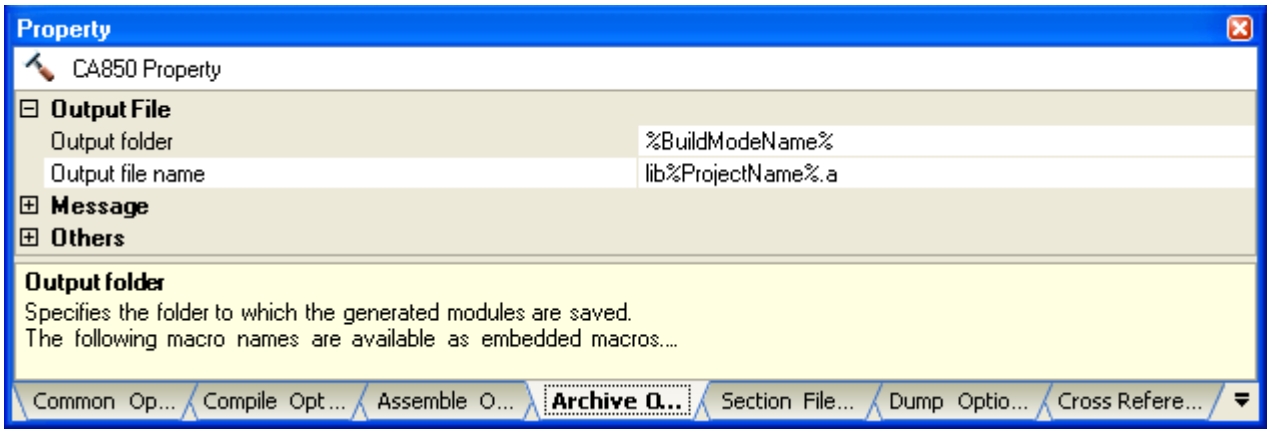
(2) Set options in CubeSuite+

This section describes how to set archive options from CubeSuite+.

On CubeSuite+'s Project Tree panel, select the Build Tool node. Next, select the [View] menu -> [Property]. The Property panel opens. Next, select the [Archive Options] tab.

You can set the various archive options by setting the necessary properties in this tab.

Figure B-39. Property Panel: [Archive Options] Tab



When starting the archiver from the command line, collect a group of object files and create an archive file. Various detailed operations can be performed within archive files, such as manipulation of archive file objects.

By contrast, when using CubeSuite+ to create an archive file, start by compiling and assembling source files, then collect the resulting objects into an archive file. Operations cannot be executed within complete archive files via CubeSuite+. The user should keep this difference in mind when choosing between command-line activation and activation via CubeSuite+.

B.6.2 Key/Option

This section explains keys and options of the archiver.

A key is an item that must be specified for activation, while an option can be omitted.

The types and explanations for archiver keys/options are shown below.

Table B-19. Archive Keys

Classification	Key	Description
Key	V	Outputs the version information of the archiver to the standard error output.
	d	Deletes the specified member from the specified archive file.
	m	Moves the specified member to the end of the specified archive file.
	ma	Moves the specified member to the position immediately after the member of the specified archive file.
	mb	Moves the specified member to the position immediately before the member of the specified archive file.
	q	Adds the specified file to the end of the specified archive file.
	r	Replaces the specified file with the member having the same name in the specified archive file.
	ra	Replaces the specified file with the member having the same name in the specified archive file, and then moves the specified file to the position immediately after the specified member.
	ru	If the specified file has been updated more recently than the member having the same name in the specified archive file, replaces the member with the specified file.
	t	Outputs only the member name of the member existing in the specified archive file.
	x	Extracts the member in the specified archive file and creates files having the same names.

Table B-20. Archive Options

Classification	Option	Description
Archiver	c	Does not output messages.
	v	Outputs the execution status of the archiver.
	@	Handles the specified file as a command file.
Output file	+err_file	Adds and saves error messages to the file.
	-err_file	Overwrites and saves error messages to the file.

Key

The archiver keys are as follows.

- V
- d
- m
- ma
- mb
- q
- r
- ra
- ru
- t
- x

V

[Description format]

```
V
```

- Interpretation when omitted
  None

[Function Description]

- This key outputs the version information of the archiver to the standard error output and terminates processing.

[Example of use]

- To output the version information of the archiver to the standard error output, describe as:

```
C:\>ar850 V
```

d

[Description format]

```
d
```

- Interpretation when omitted
  None

[Function Description]

- This key deletes the specified member from the specified archive file.

[Example of use]

- To delete the member (sub.o) from the archive file (libarc.a), describe as:

```
C:\>ar850 d libarc.a sub.o
```

m

[Description format]

```
m
```

- Interpretation when omitted
  None

[Function Description]

- This key moves the specified member to the end of the specified archive file.

[Example of use]

- To move the member (sub.o) to the end of the archive file (libarc.a), describe as:

```
C:\>ar850 m libarc.a sub.o
```

ma

[Description format]

```
ma member
```

- Interpretation when omitted
  None

[Function Description]

- This key moves the specified member to the position immediately after member *member* of the specified archive file.
- If *member* is omitted, processing is stopped.

[Example of use]

- To move the member (sub.o) to the position immediately after member (main.o) of the archive file (libarc.a), describe as:

```
C:\>ar850 ma main.o libarc.a sub.o
```

mb

[Description format]

```
mb member
```

- Interpretation when omitted
  None

[Function Description]

- This key moves the specified member to the position immediately before member *member* of the specified archive file.
- If *member* is omitted, processing is stopped.

[Example of use]

- To move the member (sub.o) to the position immediately before member (main.o) of the archive file (libarc.a), describe as:

```
C:\>ar850 mb main.o libarc.a sub.o
```

q

[Description format]

```
q
```

- Interpretation when omitted
  None

[Function Description]

- This key adds the specified file to the end of the specified archive file.
  There is no checking as to whether or not a member with the same name as the specified file exists.
- If the specified archive file does not exist, a new archive file that contains the specified file is created.
  There is no checking as to whether or not a member with the same name as the specified file exists.
- If there is a members with the same name, the archive file contains multiple members with the same name, and the oldest member will be selected during linking.
- Be sure to delete on old archive file if a new file is created.
- To replace the member with the member having the same name, use the r key.

[Example of use]

- To add the member (sub.o) to the end of the archive file (libarc.a), describe as:

```
C:\>ar850 q libarc.a sub.o
```

r

[Description format]

```
r
```

- Interpretation when omitted
  None

[Function Description]

- This key replaces the specified file with the member having the same name in the specified archive file.
- If the member with the same name as the specified file does not exist in the specified archive file, the specified file is added to the end of the specified archive file.
- If the specified archive file does not exist, a new archive file that contains the specified file is created.

[Example of use]

- To replace the member (sub.o) in the archive file (libarc.a), describe as:

```
C:\>ar850 r libarc.a sub.o
```

ra

[Description format]

```
ra member
```

- Interpretation when omitted
  None

[Function Description]

- This key replaces the specified file with the member having the same name in the specified archive file, and then moves the specified file to the position immediately after member *member*.
- If the member with the same name as the specified file does not exist in the specified archive file, the specified file is added to the end of the specified archive file.
- If *member* is omitted, processing is stopped.

[Example of use]

- To exchange the member (sub.o) in the archive file (libarc.a), and then moves the member to the position immediately after the member (main.o), describe as:

```
C:\>ar850 ra main.o libarc.a sub.o
```

ru

[Description format]

```
ru
```

- Interpretation when omitted
  None

[Function Description]

- If the specified file has been updated more recently than the member having the same name in the specified archive file, this key replaces the member with the specified file.
- If the member with the same name as the specified file does not exist in the specified archive file, the specified file is added to the end of the specified archive file.
- If the specified archive file does not exist, a new archive file that contains the specified file is created.

[Example of use]

- If sub.o has been updated more recently than sub.o in the archive file (libarc.a), to replace the members, describe as:

```
C:\>ar850 ru libarc.a sub.o
```

t

[Description format]

```
t
```

- Interpretation when omitted
  None

[Function Description]

- If a member name is specified, this key outputs only the member name of the member existing in the specified archive file.
- If a member name is not specified, this key outputs (via the standard output) the names of all members existing in the specified archive file.

[Example of use]

- To output the names of all members existing in the archive file (libarc.a), describe as:

```
C:\>ar850 t libarc.a
```

x

[Description format]

```
x
```

- Interpretation when omitted
  None

[Function Description]

- If a member name is specified and if the specified member exists in the specified archive file, this key extracts that member and creates a file having the same name.
- If a member name is not specified, this key extracts all of the members existing in the specified archive file and creates files having the same names. The contents of the archive file are not changed.

[Example of use]

- To extracts the member (sub.o) existing in the archive file (libarc.a) and creates a file, describe as:

```
C:\>ar850 x libarc.a sub.o
```

Archiver

The options related to the archiver are as follows.

- c
- v
- @

c

[Description format]

```
c
```

- Interpretation when omitted
  None

[Function Description]

- This option does not output messages.

[Example of use]

- Not to output messages, describe as:

```
C:\>ar850 tc libarc.a
```

v

[Description format]

```
v
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs the execution status of the archiver using the format "[a|d|q|m|r|x] - *file*".

a - *file*	Add
d - *file*	Delete
q - *file*	Create new, or add
m - *file*	Move
r - *file*	Replace
x - *file*	Extract

[Example of use]

- To display the execute status, describe as:

```
C:\>ar850 dv libarc.a sub.o
```

@

[Description format]

```
@cfile
```

- Interpretation when omitted
  Command files are assumed not to exist.

[Function Description]

- This option handles *cfile* as a command file.
- Instead of specifying options and file names for commands as command-line arguments, they can be specified in a command file.
- On Windows, the length of a character string specified as options for commands is limited. If many options are set and some of the options cannot be recognized, create a command file and specify this option.
- See "(2) Command file" for details about a command file.

[Example of use]

- To handle "command" as a command file, describe as:

```
C:\>ar850 @command
```

Output file

The options related to the output file are as follows.

- +err_file
- -err_file

+err_file

[Description format]

```
+err_file=file
```

- Interpretation when omitted
  None

[Function Description]

- This option adds and saves error messages to file *file*.

[Example of use]

- To add and save error messages to the file "err", describe as:

```
C:\>ar850 +err_file=err ar850 d libarc.a sub.o
```

-err_file

[Description format]

```
-err_file=file
```

- Interpretation when omitted

  None

[Function Description]

- This option overwrites and saves error messages to file *file*.

[Example of use]

- To overwrite and save error messages to the file "err", describe as:

```
C:\>ar850 -err_file=err ar850 d libarc.a sub.o
```

B.7 Section File Generator

This section explains a section file and the section file generator.

B.7.1 Section file

The section file is a file that define the sections to which external variables (global variables) and static variables that have been declared in a C source file are allocated. The sections to which these variables are allocated can be determined at compilation by referencing the section file. As the default setting, as many high access-frequency variables as possible are assigned to the .tidata-attribute, .tidata.word-attribute, .tidata.byte-attribute, .sidata-attribute, and .sedata-attribute sections allocated to the internal RAM area of the V850 microcontrollers.

The C compiler provides the following three methods for declaring external variables in C source files and allocating the variables to the intended sections.

(1) Use the compile option (-G*num*) to limit the data size when allocating to a .sdata section or .sbss section.

(2) Use the #pragma section directive to determine the section for allocation of each variable.

(3) Use a section file to allocate the specified variables when the compiler is activated.

Method (1) is applicable in cases where external variables that do not exceed a certain size can be allocated to either .sdata or .sbss sections. Since this specification is via a compile option, there is no need to add changes to the C source file.

Method (2) enables a freer choice of the section for allocation. Here, the #pragma section directive is used in the C source file to explicitly specify the target section for allocation. However, this method requires that changes be added to the C source file.

Methods (1) and (2) cannot be used much if you want to freely set the section for allocation, but don't want to use the #pragma section instruction because you want your code to be strictly ANSI compliant, or you want to port C source files compiled on other than the CA850 to the CA850 with minimal modifications.

Use the section file in method (3) to resolve this issue.

Define the following for all external variables and static variables in the section file.

- The names of C source files where the static variables are declared
- External variable names, static variable names, and the names of the sections where they are allocated

Also, by having the section file referenced by the CA850, the variables can be allocated to the intended locations without having to modify the C source file.

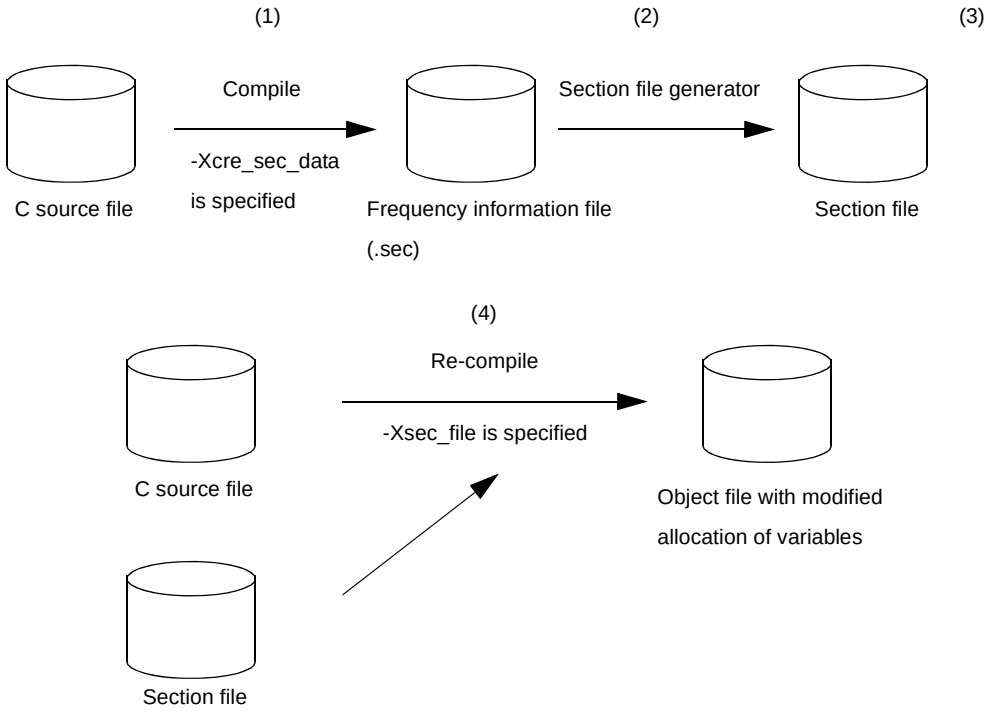
With the CA850, specification of a compile option (-Xcre_sec_data or -Xcre_sec_data_only) generates a frequency information file, which can be input to the section file generator to generate a section file.

However, the section file generator is designed to output information for allocating data to tidata-attribute, tidata.word-attribute, tidata.byte-attribute, sidata-attribute, sedata-attribute, and sdata-attribute sections that are intended to be allocated in the internal RAM of V850 microcontroller.

Since a section file is a text-format file, it can be edited and modified by using an editor. In other words, changes can be made in this way to the section file that is output by the section file generator in order to create the final (completed) section file.

When compilation is performed once again using the completed section file (with the -Xsec_file option specified), the object file whose external variables and static variables are allocated to the specified sections is completed.

Figure B-40. Image of Compilation Using Section File Specifications



(1) Compile once using the -Xcre_sec_data option to generate a section file.

(2) Use the section file generator to convert the frequency information file into a section file.

(3) Edit the section file, if necessary.

(4) Compile once more using the -Xsec_file option to input the section file.

See "3.4 Section File Generator" for details about the section file's format.

The variables whose allocation can be specified via a section file are external variables (global variables), static variables in files (static variables that are declared within a file), and static variables in functions (static variables that are declared within a function). Allocation specifications cannot be made using character string constants (such as "abc").

When compiling each of two or more C source files and linking them to generate an object file, compile each file specifying its frequency information output, which generates two or more .sec files. However, when generating these section files, all the .sec files must be input to the section file generator at once and then integrated. Otherwise, the variable information for the external variables will not be integrated, and valid section files cannot be generated.

Variables specified in the section file are the same as if they are specified for allocation to the section via the "#pragma section" directive. Therefore, a tentative definition of an external variable is handled as a "definition", so if an external variable is tentatively defined by two or more files, an error occurs during linking. In such cases, extern must be always declared in a file that references external variables.

If a variable whose allocation has been specified via a section file has also been specified (via a #pragma section directive in a C source file) to be allocated to a different section, the specification via the section file takes precedence.

Even when the "-G*num*" compile option has been specified, if a section file specifies that the variable will be allocated to the .sdata section or .sbss section, it will be allocated to that section regardless of the *num* value. In other words, the order of precedence among the specifications, "section file" specification, "#pragma section" specification, and "-G*num*" specification, is as follows.

```
(Higher precedence) Section file > #pragma section > -Gnum (Lower precedence)
```

B.7.2 Method for manipulating

This section explains how to manipulate the section file generator.

(1) Command input method

Enter the following from the command prompt.

```
C:\>sf850 [option] ... file-name [file-name] ...
      [ ]:     Can be omitted
      ...:     Pattern in proceeding [ ] can be repeated
```

(2) Use from command line

This section describes how to use the section file from the command line.

(a) First, create a frequency information file. Specify the compile option "-Xcre_sec_data_only" and compile the C source file to create a frequency information file for the external variables and static variables in the C source file. The default file name is "source-file-name.sec".
If the -Xcre_sec_data_only option is specified along with a file name, the specified file name will be the name of the frequency information file.

Example A frequency information file for "func1.c" is output as "secsrc"

```
C:\>ca850 -cpu 3201 -Xcre_sec_data_only=secsrc func1.c
```

(b) Input the generated frequency information file to the section file generator, which outputs a section file. In this case, the generated section file specifies that variables will be allocated to tidata-attribute sections, tidata.word-attribute sections, tidata.byte-attribute sections, sidata-attribute sections, sedata-attribute sections, and sdata-attribute sections .

Example The three frequency information files func1.sec, func2.sec, and func3.sec are collected as one section file, which is output as "secfile".

```
C:\>sf850 func1.sec func2.sec func3.sec -o secfile
```

It is convenient to create a command file if there are a large number of files. See "(2) Command file" for details about command files.

(c) Since the default specification for the output section file is that all variables are allocated to a .tidata-attribute section, it may be necessary to modify the section file.
If the -O option is specified when activating the section file generator, the variables that can be accommodated in the memory range of the .tidata-attribute section can be automatically selected in sequence, starting from the most frequently referenced variable.

(d) Re-compile the C source file by specifying the compile option "-Xsec_file". As a result of compilation, an object file will be generated with sections allocated in accordance with the input section file.

Example "secfile" is input as a section file and func1.c, func2.c, and func3.c are compiled.

```
C:\>ca850 -cpu 3201 -Xsec_file secfile func1.c func2.c func3.c
```

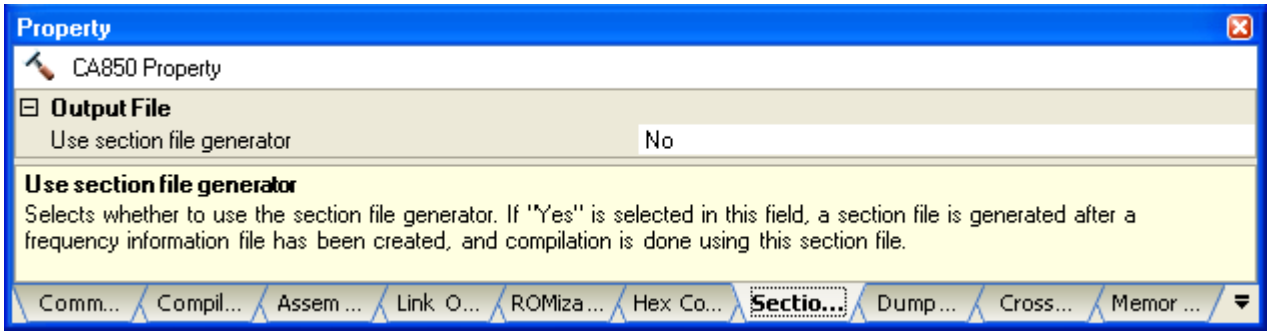
(3) Set options in CubeSuite+

This section describes how to set section file generate options from CubeSuite+.

On CubeSuite+'s Project Tree panel, select the Build Tool node. Next, select the [View] menu -> [Property]. The Property panel opens. Next, select the [Section File Generate Options] tab.

You can set the various librarian options by setting the necessary properties in this tab.

Figure B-41. Property Panel: [Section File Generate Option] Tab



B.7.3 Option

This section explains section file generate options.

The types and explanations for section file generate options are shown below.

Table B-21. Section File Generate Options

Classification	Option	Description
Section file generator	-O	Determines that only the number of variables that can be allocated to the sections to be optimized will be selected, in the order starting from highest use frequency and outputs.
	-V	Outputs the version information of the section file generator to the standard error output.
	-Xcs	Does not subject variables allocated to the specified section to optimization when the -O option is specified.
	-Xcv	Does not subject specified variables to optimization when the -O option is specified.
	-cl	Specifies the comment level of the section file to be output.
	+err_file	Adds and saves error messages to the file.
	-err_file	Overwrites and saves error messages to the file.
	-h	Outputs option descriptions of the section file generator to the standard error output.
	-help	
	-ns	Sorts variable names in the section file to be output in the order they appear.
	-o	Specifies the section file name to be output.
	-size_tidata	Limits the upper size variables allocated to the .tidata.word/.tidata.byte section.
	-size_tidata_byte	Limits the upper size variables allocated to the .tidata.byte section.
	-size_sidata	Limits the upper size variables allocated to the .sidata section.
	-size_sedata	Limits the upper size variables allocated to the .sedata section.
	-size_sdata	Limits the upper size variables allocated to the .sdata section.
	-sname	Sorts variable names in the section file to be output according to the dictionary order of variable names.
	-ssection	Sorts variable names in the section file to be output according to the dictionary order of section names to be allocated.
	-ssize	Sorts variable names in the section file to be output according to the variables (smallest first).
	-v	Displays the execution process of the section file generator.
	@	Handles the specified file as a command file.

Section file generator

The section file generator options are as follows.

- -O
- -V
- -Xcs
- -Xcv
- -cl
- +err_file
- -err_file
- -h/-help
- -ns
- -o
- -size_tidata
- -size_tidata_byte
- -size_sidata
- -size_sedata
- -size_sdata
- -sname
- -ssection
- -ssize
- -v
- @

-O

[Description format]

```
-Oc
```

- Interpretation when omitted
  All variables that have appeared are output to the section file.

[Function Description]

- If *c* is not specified, this option determines that only the number of variables that can be allocated to the sections to be optimized will be selected, in the order starting from highest use frequency and outputs.
- The maximum data size that can be allocated to the .tidata section is 256 bytes, which are internally divided into .tidata.byte byte data (128 bytes) and .tidata.word word data. When this option is specified, variables are selected until the total section size of 256 bytes is reached, at which point the variables are output to the section file. However, selection is stopped when the byte data reaches 128 bytes.
- If 2 is specified for *c*, this option selects variables for each variable size that can be allocated to .tidata, sidata, .sedata, and .sdata sections in the order starting from highest use frequency and determines that only the number of variables that can be allocated will be selected and outputs.

[Example of use]

- To determine that only the number of variables that can be allocated to the sections to be optimized will be selected, in the order starting from highest use frequency and outputs, describe as:

```
C:\>sf850 -O main.sec
```

-V

[Description format]

```
-V
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs the version information of the section file generator to the standard error output and terminates processing.

[Example of use]

- To output the version information of the section file generator to the standard error output, describe as:

```
C:\>sf850 -V
```

-Xcs

[Description format]

```
-Xcs[=name]
```

- Interpretation when omitted
  None

[Function Description]

- This option does not subject variables allocated to the section specified as *name* to optimization when the -O or -O2 option is specified.
- Specify *name* as a section file name to be specified in the link directive file.
- Replace .bss/.sbss of the bss-attribute section with .data/.sdata.
- If *num* is omitted, it is assumed that all section names has been specified.
- If .tidata is specified as *name*, it is assumed that .tidata.word and tidata.byte have been specified.

[Example of use]

- Not to subject variables allocated to the .const section to optimization, describe as:

```
C:\>sf850 -O -Xcs=.const main.sec
```

-Xcv

[Description format]

```
-Xcv=name
```

- Interpretation when omitted
  None

[Function Description]

- This option does not subject variables specified as *name* to optimization when the -O or -O2 option is specified.
- Specify *name* with the same format as "Table 3-1. Variable Types and Displays".

[Example of use]

- Not to subject variable "val" to optimization, describe as:

```
C:\>sf850 -O -Xcv=val main.sec
```

-cl

[Description format]

```
-cl num
```

- Interpretation when omitted
  -cl 1

[Function Description]

- This option specifies the comment level of the section file to be output.
- The following number can be specified as *num*.

0	No comment is output.
1	A dash (-) will be output for dates and other file generation information, variable information, and variable information outputting their descriptions if the section name, size, or section names for usage frequency external variables are not determined.
2	If -O which outputs a format guide in addition to level 1 has been specified, variables judged not to fit in the .tidata section are output as comments.

[Example of use]

- To specify 2 as the comment level of the section file to be output, describe as:

```
C:\>sf850 -cl 2 main.sec
```

+err_file

[Description format]

```
+err_file=file
```

- Interpretation when omitted
  None

[Function Description]

- This option adds and saves error messages to file *file*.

[Example of use]

- To add and save error messages to the file "err", describe as:

```
C:\>sf850 +err_file=err main.sec
```

-err_file

[Description format]

```
-err_file=file
```

- Interpretation when omitted
  None

[Function Description]

- This option overwrites and saves error messages to file *file*.

[Example of use]

- To overwrite and save error messages to the file "err", describe as:

```
C:\>sf850 -err_file=err main.sec
```

-h/-help

[Description format]

```
-h
-help
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs option descriptions of the section file generator to the standard error output and terminates processing.

[Example of use]

- To output option descriptions of the section file generator to the standard error output, describe as:

```
C:\>sf850 -help
```

-ns

[Description format]

```
-ns
```

- Interpretation when omitted
  Variable names in the section file to be output are sorted in the order starting from highest use frequency.

[Function Description]

- This option sorts variable names in the section file to be output in the order they appear instead of sorting them.

[Example of use]

- To sort variable names in the section file to be output in the order they appear instead of sorting them, describe as:

```
C:\>sf850 -ns main.sec
```

-o

[Description format]

```
-o name
```

- Interpretation when omitted
  The section file is output to the standard output.

[Function Description]

- This option specifies *name* as the section file name to be output.

[Example of use]

- To specify "secfile" as the section file name to be output, describe as:

```
C:\>sf850 -o secfile main.sec
```

-size_tidata

[Description format]

```
-size_tidata=num
```

- Interpretation when omitted
  -size_tidata=256

[Function Description]

- This option specifies *num* bytes as the upper size limit of variables allocated to the tidata.word/tidata.byte section when the -O or -O2 option is specified.
- 0 to 2147483647 (in decimal numbers) can be specified as *num*.

[Example of use]

- To specify 128 bytes as the upper size limit of variables allocated to the tidata.word/tidata.byte section, describe as:

```
C:\>sf850 -O -size_tidata=128 main.sec
```

-size_tidata_byte

[Description format]

```
-size_tidata_byte=num
```

- Interpretation when omitted
  -size_tidata_byte=128

[Function Description]

- This option specifies *num* bytes as the upper size limit of variables allocated to the tidata.byte section when the -O or -O2 option is specified.
- 0 to 2147483647 (in decimal numbers) can be specified as *num*.

[Example of use]

- To specify 64 bytes as the upper size limit of variables allocated to the tidata.byte section, describe as:

```
C:\>sf850 -size_tidata_byte=64 main.sec
```

-size_sidata

[Description format]

```
-size_sidata=num
```

- Interpretation when omitted
  -size_sidata=32512

[Function Description]

- This option specifies *num* bytes as the upper size limit of variables allocated to the .sidata section when the -O option is specified.
- 0 to 2147483647 (in decimal numbers) can be specified as *num*.

[Example of use]

- To specify 32000 bytes as the upper size limit of variables allocated to the .sidata section, describe as:

```
C:\>sf850 -size_sidata=32000 main.sec
```

-size_sedata

[Description format]

```
-size_sedata=num
```

- Interpretation when omitted
  -size_sidata=32768

[Function Description]

- This option specifies *num* bytes as the upper size limit of variables allocated to the .sedata section when the -O option is specified.
- 0 to 2147483647 (in decimal numbers) can be specified as *num*.

[Example of use]

- To specify 16384 bytes as the upper size limit of variables allocated to the .sedata section, describe as:

```
C:\>sf850 -size_sedata=16384 main.sec
```

-size_sdata

[Description format]

```
-size_sdata=num
```

- Interpretation when omitted
  -size_sdata=65536

[Function Description]

- This option specifies *num* bytes as the upper size limit of variables allocated to the .sdata section when the -O option is specified.
- 0 to 2147483647 (in decimal numbers) can be specified as *num*.

[Example of use]

- To specify 32768 bytes as the upper size limit of variables allocated to the .sdata section, describe as:

```
C:\>sf850 -size_sdata=32768 main.sec
```

-sname

[Description format]

```
-sname
```

- Interpretation when omitted
  None

[Function Description]

- This option sorts variable names in the section file to be output according to the dictionary order of variable names.
- If two variables have the same name, they are sorted according to the dictionary order of file names and function names.

[Example of use]

- To sort variable names in the section file to be output according to the dictionary order of variable names, describe as:

```
C:\>sf850 -sname func.sec
```

-ssection

[Description format]

```
-ssection
```

- Interpretation when omitted
  None

[Function Description]

- This option sorts variable names in the section file to be output according to the dictionary order of section names to be allocated.
- If two section files have the same name, they are sorted in the order starting from highest use frequency.

[Example of use]

- To sort variable names in the section file to be output according to the dictionary order of section names to be allocated, describe as:

```
C:\>sf850 -ssection main.sec
```

-ssize

[Description format]

```
-ssize
```

- Interpretation when omitted
  None

[Function Description]

- This option sorts variable names in the section file to be output according to the variables (smallest first).
- If two variables have the same size, they are sorted in the order starting from highest use frequency.

[Example of use]

- To sort variable names in the section file to be output according to the variables (smallest first), describe as:

```
C:\>sf850 -ssize main.sec
```

-v

[Description format]

```
-v
```

- Interpretation when omitted
  None

[Function Description]

- This option displays the execution process of the section file generator.

[Example of use]

- To display the execution process of the section file generator, describe as:

```
C:\>sf850 -v main.sec
```

@

[Description format]

```
@cfile
```

- Interpretation when omitted
  Command files are assumed not to exist.

[Function Description]

- This option handles *cfile* as a command file.
- Instead of specifying options and file names for commands as command-line arguments, they can be specified in a command file.
- On Windows, the length of a character string specified as options for commands is limited. If many options are set and some of the options cannot be recognized, create a command file and specify this option.
- See "(2) Command file" for details about a command file.

[Example of use]

- To handle "command" as a command file, describe as:

```
C:\>sf850 @command
```

B.7.4 Cautions

Some options become invalid if they are specified at the same time as certain other options.

- If two or more options related to sorting (-o or -cl) are specified, the one specified last is valid and the others are invalid.
- If -V, -h, and -help are specified at the same time, the one specified first is valid, and the others are invalid.
- If -O and an option related to sorting are specified at the same time, -O is valid and the option related to sorting is invalid.
- Use the frequency information file output by the C compiler as the input to the section file generator, without modifying it first in any way. Operation is not guaranteed if a frequency information file with modified content has been input.

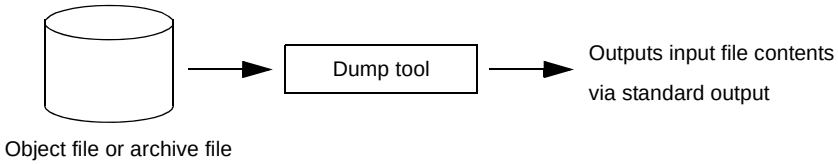
See "3.4 Section File Generator" for details about the contents of section files output by the section file generator.

B.8 Dump Tool

A dump tool displays the contents or information of a specified object file or archive file. It is used to check information such as the address, attribute, and symbol name of a section/segment in a created object file or archive file.

In the CA850, "dump850" is the dump tool.

Figure B-42. Operation Flow of Dump Tool



If an archive file is input to the dump tool, and if a member that is not an object file exists in the archive file, a warning message is output and the next member is processed; except, however, when the -e option is specified.

See "B.8.2 Option" for details about the options.

B.8.1 Method for manipulating

This section explains how to manipulate the dump tool.

(1) Command input method

Enter the following from the command prompt.

```
C:\>dump850 [option] ... file-name [file-name] ...
      [ ]:     Can be omitted
      ...:     Pattern in proceeding [ ] can be repeated
```

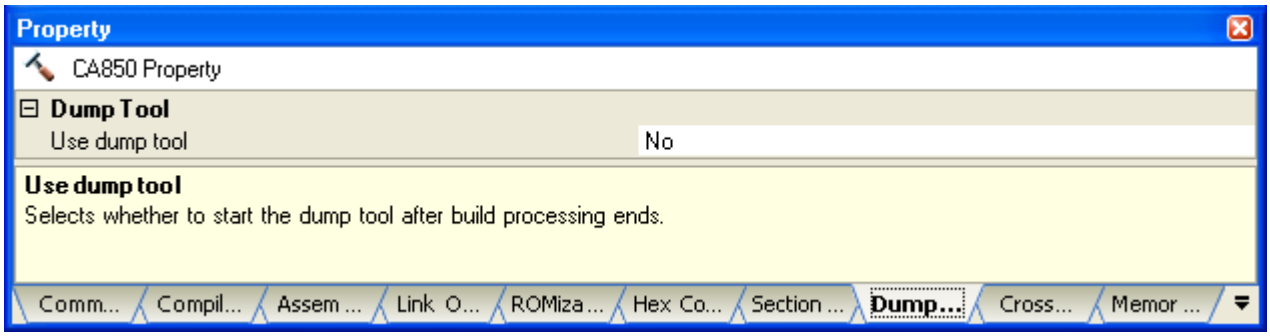
(2) Set options in CubeSuite+

This section describes how to set dump options from CubeSuite+.

On CubeSuite+'s Project Tree panel, select the Build Tool node. Next, select the [View] menu -> [Property]. The Property panel opens. Next, select the [Dump Options] tab.

You can set the various dump options by setting the necessary properties in this tab.

Figure B-43. Property Panel: [Dump Options] Tab



B.8.2 Option

This section explains dump options.

The types and explanations for dump options are shown below.

Table B-22. Dump Tool Option

Classification	Option	Description
Dump tool	-A	Displays the entire contents of the specified object file or archive file.
	-T	Does not display the update date of the member when the contents of the archive header are displayed.
	-V	Outputs the version information of the dump tool to the standard error output.
	-a	Displays the contents of the archiver header of all members existing in the specified file.
	-b	Displays the contents of debug information.
	-c	Displays the contents of the string table.
	-d	Displays data from the section indicated by the section header table.
	+d	Displays data up to the section indicated by the section header table.
	-e	Displays the contents of the member existing in the specified archive file.
	-f	Displays the contents of the ELF header of all members existing in the specified object file or archive file.
	-g	Displays the contents of the external symbol existing in the archive symbol table of the specified archive file.
	-h	Displays the contents of all section headers existing in the specified object file or archive file.
	-i	Displays the contents of all program headers existing in the specified object file or archive file.
	-k	Displays the contents of the global pointer table.
	-l	Displays the contents of line number information.
	-m	Displays the contents of the string existing in the archive string table of the specified file.
	-n	Displays the contents of the specified section.
	-p	Does not display the title.
	-r	Displays the contents of relocation information.
	-s	Displays the contents of the section.
	-t	Displays the contents of a symbol table starting from the specified symbol table entry.
	+t	Displays the contents of a symbol table up to the specified symbol table entry.
	-v	Displays a value, such as for a section attribute value, using a character string to indicate the meaning of the value.
	-z	Displays contents of line number information for the function, starting from the specified line number entry.
	+z	Displays contents of line number information for the function, up to the specified line number entry.
	@	Handles the specified file as a command file.

Dump tool

The dump tool options are as follows.

- -A
- -T
- -V
- -a
- -b
- -c
- -d
- +d
- -e
- -f
- -g
- -h
- -i
- -k
- -l
- -m
- -n
- -p
- -r
- -s
- -t
- +t
- -v
- -z
- +z
- @

-A

[Description format]

```
-A
```

- Interpretation when omitted
  -A

[Function Description]

- This option displays the entire contents of the specified object file or archive file.
- Specifying this option is the same as specifying "-abcfghiklmrst". If no option is specified, it is assumed that the -A option has been specified.

[Example of use]

- To display the entire contents of a.out, describe as:

```
C:\>dump850 -A a.out
```

-T

[Description format]

```
-T
```

- Interpretation when omitted
  None

[Function Description]

- This option does not display the update date of the member when the contents of the archive header are displayed.

[Example of use]

- Not to display the update date of the member when the contents of the archive header are displayed.

```
C:\>dump850 -T libarc.a
```

-V

[Description format]

```
-V
```

- Interpretation when omitted
  None

[Function Description]

- This key outputs the version information of the dump tool to the standard error output and terminates processing.

[Example of use]

- To output the version information of the dump tool to the standard error output, describe as:

```
C:\>dump850 -V
```

-a

[Description format]

```
-a
```

- Interpretation when omitted

  -a

[Function Description]

- This option displays the contents of the archiver header of all members existing in the specified archive file.

[Example of use]

- To display the contents of the archiver header of all members existing in libarc.a, describe as:

```
C:\>dump850 -a libarc.a
```

-b

[Description format]

```
-b
```

- Interpretation when omitted
  -b

[Function Description]

- This option displays the contents of debug information.

[Example of use]

- To display the contents of debug information, describe as:

```
C:\>dump850 -b a.out
```

-c

[Description format]

```
-c
```

- Interpretation when omitted

  -c

[Function Description]

- This option displays the contents of the string table.

[Example of use]

- To display the contents of the string table, describe as:

```
C:\>dump850 -c a.out
```

-d

[Description format]

```
-d num
```

- Interpretation when omitted
  All sections are displayed.

[Function Description]

- This option displays data from the section indicated by the section header table index *num*.

[Example of use]

- To display data from the section indicated by the section header table index 2, describe as:

```
C:\>dump850 -d 2 a.out
```

+d

[Description format]

```
+d num
```

- Interpretation when omitted
  All sections are displayed.

[Function Description]

- This option displays data up to the section indicated by the section header table index *num*.

[Example of use]

- To display data up to the section indicated by the section header table index 9, describe as:

```
C:\>dump850 +d 9 a.out
```

-e

[Description format]

```
-e
```

- Interpretation when omitted
  None

[Function Description]

- This option displays the contents of members (other than archive symbol table, archive string table, and object file) existing in the specified archive file.

[Example of use]

- To display the contents of members (other than archive symbol table, archive string table, and object file) existing in libarc.a, describe as:

```
C:\>dump850 -e libarc.a
```

-f

[Description format]

```
-f
```

- Interpretation when omitted

  -f

[Function Description]

- This option displays the contents of the ELF header of all members existing in the specified object file or archive file.

[Example of use]

- To display the contents of the ELF header of members existing in a.out, describe as:

```
C:\>dump850 -f a.out
```

-g

[Description format]

```
-g
```

- Interpretation when omitted

  -g

[Function Description]

- This option displays the contents of the external symbol existing in the archive symbol table of the specified archive file.

[Example of use]

- To display the contents of the external symbol existing in the archive symbol table of libarc.a, describe as:

```
C:\>dump850 -g libarc.a
```

-h

[Description format]

```
-h
```

- Interpretation when omitted

  -h

[Function Description]

- This option displays the contents of all section headers existing in the specified object file or archive file.

[Example of use]

- To display the contents of all section headers existing in a.out, describe as:

```
C:\>dump850 -h a.out
```

-i

[Description format]

```
-i
```

- Interpretation when omitted

  -i

[Function Description]

- This option displays the contents of all program headers existing in the specified object file or archive file.

[Example of use]

- To display the contents of all program headers existing in a.out, describe as:

```
C:\>dump850 -i a.out
```

-k

[Description format]

```
-k
```

- Interpretation when omitted

  -k

[Function Description]

- This option displays the contents of the global pointer table.

[Example of use]

- To display the contents of the global pointer table, describe as:

```
C:\>dump850 -k a.out
```

-l

[Description format]

```
-l
```

- Interpretation when omitted

  -l

[Function Description]

- This option displays the contents of line number information.

[Example of use]

- To display the contents of line number information, describe as:

```
C:\>dump850 -l a.out
```

-m

[Description format]

```
-m
```

- Interpretation when omitted

  -m

[Function Description]

- This option displays the contents of the string existing in the archive string table of the specified archive file.

[Example of use]

- To display the contents of the string existing in the archive string table of libarc.a, describe as:

```
C:\>dump850 -m libarc.a
```

-n

[Description format]

```
-n name
```

- Interpretation when omitted
  The contents of all sections is displayed.

[Function Description]

- This option displays the contents of the section indicated by section name *name*.

[Example of use]

- To display the contents of the .text section, describe as:

```
C:\>dump850 -n .text a.out
```

-p

[Description format]

```
-p
```

- Interpretation when omitted
  None

[Function Description]

- This option does not display the title.

[Example of use]

- Not to display the title, describe as:

```
C:\>dump850 -p a.out
```

-r

[Description format]

```
-r
```

- Interpretation when omitted
  The contents of relocation information is displayed.

[Function Description]

- This option displays the contents of relocation information.

[Example of use]

- To display the contents of relocation information, describe as:

```
C:\>dump850 -r main.o
```

-s

[Description format]

```
-s
```

- Interpretation when omitted

  -s

[Function Description]

- This option displays the contents of the section.

[Example of use]

- To display the contents of the section, describe as:

```
C:\>dump850 -s a.out
```

-t

[Description format]

```
-t [num]
```

- Interpretation when omitted
  The contents of all symbol table is displayed.

[Function Description]

- This option displays the contents of a symbol table starting from the *num*th symbol table entry.
- If *num* is omitted, the display starts from the first symbol table entry.

[Example of use]

- To display the contents of a symbol table starting from the 5th symbol table entry, describe as:

```
C:\>dump850 -t 5 a.out
```

+t

[Description format]

```
+t num
```

- Interpretation when omitted
  The contents of all symbol table is displayed.

[Function Description]

- This option displays the contents of a symbol table starting up to the *num*th symbol table entry.

[Example of use]

- To display the contents of a symbol table starting up to the 10th symbol table entry, describe as:

```
C:\>dump850 +t 10 arc.a
```

-v

[Description format]

```
-v
```

- Interpretation when omitted
  A value, such as for a section attribute value, is displayed using a number.

[Function Description]

- This option displays a value, such as for a section attribute value, using a character string to indicate the meaning of the value rather than a number (see "3.5.2 Element values and meanings").

[Example of use]

- To display a value, such as for a section attribute value, using a character string to indicate the meaning of the value rather than a number, describe as:

```
C:\>dump850 -v a.out
```

-z

[Description format]

```
-z name [num]
```

- Interpretation when omitted
  The contents of line number information for all functions is displayed.

[Function Description]

- This option displays contents of line number information for function *name*, starting from the *num*th line number entry.
- If *num* is omitted, the display starts from the first line number entry.

[Example of use]

- To display contents of line number information for the function (func), starting from the first line number entry, describe as:

```
C:\>dump850 -z func a.out
```

+z

[Description format]

```
+z num
```

- Interpretation when omitted
  The contents of line number information for all functions is displayed.

[Function Description]

- This option displays contents of line number information, up to the *num*th line number entry.

[Example of use]

- To display contents of line number information for the function (func), up to the 10th line number entry, describe as:

```
C:\>dump850 -z func +z 10 a.out
```

@

[Description format]

```
@cfile
```

- Interpretation when omitted
  Command files are assumed not to exist.

[Function Description]

- This option handles *cfile* as a command file.
- Instead of specifying options and file names for commands as command-line arguments, they can be specified in a command file.
- On Windows, the length of a character string specified as options for commands is limited. If many options are set and some of the options cannot be recognized, create a command file and specify this option.
- See "(2) Command file" for details about a command file.

[Example of use]

- To handle "command" as a command file, describe as:

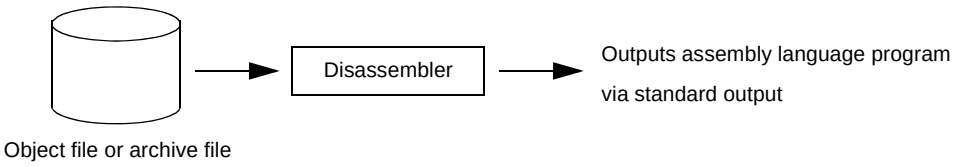
```
C:\>dump850 @command
```

B.9 Disassembler

A disassembler is a utility that converts the program codes of an object file that has been compiled or assembled, or an archive file created with the archiver into assembly language codes for output. This utility is used to verify the codes of an object file.

In the CA850, "dis850" is the disassembler.

Figure B-44. Operation Flow of Disassembler



B.9.1 Method for manipulating

This section explains how to manipulate the disassembler.

(1) Command input method

Enter the following from the command prompt.

```
C:\>dis850 [option] ... file-name [file-name] ...
      [ ]:     Can be omitted
      ...:     Pattern in proceeding [ ] can be repeated
```

B.9.2 Option

This section explains disassemble options.

Caution If no option is specified, it is assumed that the -o option has been specified.

The types and explanations for disassemble options are shown below.

Table B-23. Disassemble Options

Classification	Option	Description
Disassembler	-A	Assumes that -aoptr has been specified.
	-F	The device file is searched from the standard folder.
	-V	Outputs the version information of the disassembler to the standard error output.
	-a	Displays the address.
	-c	Displays the code (assembler instruction and data).
	-e	Specifies the end address.
	-l	Specifies the display size.
	-m	Displays in the assembler source format.
	-o	Displays the offset from symbols.
	-p	Displays the code that has been arranged according to the processor's instruction format.
	-r	Displays registers r0, r2, r3, r4, r5, r30, and r31 as zero, hp, sp, gp, tp, ep, and lp.
	-s	Specifies the start address.
	-t	Displays the title indicating the displayed contents.
	-v	Displays comments, etc.
	@	Handles the specified file as a command file.

Disassembler

The disassembler options are as follows.

- -A
- -F
- -V
- -a
- -c
- -e
- -l
- -m
- -o
- -p
- -r
- -s
- -t
- -v
- @

-A

[Description format]

```
-A
```

- Interpretation when omitted
  -o

[Function Description]

- This option assumes that -aoptr has been specified.

[Example of use]

- To display the address, offset from the address, and title indicating the displayed contents of a.out, and then display registers r0, r2, r3, r4, r5, r30, and r31 as zero, hp, sp, gp, tp, ep, and lp, describe as:

```
C:\>dis850 -A a.out
```

-F

[Description format]

```
-F devpath
```

- Interpretation when omitted
  The device file is searched from the standard folder.

[Function Description]

- This option searches a device file from folder *devpath*.

[Example of use]

- To search a device file from folder D:\dev, describe as:

```
C:\>dis850 -F D:\dev a.out
```

-V

[Description format]

```
-V
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs the version information of the disassembler to the standard error output and terminates processing.

[Example of use]

- To output the version information of the disassembler to the standard error output, describe as:

```
C:\>dis850 -V
```

-a

[Description format]

```
-a
```

- Interpretation when omitted
  None

[Function Description]

- This option displays the addresses among the information in the object file or archive file.

[Example of use]

- To display the addresses among the information in a.out, describe as:

```
C:\>dis850 -a a.out
```

-c

[Description format]

```
-c
```

- Interpretation when omitted
  None

[Function Description]

- This option displays the code (assembler instruction and data) of the object file or archive file.

[Example of use]

- To display the code (assembler instruction and data) of a.out, describe as:

```
C:\>dis850 -c a.out
```

-e

[Description format]

```
-e address
```

- Interpretation when omitted
  -e 0xffffffff

[Function Description]

- This option specifies the end address.
- Specify a decimal number or a hexadecimal number that starts with 0x as *address*.

[Example of use]

- To specify 0xffff as the end address, describe as:

```
C:\>dis850 -e 0xffff a.out
```

-l

[Description format]

```
-l size
```

- Interpretation when omitted
  -l 0xffffffff

[Function Description]

- This option specifies the display size.
- Specify a decimal number or a hexadecimal number that starts with 0x as *size*.

[Example of use]

- To specify 0xffff as the display size, describe as:

```
C:\>dis850 -l 0xffff a.out
```

-m

[Description format]

```
-m
```

- Interpretation when omitted
  The assembler source is displayed with a symbol offset, etc.

[Function Description]

- This option displays in the assembler source format.

[Example of use]

- To display in the assembler source format, describe as:

```
C:\>dis850 -m a.out
```

-o

[Description format]

```
-o
```

- Interpretation when omitted
  If the -a or -m option is not specified, the offset from symbols is displayed.

[Function Description]

- This option displays the offset from symbols among the information in the object file or archive file.

[Example of use]

- To display the offset from symbols among the information in a.out, describe as:

```
C:\>dis850 -o a.out
```

-p

[Description format]

```
-p
```

- Interpretation when omitted
  None

[Function Description]

- This option displays the code that has been arranged according to the processor's instruction format among the information in the object file or archive file.
- The -c option is specified, -c is given precedence,

[Example of use]

- To display the code that has been arranged according to the processor's instruction format among the information in a.out, describe as:

```
C:\>dis850 -p a.out
```

-r

[Description format]

```
-r
```

- Interpretation when omitted
  All registers are displayed in "rnum" format. "num" is a numerical value from 0 to 31.

[Function Description]

- This option displays registers r0, r2, r3, r4, r5, r30, and r31 as zero, hp, sp, gp, tp, ep, and lp.

[Example of use]

- To display registers r0, r2, r3, r4, r5, r30, and r31 as zero, hp, sp, gp, tp, ep, and lp, describe as:

```
C:\>dis850 -r a.out
```

-s

[Description format]

```
-s address
```

- Interpretation when omitted
  -s 0x0

[Function Description]

- This option specifies the start address.
- Specify a decimal number or a hexadecimal number that starts with 0x as *address*.
- If numerical value *address* is larger than 0xfffffffe, the value is omitted.

[Example of use]

- To specify 0x1000 as the start address, describe as:

```
C:\>dis850 -s 0x1000 a.out
```

-t

[Description format]

```
-t
```

- Interpretation when omitted
  None

[Function Description]

- This option displays the title indicating the displayed contents among the information in the object file or archive file.

[Example of use]

- To display the title indicating the displayed contents among the information in a.out, describe as:

```
C:\>dis850 -t a.out
```

-v

[Description format]

```
-v
```

- Interpretation when omitted
  None

[Function Description]

- This option displays comments, etc.

[Example of use]

- To display comments, etc., describe as:

```
C:\>dis850 -v a.out
```

@

[Description format]

```
@cfile
```

- Interpretation when omitted
  Command files are assumed not to exist.

[Function Description]

- This option handles *cfile* as a command file.
- Instead of specifying options and file names for commands as command-line arguments, they can be specified in a command file.
- On Windows, the length of a character string specified as options for commands is limited. If many options are set and some of the options cannot be recognized, create a command file and specify this option.
- See "(2) Command file" for details about a command file.

[Example of use]

- To handle "command" as a command file, describe as:

```
C:\>dis850 @command
```

B.9.3 Cautions

Cautions are shown below.

- If labels for the same address exist in the object file, the latter label in the symbol table takes precedence.
- If the program starts from address 0 and if output of the symbol at address 0 is required during output for an object that does not have a symbol indicating address 0, "__dummy" may be output as the symbol of address 0.

B.10 Cross Reference Tool

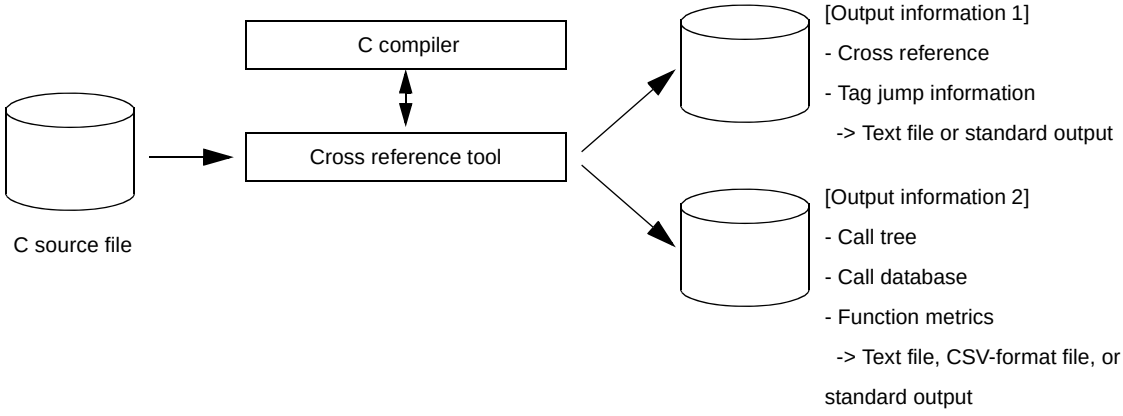
The cross reference tool "cxref" is a tool that checks identifier references and definition locations based on the C source file. The target identifiers, which are functions and variables (other than auto variables), also identify their storage class. Cross reference information and tag jump information are output as the detection results. The analysis is performed for individual functions, and a call tree, function metrics, and call database can also be output.

In cross reference tool processing, a "reference" means that the identifier appears within an expression and a "definition" means that the identifier appears within a declaration statement. "Definition" means that the identifier appears within a declaration statement. The cross reference tool handles an identifier for which it cannot determine whether it appears in an expression or a declaration statement as "unknown."

Call trees, function metrics, or call databases that are output by the cross reference tool have the following features.

- They do not depend on the target and the ca850 optimization.
- Standard output can be used by specifying an option.

Figure B-45. Operation Flow of Cross Reference Tool



B.10.1 Input/Output

(1) Input file

The input file of the cross reference tool is a C source file. If the -cpp850 option is specified when the cross reference tool is started, the cross reference tool processing is performed after the specified C source file has passed through the preprocessor.

- A prerequisite for cross reference tool processing is that the C source file to be input contains no syntax errors. Confirm that compilation has been executed for the C source file and that no syntax error was found.
- The character set is assumed to be Shift-JIS.
- The cross reference tool does not treat preprocess directives in the C source file as errors. Instead, it simply ignores them and continue the analysis.Therefore, if a C source file does not contain any of the following items, it can be processed directly without specifying the -cpp850 option, even if the file has not passed through the ca850. This is effective when ignoring a header file, when subjecting false condition blocks to analysis, and when targeting macro names for cross reference.
  - Condition block in which braces { } are not balanced
  - Macro created for a control structure
  - Macro created for a declaration statement
- The input file can contain line number information and comment information.

(2) Output information

The following information is output by the cross reference tool.

(a) Cross reference

The cross reference tool outputs cross reference information for variables and functions that are used within the file, for each file.

(b) Tag information

The cross reference tool outputs the definition file name and line number information (tag jump information) for variables and functions.

(c) Call tree

The cross reference tool outputs which functions are called by certain function in tree format.

(d) Function metrics

The cross reference tool outputs information about the function such as the "number of lines" and "call frequency."

(e) Call database

The cross reference tool outputs the functions called by certain function, and how many times it calls them.

See "3.7 Cross Reference Tool" for details about these information.

B.10.2 Method for manipulating

This section explains how to manipulate the cross reference tool.

(1) Command input method

Enter the following from the command prompt.

```
C:\>cxref [option] ... [file-name] ...
      [ ]:     Can be omitted
      ...:     Pattern in proceeding [ ] can be repeated
```

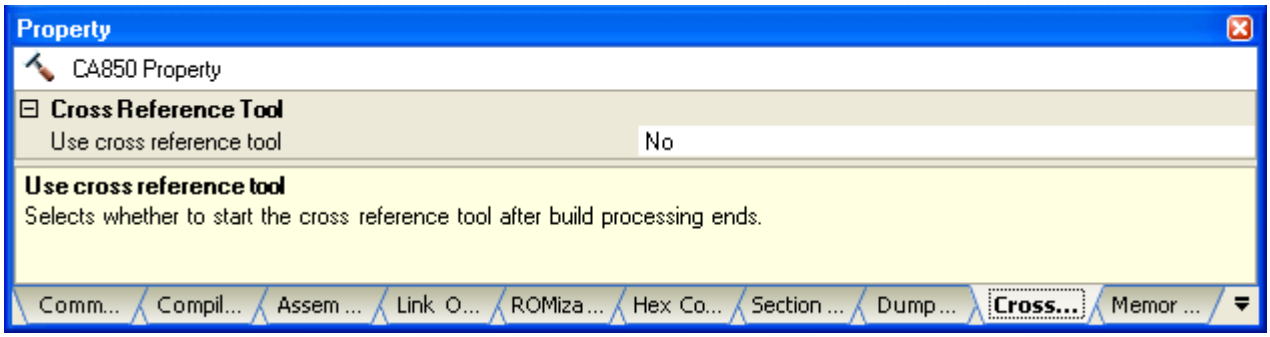
(2) Set options in CubeSuite+

This section describes how to set cross reference options from CubeSuite+.

On CubeSuite+'s Project Tree panel, select the Build Tool node. Next, select the [View] menu -> [Property]. The Property panel opens. Next, select the [Cross Reference Options] tab.

You can set the various cross reference options by setting the necessary properties in this tab.

Figure B-46. Property Panel: [Cross Reference Option] Tab



B.10.3 Option

This section explains cross reference options.

The types and explanations for cross reference options are shown below.

Table B-24. Cross Reference Options

Classification	Option	Description
Common options	-V	Outputs the version information of the cross reference tool to the standard error output.
	-all	Outputs all information to a text-format file and CSV-format file.
	-cpp850	Processes the C source file after it is passed through the ca850 (preprocessor).
	-d	Specifies the identifier that is handled as a type name and the name of the file that the identifier is described.
	-file	Specifies the file in which the information is described.
	-h	Outputs option descriptions.
	-help	
	-i	Specifies the identifier that is not to be displayed in the execution results.
	-ni	Does not display include file information. Specifies the file name that is not to be displayed in the execution results.
	-o	Specifies the output file path.
	@	Handles the specified file as a command file.
Cross reference	-x	Outputs the cross reference in text-format to the specified file.
	-xstd	Outputs the cross reference to the standard output.
Tag information	-t	Outputs the tag information in text-format to the specified file.
	-tstd	Outputs tag information to the standard output.

Classification	Option	Description
Call tree	-c	Outputs the call tree in text-format to the specified file.
	-cc	Outputs the call tree in CSV-format to the specified file.
	-call	Outputs the call tree in text-format and CSV-format to the specified file.
	-ce	Specifies the method of omitting output.
	-cf	Specifies the name of the function for which the call tree is to be output or the text file that the function name is described.
	-cl	Specifies the output level.
	-cp	Includes the arguments and return value in the output.
	-cr	Includes reference information in the output.
	-cs	Includes the source file name and description starting line in the output.
	-cstd	Outputs the text-format call tree to the standard output.
	-ct	Outputs only the first tree.
Function metrics	-m	Outputs the function metrics in text-format to the specified file.
	-mc	Outputs the function metrics in CSV-format to the specified file.
	-mall	Outputs the function metrics in text-format and CSV-format to the specified file.
	-ms	Specifies the output order.
	-mstd	Outputs the text-format function metrics to the standard output.
Call database	-b	Outputs the call database in text-format to the specified file.
	-bc	Outputs the call database in CSV-format to the specified file.
	-ball	Outputs the call database in text-format and CSV-format to the specified file.
	-mstd	Outputs the text-format call database to the standard output.

Common options

The common options of the cross reference tool are as follows.

- -V
- -all
- -cpp850
- -d
- -file
- -h/-help
- -i
- -ni
- -o
- @

-V

[Description format]

```
-V
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs the version number of the cross reference tool and then terminates processing.

[Example of use]

- To output the version number of the cross reference tool, describe as:

```
C:\>cxref -V
```

-all

[Description format]

```
-all
```

- Interpretation when omitted
  Cross reference is output to the standard output.

[Function Description]

- This option outputs all information to a text-format file and CSV-format file.
- This option has the same result as when "-x -t -c -cc -m -mc -b -bc" is specified.

[Example of use]

- To output all information to a text-format file and CSV-format file, describe as:

```
C:\>cxref -all main.c
```

-cpp850

[Description format]

```
-cpp850
```

- Interpretation when omitted
  The ca850 (preprocessor) is not executed.

[Function Description]

- This option processes the C source file after it is passed through the ca850 (preprocessor).
- This option and all subsequent options are passed as the ca850 options. Therefore, this option must be specified as the last cross reference option.
- Setting the -c option that works to include comments of the source programs with the preprocessor is recommended so that line numbers are output correctly.

[Example of use]

- To process the C source file after it is passed through the ca850 (preprocessor), describe as:

```
C:\>cxref -cpp850 main.c
```

-d

[Description format]

```
-dident
-d=file
```

- Interpretation when omitted
  None

[Function Description]

- This option specifies identifier *ident* that is handled as a type name.
- Specify file *file* that the identifier handled as a type name is described.

[Example of use]

- To handle identifier U16 as a type name, describe as:

```
C:\>cxref -dU16 main.c
```

-file

[Description format]

```
-file=file
```

- Interpretation when omitted
  None

[Function Description]

- This option specifies file *file* in which the following information is described.
  - File name that is not to be displayed in execution results
  - Identifier name that is not to be displayed in execution results
  - Identifier name that is to be handled as a type name
- If -file=*file* and -ni are specified at the same time, the contents of "NoIncludeFile" in *file* of the previously specified -file=*file* are invalid.
- File format specified in the -ni/-i/-d/-file options
  The -ni/-i/-d options read the corresponding section information, and the -file option reads all the section information.
  The three sections below can be described.
  - NoIncludeFile section
  - IgnoreIdent section
  - DefinitionType section

  If the line begins with //, the line is interpreted as a comment.

(1) NoIncludeFile section

This section specifies information that is not displayed as an analysis result in file units. Describe mainly include files.
The file name described here has the same effect as when specified following the -ni option.
Describe one file name on one line.
Wildcard characters can be used.

```
[NoIncludeFile]
// All the * .h files
*.h
// Common definition file
common.def
```

(2) IgnoreIdent section

This section specifies information that is not displayed as an analysis result in identifier units.
The file name described here has the same effect as when specified following the -i option.
Describe one identifier on one line.

```
[IgnoreIdent]
// Common area temporarily used in each process
tmp
buf
work
```

(3) DefinitionType section

This section specifies an identifier that is handled as a type name.
The file name described here has the same effect as when specified following the -d option.
Describe one identifier on one line.

```
[DefinitionType]
// 1-byte type
BYTE
UBYTE
// 2-byte type
WORD
UWORD
```

[Example of use]

- Information of the file name and identifier that is specified in the file (noresult) is not displayed as an analysis result.
  The identifier specified in "noresult" is handled as a type name.

```
C:\>cxref -file=noresult main.c
```

-h/-help

[Description format]

```
-h
-help
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs the description of the options and then terminates processing.

[Example of use]

- To output the description of the cross reference options and then terminates processing, describe as:

```
C:\>cxref -help
```

-i

[Description format]

```
-iident
```

- Interpretation when omitted
  None

[Function Description]

- This option specifies the identifier that is not to be displayed in the execution results.

[Example of use]

- Not to display the identifier (data) in the execution results, describe as:

```
C:\>cxref -idata main.c
```

-ni

[Description format]

```
-ni
-nifile
-ni=file
```

- Interpretation when omitted
  None

[Function Description]

- In the case of -ni, this option does not display include file information.
- In the case of -ni*file*, this option specifies file name *file* that is not to be displayed in the execution results.
  The following wildcard characters can be used in *file*.

?	One arbitrary character
*	Arbitrary character sequences of zero or more characters

- In the case of -ni=*file*, this option specifies file *file* in which file names that are not to be displayed in the execution results are described.

[Example of use]

- Not to display include file information, describe as:

```
C:\>cxref -ni main.c
```

- Not to display information for files whose name includes an "r", describe as:

```
C:\>cxref -ni*r* main.c
```

- Not to display information for files whose name includes an "e", followed by at least two characters, describe as:

```
C:\>cxref -ni*e??* main.c
```

- Not to display information for files whose name starts with "w", contain at least two characters, describe as:

```
C:\>cxref -niw?*.h main.c
```

- Not to display information of the file name that is described in the file (noresult), describe as:

```
C:\>cxref -ni=noresult main.c
```

-o

[Description format]

```
-o path
```

- Interpretation when omitted
  The file is output to the current path.

[Function Description]

- This option specifies *path* as the output file path.

[Example of use]

- To output the file to folder D:\sample, describe as:

```
C:\>cxref -o D:\sample main.c
```

@

[Description format]

```
@cfile
```

- Interpretation when omitted
  Command files are assumed not to exist.

[Function Description]

- This option handles *cfile* as a command file.
- Instead of specifying options and file names for commands as command-line arguments, they can be specified in a command file.
- On Windows, the length of a character string specified as options for commands is limited. If many options are set and some of the options cannot be recognized, create a command file and specify this option.
- See "(2) Command file" for details about a command file.

[Example of use]

- To handle "command" as a command file, describe as:

```
C:\>cxref @command
```

Cross reference

The cross reference options are as follows.

- -x
- -xstd

-x

[Description format]

```
-x[=file]
```

- Interpretation when omitted
  Cross reference is output to the standard output.

[Function Description]

- This option outputs the cross reference in text-format to the specified file.
- If =*file* is omitted, the file name is "cxref".

[Example of use]

- To output the cross reference in text-format to the file (cxfile), describe as:

```
C:\>cxref -x=cxfile main.c
```

-xstd

[Description format]

```
-xstd
```

- Interpretation when omitted
  -xstd

[Function Description]

- This option outputs the cross reference to the standard output (default).

[Example of use]

- To output the cross reference to the standard output, describe as:

```
C:\>cxref -xstd main.c
```

Tag information

The options for tag information are as follows.

- -t
- -tstd

-t

[Description format]

```
-t[=file]
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs the tag information in text-format to the specified file *file*.
- If =*file* is omitted, the file name is "ctags".

[Example of use]

- To output the tag information in text-format to the file (tagfile), describe as:

```
C:\>cxref -t=tagfile main.c
```

-tstd

[Description format]

```
-tstd
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs tag information to the standard output.

[Example of use]

- To output tag information to the standard output, describe as:

```
C:\>cxref -tstd main.c
```

Call tree

The options for the call tree are as follows.

- -c
- -cc
- -call
- -ce
- -cf
- -cl
- -cp
- -cr
- -cs
- -cstd
- -ct

-c

[Description format]

```
-c[=file]
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs the call tree in text-format to the specified file *file*.
- If =*file* is omitted, the file name is "ccalltre.lst".

[Example of use]

- To output the call tree in text-format to the file (callfile.lst), describe as:

```
C:\>cxref -c=callfile.lst main.c
```

-cc

[Description format]

```
-cc[=file]
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs the call tree in CSV-format to the specified file *file*.
- If =*file* is omitted, the file name is "ccalltre.csv".

[Example of use]

- To output the call tree in CSV-format to the file (callfile.csv), describe as:

```
C:\>cxref -cc=callfile.csv main.c
```

-call

[Description format]

```
-call[=file]
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs the call tree in text-format and CSV-format to the specified file.
- The file names are *file*.lst and *file*.csv.
- If an extension is appended to *file*, that extension is ignored.
- If =*file* is omitted, the file names are "ccalltre.lst" and "ccalltre.csv".

[Example of use]

- To output the call tree in text-format and CSV-format to the file (callfile.lst and callfile.csv), describe as:

```
C:\>cxref -call=callfile main.c
```

-ce

[Description format]

```
-ce[num]
```

- Interpretation when omitted
  -ce3

[Function Description]

- This option specifies the method of omitting output.
- Any of the following numbers can be specified as *num*.

1	Output all information
2	Omit output for call trees at the same level
3	Omit output once the information has been output

[Example of use]

- To omit output for call trees at the same level, describe as:

```
C:\>cxref -call -ce2 main.c
```

-cf

[Description format]

```
-cfstring
-cf=file
```

- Interpretation when omitted
  None

[Function Description]

- This option specifies for *string* the name of the function for which the call tree is to be output.
- This option specifies text file *file* that the name of the function for which the call tree is to be output is described.

[Example of use]

- To specify for "func the name of the function for which the call tree is to be output, describe as:

```
C:\>cxref -call -cffunc main.c
```

-cl

[Description format]

```
-cl[num]
```

- Interpretation when omitted
  -cl255

[Function Description]

- This option specifies the output level.1to 255 can be specified as *num*.

[Example of use]

- To specify the output level, describe as:

```
C:\>cxref -call -cl128 main.c
```

-cp

[Description format]

```
-cp
```

- Interpretation when omitted
  None

[Function Description]

- This option includes the arguments and return value in the output.

[Example of use]

- To include the arguments and return value in the output, describe as:

```
C:\>cxref -call -cp main.c
```

-cr

[Description format]

```
-cr
```

- Interpretation when omitted
  None

[Function Description]

- This option includes reference information in the output.

[Example of use]

- To include reference information in the output, describe as:

```
C:\>cxref -call -cr main.c
```

-cs

[Description format]

```
-cs
```

- Interpretation when omitted
  None

[Function Description]

- This option includes the source file name and description starting line in the output.

[Example of use]

- To include the source file name and description starting line in the output, describe as:

```
C:\>cxref -call -cs main.c
```

-cstd

[Description format]

```
-cstd
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs the text-format call tree to the standard output.

[Example of use]

- To output the text-format call tree to the standard output, describe as:

```
C:\>cxref -cstd main.c
```

-ct

[Description format]

```
-ct
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs only the first tree.

[Example of use]

- To output only the first tree, describe as:

```
C:\>cxref -call -ct main.c
```

Function metrics

The options for the function metrics are as follows.

- -m
- -mc
- -mall
- -ms
- -mstd

-m

[Description format]

```
-m[=file]
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs the function metrics in text-format to the specified file *file*.
- If =*file* is omitted, the file name is "cmeasure.lst".

[Example of use]

- To output the function metrics in text-format to the file (measurefile.lst), describe as:

```
C:\>cxref -m=measurefile.lst main.c
```

-mc

[Description format]

```
-mc[=file]
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs the function metrics in CSV-format to the specified file *file*.
- If =*file* is omitted, the file name is "cmeasure.csv".

[Example of use]

- To output the function metrics in CSV-format to the file (measurefile.csv), describe as:

```
C:\>cxref -mc=measurefile.csv main.c
```

-mall

[Description format]

```
-mall[=file]
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs the function metrics in text-format and CSV-format to the specified file.
- The file names are *file*.lst and *file*.csv.
- If an extension is appended to *file*, that extension is ignored.
- If =*file* is omitted, the file names are "cmeasure.lst" and "cmeasure.csv".

[Example of use]

- To output the function metrics in text-format and CSV-format to the file (measurefile.lst and measurefile.csv), describe as:

```
C:\>cxref -mall=measurefile main.c
```

-ms

[Description format]

```
-ms[+|-]num
```

- Interpretation when omitted
  The information is output without sorting, in the order that the functions appeared.

[Function Description]

- This option specifies the output order.Any of the following numbers can be specified as *num*.

1	Output the information sorted in alphabetical order of the function names.
2	Output the information sorted in alphabetical order of the file names and function names.
3	Output the information without sorting.

- If "+" is specified, the information is output in ascending order. If "-" is specified, the information is output in descending order. By default, the information is output in descending order.

[Example of use]

- To output the information sorted in descending order of the function names, describe as:

```
C:\>cxref -ms1 main.c
```

-mstd

[Description format]

```
-mstd
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs the text-format function metrics to the standard output.

[Example of use]

- To output the text-format function metrics to the standard output, describe as:

```
C:\>cxref -mstd main.c
```

Call database

The options for the call database are as follows.

- -b
- -bc
- -ball
- -bstd

-b

[Description format]

```
-b[=file]
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs the call database in text-format to the specified file *file*.
- If =*file* is omitted, the file name is "cprofile.dat".

[Example of use]

- To output the call database in text-format to the file (calldbfile.dat), describe as:

```
C:\>cxref -b=calldbfile.dat main.c
```

-bc

[Description format]

```
-bc[=file]
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs the call database in CSV-format to the specified file *file*.
- If =*file* is omitted, the file name is "cprofile.csv".

[Example of use]

- To output the call database in CSV-format to the file (calldbfile.csv), describe as:

```
C:\>cxref -bc=calldbfile.csv main.c
```

-ball

[Description format]

```
-ball[=file]
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs the call database in text-format and CSV-format to the specified file.
- The file names are *file*.dat and *file*.csv.
- If an extension is appended to *file*, that extension is ignored.
- If =*file* is omitted, the file name is "cprofile.dat" and "cprofile.csv".

[Example of use]

- To output the call database in text-format and CSV-format to the file (calldbfile.dat and calldbfile.csv), describe as:

```
C:\>cxref -ball=calldbfile main.c
```

-bstd

[Description format]

```
-bstd
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs the text-format call database to the standard output.

[Example of use]

- To output the text-format call database to the standard output, describe as:

```
C:\>cxref -bstd main.c
```

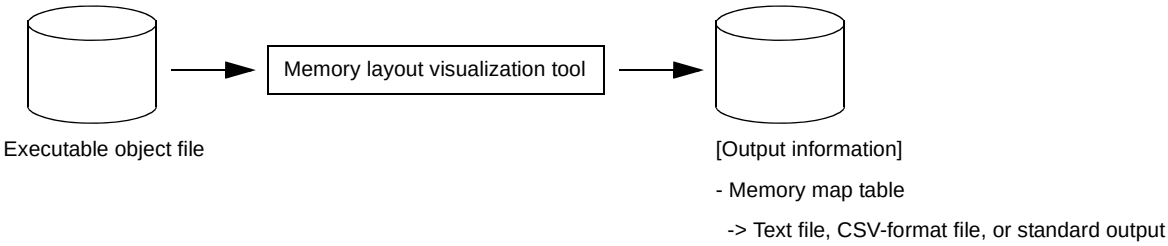
B.11 Memory Layout Visualization Tool

The memory layout visualization tool is a utility that reads the memory map information of variables from the created load module file for display.

In the CA850, "rammap" is the memory layout visualization tool.

The memory layout visualization tool outputs the memory map information of variables to a text-format file and CSV-format file.

Figure B-47. Operation Flow of Memory Layout Visualization Tool



B.11.1 Input/Output

(1) Input file

The input file of the memory layout visualization tool is an executable object file[Note] (.out file) output by the ld850.

Note Does not include a re-linkable object file or a file (.out file) output by the romp850.

(2) Output information

The information that is output by memory layout visualization tool is a memory map that shows the variable names, sizes, and memory layout.

(a) Memory map table

The memory layout visualization tool outputs a memory map that shows the variable names, sizes, and memory layout.

See "3.8 Memory Layout Visualization Tool" for details about this information.

B.11.2 Method for manipulating

This section explains how to manipulate the memory layout visualization tool.

(1) Command input method

Enter the following from the command prompt.

```
C:\>rammap [option][file-name]
      [ ]:     Can be omitted
```

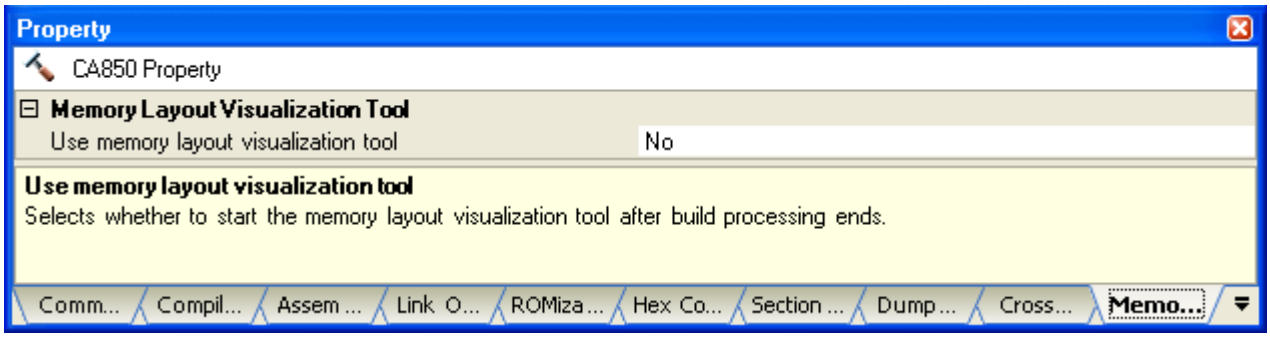
(2) Set options in CubeSuite+

This section describes how to set memory layout visualization options from CubeSuite+.

On CubeSuite+'s Project Tree panel, select the Build Tool node. Next, select the [View] menu -> [Property]. The Property panel opens. Next, select the [Memory Layout Visualization Options] tab.

You can set the various memory layout visualization options by setting the necessary properties in this tab.

Figure B-48. Property Panel: [Memory Layout Visualization Options] Tab



B.11.3 Option

This section explains memory layout visualization options.

The types and explanations for memory layout visualization options are shown below.

Table B-25. Memory Layout Visualization Options

Classification	Option	Description
Memory layout visualization tool	-V	Outputs the version number of the memory layout visualization tool to the standard output.
	-all	Outputs all information to a text-format file and CSV-format file.
	-h	Outputs option descriptions.
	-help	
	-m	Outputs the memory map table in text-format to the specified file.
	-mall	Outputs the memory map table in text-format and CSV-format to the specified file.
	-mc	Outputs the memory map table in CSV-format to the specified file.
	-mr	Specifies the range for outputting the memory map table.
	-mstd	Outputs the text-format memory map table to the standard output.
	-o	Specifies the output file path.
	@	Handles the specified file as a command file.

Memory layout visualization tool

The memory layout visualization options are as follows.

- -V
- -all
- -h/-help
- -m
- -mall
- -mc
- -mr
- -mstd
- -o
- @

-V

[Description format]

```
-V
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs the version number of the memory layout visualization tool and then terminates processing.

[Example of use]

- To output the version number of the memory layout visualization tool, describe as:

```
C:\>rammap -V
```

-all

[Description format]

```
-all
```

- Interpretation when omitted
  The text-format memory map table is output to the standard output.

[Function Description]

- This option outputs all information to a text-format file and CSV-format file.
- This option has the same result as when "-mall" is specified.

[Example of use]

- To output all information to a text-format file and CSV-format file, describe as:

```
C:\>rammap -all a.out
```

-h/-help

[Description format]

```
-h
-help
```

- Interpretation when omitted
  None

[Function Description]

- This option outputs the description of the options and then terminates processing.

[Example of use]

- To output option descriptions of the memory layout visualization tool, describe as:

```
C:\>rammap -help
```

-m

[Description format]

```
-m[=file]
```

- Interpretation when omitted

  -m

[Function Description]

- This option outputs the memory map table in text-format to the specified file *file*.
- If =*file* is omitted, the file name is "rammap.txt".

[Example of use]

- To output the memory map table in text-format to the file (memmapfile.txt), describe as:

```
C:\>rammap -m=memmapfile.txt a.out
```

-mall

[Description format]

```
-mall[=file]
```

- Interpretation when omitted
  The text-format memory map table is output to the standard output.

[Function Description]

- This option outputs the memory map table in text-format and CSV-format to the specified file.
- The file names are *file*.txt and *file*.csv.
- If an extension is appended to *file*, that extension is ignored.
- If =*file* is omitted, the file name is "rammap.txt" and "rammap.csv".

[Example of use]

- To output the memory map table in text-format and CSV-format to the file (memmapfile.txt and memmapfile.csv), describe as:

```
C:\>rammap -mall=memmapfile a.out
```

-mc

[Description format]

```
-mc[=file]
```

- Interpretation when omitted
  The text-format memory map table is output to the standard output.

[Function Description]

- This option outputs the memory map table in CSV-format to the specified file *file*.
- If =*file* is omitted, the file name is "rammap.csv".

[Example of use]

- To output the memory map table in CSV-format to the file (memmapfile.csv), describe as:

```
C:\>rammap -mc=memmapfile.csv a.out
```

-mr

[Description format]

-mr*range*

- Interpretation when omitted
  All ranges within the object are targeted for the memory map table.

[Function Description]

- This option specifies the range for outputting the memory map table.
- Do not enter a blank space between "-mr" and *range*.
- Octal, decimal, or hexadecimal numbers can be specified for the addresses.

Octal specification format	-mr0200000-0400000
Decimal specification format	-mr65536-131072
Hexadecimal specification format	-mr0x10000-0x20000

- Multiple ranges can be specified.
- To specify multiple ranges, either specify multiple -mr options or separate each of the ranges with commas.
- When specified ranges overlap, they are handled as follows.

Examples 1. This case is handled as one in which the two ranges a to b and c to d are specified.

a ---------- b c ---------- d

2. This case is handled as one in which the one range a to d is specified.

a ---------- b
c ---------- d

3. This case is handled as one in which the one range a to d is specified.

a ---------- b
c ---------- d

4. This case is handled as one in which the one range a to b is specified.

a ---------- b
c ---------- d

Cautions 1. **The actual address range is aligned at 16 bytes.**
For the start address, the specified value is rounded to 16 bytes (logical AND with 0xfffffff0).
For the end address, the specified value is rounded to 16 bytes and added to 0xF.

-mr0x10000-0x20000	0x10000 to 0x2000f

-mr0x10004-	0x10000 to 0xffffffff
-mr-0x20005	0x0 to 0x2000f

2. If the range specification is illegal, an error message is output, and processing is interrupted.

[Example of use]

- To specify 0x10000 to 0x20000 as the range for outputting the memory map table, describe as:

```
C:\>rammap a.out -mr0x10000-0x20000
```

- To specify 0x10000 as the start address for outputting the memory map table, describe as the following. In this case, the end address is 0xffffffff.

```
C:\>rammap a.out -mr0x10000-
```

- To specify 0x20000 as the end address for outputting the memory map table, describe as the following. In this case, the start address is 0x0.

```
C:\>rammap a.out -mr-0x20000
```

- To specify 0x10000 to 0x20000 and 0x30000 to 0x40000 as the range for outputting the memory map table, describe as:

```
C:\>rammap a.out -mr0x10000-0x20000 -mr0x30000-0x40000
```

or

```
C:\>rammap a.out -mr0x10000-0x20000,0x30000-0x40000
```

-mstd

[Description format]

```
-mstd
```

- Interpretation when omitted
  -mstd

[Function Description]

- This option outputs the text-format memory map table to the standard output.

[Example of use]

- To output the text-format memory map table to the standard output, describe as:

```
C:\>rammap -mstd a.out
```

-o

[Description format]

```
-o path
```

- Interpretation when omitted
  The file is output to the current path.

[Function Description]

- This option specifies *path* as the output file path.

[Example of use]

- To output the file to folder D:\sample, describe as:

```
C:\>rammap -mc -o D:\sample a.out
```

@

[Description format]

```
@cfile
```

- Interpretation when omitted
  Command files are assumed not to exist.

[Function Description]

- This option handles *cfile* as a command file.
- Instead of specifying options and file names for commands as command-line arguments, they can be specified in a command file.
- On Windows, the length of a character string specified as options for commands is limited. If many options are set and some of the options cannot be recognized, create a command file and specify this option.
- See "(2) Command file" for details about a command file.

[Example of use]

- To handle "command" as a command file, describe as:

```
C:\>rammap @command
```

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