RX Compiler CC-RX V2.06.00

Release Notes

R20UT3943EJ0100
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Contents

Chapter 1. Changes

This section describes changes on CC-RX from V2.05.00 to V2.06.00.
The features indicated as [Professional edition] can only be used if the compiler is registered under the professional license.

1.1 Improvements to the feature for checking source code against MISRA-C:2012 rules [Professional edition]

The following rule numbers have been added to the arguments for -misra2012 option, which allows the compiler to check the source code against MISRA-C:2012 rules.

2.2、3.2、5.1、5.6、5.7、5.8、5.9、8.3、8.9、8.14、9.1、9.4、9.5、12.2、17.6、18.7
21.1、21.2、21.3、21.4、21.5、21.6、21.7、21.8、21.9、21.10、21.11、21.12

1.2 Change to the specifications of the –map and -list linkage options

When the –map option is specified, the specification has been changed so that errors are suppressed to the extent that it is possible when the external variable allocation information file is output, even if the section address exceeds the available range of addresses. In addition, if the –list option is specified at the same time as the –map option, symbol information is output to a linkage map file.

When the -map option is specified to enable optimization of access to external variables, once linkage has proceeded and the external variable allocation information file has been generated, the process from compilation to linkage is repeated with that file used for reference to generate efficient code for access to external variables relative to the base address.

In the previous versions, if an error occurred during the first round of linkage and an external symbol allocation information file was provisionally generated, optimization of access to external variables was possible. Thus, even in cases where a second round of linkage should have been successful, exit from building proceeded during the first round of linkage so that no external symbol allocation information file was generated. With this change to the specification, access to external variables will still be optimized and exit from building will not proceed even in such cases.

This improvement is also effective to optimization of a linker (non-reference symbol elimination).

1.3 Change to the specification of the -subcommand linkage option

The –subcommand option has now been made specifiable in subcommand files.

1.4 Method of authenticating licenses

The way licenses are authenticated has been changed.

In response to the change in the authentication method, you will need to install V2.00.00 or a later version of the license manager. If you have not done so and attempt building by using V2.06.00 or a later version of CC-RX, CC-RX will generate the warning messages shown below and operate as the evaluation edition.

W0511183:License manager is not installed
W0561014:License manager is not installed

1.5 Enhanced optimization

For V2.06.00, optimization has been further enhanced on points (a) to (c), listed and described below.

(a) Deleting redundant sign extensions

The output of code has been improved so that redundant sign-extension instructions are not generated.

```
< source code >
short func(short a) {
  return (a < 5) ? a : 5;
}
```

```
< V2.05.00 generate code >
_func:
    CMP #05H, R1
    MOV.L #00000005H, R14
    BGE L12
L11:
    MOV.W R1, R14
L12:
    MOV.W R14, R1
    RTS
```

```
< V2.06.00 generate code >
_func:
    CMP #05H, R1
    BLT L12
L11:
    MOV.L #00000005H, R1
L12:
    RTS
```

(b) Using the max and min instructions

Code generated from the max and min instructions is improved in many cases.

```
< source code>
short func(short *in){
  int   i;
  short max;

  max = *in++;
  for (i = 1 ; i < 8 ; i++ ){
    if (max < *in) {
      max = *in;
    }
    in++;
  }
  return  max;
}
```

```
< V2.05.00 generate code >
_func:
    MOV.W [R1+], R14
    MOV.L #00000007H, R15
L11:
    MOV.W [R1], R5
    MOV.W R14, R4
    CMP R5, R4
    BLT L13
L12:
    MOV.L R14, R5
L13:
    ADD #02H, R1
    SUB #01H, R15
    MOV.L R5, R14
    BNE L11
L14:
    MOV.W R5, R1
    RTS
```

```
<V2.06.00 generate code >
_func:
    MOV.W [R1+], R14
    MOV.L #00000007H, R15
L11:
    MOV.W R14, R14
    MAX [R1].W, R14
    ADD #02H, R1
    SUB #01H, R15
    BNE L11
L12:
    MOV.L R14, R1
    RTS
```

(c) Using string manipulation instructions

Output code is in many cases improved in terms of the use of the SMOVF and SUNTIL string manipulation instructions.

```
< source code >
// The -lang=c99 option is required to compile this source program
void* func(void* restrict dest, const void* restrict src, unsigned short len) {
  unsigned short i;
  unsigned char* restrict d = dest;
  const unsigned char* restrict s = src;
  for (i = 0; i < len; i++) {
    d[i] = s[i];
  }
  return d;
}
```

```
< V2.05.00 generate code >
_func:
    MOV.L #00000000H, R14
    MOV.L R1, R15
L11:
    CMP R3, R14
    BEQ L13
L12:
    MOVU.B [R2+], R5
    ADD #01H, R14
    MOV.B R5, [R15+]
    BRA L11
L13:
    RTS
```

```
<V2.06.00 generate code >
_func:
    MOV.L R1, R14
    SMOVF
    MOV.L R14, R1
    RTS
```

1.6 Other improvements

Other major improvements are described below.

(a) Output of bit manipulation instructions

In CC-RX V2.05.00 or earlier versions, the compiler automatically determined the output of bit manipulation instructions from the level of optimization and the statements in source code. In V2.06.00, users can control the output. For details on the conditions for output, refer to the user's manual.

(b) Points for caution on the following items no longer apply.

- Programs which Include Loops that should be Iterated More than Once (No. 39)
- Passing an Argument of a Function by Using the Stack (No. 40)
- Updating of Values of Array Elements, Structure Members, or Union Members Not being Reflected (No.41)
- The Loop that has the Operation Expression of which Result is Decremented by One (No.42)

(c) Fixing the problem regarding the targets of -noconst_copy

The problem of constants not being propagated to the initial values of the local variable when the noconst_copy option is specified has been fixed.

(d) Elimination of an internal error

The problem of an internal error occurring during building has been eliminated.

Chapter 2. Points for Caution

This section describes points for caution regarding CC-RX.

2.1 Note on a case of the W052304 message [C/C++ Compiler]

When the int_to_short option is specified and a file including a C standard header is compiled as C++ or EC++, the compiler may show the W052304 message. In this case, simply ignore the message because there are no problems.

[NOTE]

In compilation of C++ or EC++, the int_to_short option will be invalid.

Data that are shared between C and C++ (EC++) program must be declared as the long or short type rather than as the int type.

2.2 Note on using MVTC or POPC instructions [Assembler]

In the assembly language, the program counter (PC) cannot be specified for MVTC or POPC instructions.

2.3 Note on the delete option for linkage [Optimizing linkage editor]

When a function symbol is removed by the delete option, its following function in the source program is not allowed to have a breakpoint at its function name on the editor in your debugging. If you would like to set a breakpoint via the Label window at the function entrance, set the breakpoint via the Label window or at the program code of the function.

Chapter 3. Restrictions

This chapter describes restrictions on CC-RX.

3.1 Restriction on usage of math.h functions (frexp, ldex, scalbn and remquo) in C++ language (including EC++)

An object is generated which will be an infinit-loop at execution when the actual argument of some function (frexp, ldexp, scalbn or remquo) of math.h is int-type, at compiling C++ or EC++ program.

Conditions:

This problem occurs when both (1) and (2) are satisfied.

(1) This program is in C++ or the lang=cpp option is effective.

(2) math.h is included and any of the following functions is called.

(a) frexp(double, long*) with 'int *' type second argument (except when the first argument is float-type and the dbl_size=8 option is effective).

(b) ldexp(double, long) with 'int *' type second argument (except when the first argument is float-type and the dbl_size=8 option is effective).

(c) scalbn(double, long) with 'int *' type second argument (except when the first argument is float-type and the dbl_size=8 option is effective).

(d) remquo(double, double, long*) with 'int *' type third argument (except when the both the first and second arguments are float-type and the dbl_size=8 option is effective).

Examples:

file.cpp:

```
// Example of compiling C++ source that generates an infinity-loop
#include <math.h>
double d1,d2;
int i;
void func(void)
{
   d2 = frexp(d1, &i);
}
```

Command Line:

```
ccrx -cpu=rx600 -output=src file.cpp
```

file.src: Example of the generated assembly program

```
_func:
   ; ...(Omitted)
    ; Calling substitute function of frexp
   BSR __$frexp__tm__2_f__FZ1ZPi_Q2_21_Real_type__tm__4_Z1Z5_Type
   ; ...(Omitted)

__$frexp__tm__2_f__FZ1ZPi_Q2_21_Real_type__tm__4_Z1Z5_Type:
L11:
   BRA L11 ; Calls itself ==> infinity-loop
```

Countermeasures:

Select one of the following ways to avoid the problem.

(1) Compile the program with the lang=c or lang=c99 option.

(2) Change int or int * into long or long *.

(3) Append the following declarations to each function that is being used.

```
/* For the frexp function */
static inline double frexp(double x, int *y)
{ long v = *y; double d = frexp(x,&v); *y = v; return (d); }
/* For the ldexp function */
static inline double ldexp(double x, int y)
{ long v = y; double d = ldexp(x,v); return (d); }
/* For the scalbn function */
static inline double scalbn(double x, int y)
{ long v = y; double d = scalbn(x,v); return (d); }
/* For the remquo function */
static inline double remquo(double x, double y, int *z)
{ long v = *z; double d = remquo(x,y,&v); *z = v; return (d); }
```

Example of (2):

Change in file.cpp:

```
#include <math.h>
double d1,d2;
int i;
void func(void)
{
  long x = i; /* Accept as long type temporary */
  d2 = frexp(d1, &x); /* Call with long type argument */
  i = x; /* Set the result for variable 'i' */
}
```

Example of (3):

Change in file.cpp:

```
#include <math.h>
/* Append declaration */
static inline double frexp(double x, int *y)
{ long v = *y; double d = frexp(x,&v); *y = v; return (d); }
double d1,d2;
int i;
void func(void)
{
  d2 = frexp(d1, &i);
}
```

3.2 Restriction of PIC/PID function (pic and pid options)

When a standard library is created by the library generator (lbgrx) with the pic or pid option specified, the following warning may appear once or more.

```
W0591301:"-pic" option ignored (When the pic option has been specified)
W0591301:"-pid" option ignored (When the pid option has been specified)
```

Despite the warning, the created standard library has no problems.

3.3 Eliminated options (for the C/C++ compiler)

(a) -file_inline, -file_inline_path

Specifying these options has no effect and the compiler will output a warning. Instead of **-file_inline** or **-file_inline_path**, write **#include** in the source code.

(b) -enable_register

This option is simply ignored and does not affect the generated code.

3.4 Notes on C/C++ source-level debugging (for the C/C++ compiler)

(1) Even when **-debug** is specified, you may not be able to set a breakpoint or stop stepped execution on lines that

contain a dynamic initialization expression for a global variable (in C++),

are the first lines of functions that begin with a loop statement (e.g. **do** or **while**) and do not have an **auto** variable or of functions for which **#pragma inline_asm** has been specified, or

contain the control section and body of a loop statement (e.g. **for**, **while**, or **do**) written as a single line.

(2) The values of members of union type and of dummy variables that are to be passed via registers may be displayed incorrectly (e.g. in the [Watch] window).

3.5 Note on using sections that include the address 0xffffffff (in assembler)

If two or more **.section** directives in the assembly source code contain **.org** directives, the sections have the same name, and the sections overlap at 0xffffffff, the assembler outputs an internal error message (C0554098).

Example)

```
.section SS,ROMDATA
.org 0fffffffeh
.byte 1
.byte 2 ; 0xffffffff
.section SS,ROMDATA
.org 0ffffffffh
.byte 3; ; 0xffffffff
.end
```

3.6 Note on using **-form** and **-output** at the same time (in the linkage editor)

When **-form=rel** and **-output=<filename>** are specified for the linkage editor (**rlink**) at the same time, the filename extension given as **<filename>** is ignored and replaced with **.rel**.

Example)

```
rlink -form=relocate -output=DefaultBuild\lib_test.lib
```

The filename specified for output, **test.lib**, is changed to **test.rel**.

3.7 Note on using function names that begin with _**builtin** (for the C/C++ compiler)

Declaration of a function with a name that begins with _**builtin** and for which the definition is in **machine.h** in the **include** directory may lead to an internal error. In general, do not use any names that begin with an underscore (_) in your source code, since such names are reserved.

3.8 Note on using #**pragma interrupt** with functions for which **save_acc** is enabled and that have dummy arguments (for the C/C++ compiler)

When **#pragma interrupt** is specified for a function and the **save_acc** flag is enabled (including where this is done by using the **-save_acc** compiler option), the compiler may not output code that reflects the correct values of dummy arguments which are passed via R4.Note: In general, we do not recommend defining arguments for functions with the **#pragma interrupt** specification.

Chapter 4. Standard Libraries Included

This chapter describes restrictions on standard libraries included in RX Family C/C++ Compiler.

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This compiler package includes four library files (*.lib) for the RX600. You can use any of the library files if they correspond to the options that you wish to specify. Using these files shortens the time required for building.

4.1 Library files

Table 1 shows the standard library files and compiler options.

Note:

The compiler options you specify should be the same as the microcontroller options defined for each of the library files listed in table 1. Otherwise these library files are not usable, so specify your compiler options in the library generator to generate your own library file.

Library File	Purposes	Optimize*2 Options	Microcontroller Options *1 *2		
			-endian	-cpu -rtti -exception -noexception	Others *3
rx600lq.lib	For the RX600 Optimization type:Speed Little endian	-speed -goptimize	-endian=little	-cpu=rx600 -rtti=on -exception	-round=nearest -denormalize=off -dbl_size=4 -unsigned_char -unsigned_bitfield -bit_order=right -unpack -fint_register=0 -branch=24
rx600ls.lib	For the RX600 Optimization type:Size Little endian	-size -goptimize			
rx600bq.lib	For the RX600 Optimization type: Speed Big endian	-speed -goptimize	-endian=big		
rx600bs.lib	For the RX600 Optimization type: Size Big endian	-size -goptimize			

Table 1 Library Files

*Notes:

*1 For details on microcontroller options, please see the “Microcontroller Options” columns of the “(1) Compile Options” of “section B.1.3 Options”, in the Integrated Development Environment User’s Manual:RX Build.

*2 These option selections are same from the each default of them.

4.2 Using the library files

The library files included in the compiler package must be linked in the ways given in sections 4.2.1 and 4.2.2.

4.2.1 Using the library files

When CC-RX has been installed in C:\Program Files\Renesas, the library files are stored in the following location:

```
C:\Program Files\Renesas\RX\V2_6_0\lib
```

(“V2_6_0” indicates the version and revision number of the compiler package.)

4.2.2 Directory specifying a library file in the optimizing linkage editor

Copy the library file(s) included in the package (stored in the location given in section 4.2.1) into a desired directory. Then specify one of the copied library files for the library option and start the linkage processing.

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