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Chapter 1 User's Manuals

Please read the following user's manuals along with this document.

Manual Name	Document Number
CC-RL Compiler	R20UT3123EJ0104

Chapter 2 Changes

This chapter describes changes to V1.04.00 of the CC-RL compiler.

2.1 Changes to V1.04.00 of the CC-RL Compiler

This section describes the changes in CC-RL from V1.03.00 to V1.04.00. Note that the features which are only available to users holding a registered license for the Professional edition are indicated as **[Professional edition]**.

2.1.1 Enhanced optimization

For V1.04.00, optimization has been further enhanced on points (1) to (2), listed and described below.

- (1) Improving output code for long-type multiplication

Code output for long-type multiplication is now slightly more compact.

<Example of source code>

```
long a,b,c;
void func01(void)
{
    c = a * b;
}
```

<Code generated by V1.03.00>

```
_func01:
    push hl
    movw bc, !LOWW(_a)
    pop ax
    push bc
    movw ax, !LOWW(_b)
    movw de, ax
    mulh
    movw !LOWW(_c), ax
    push bc
    pop hl
    movw bc, !LOWW(_a+0x00002)
    movw ax, de
    mulh
    movw de, ax
    pop bc
    push bc
    movw ax, !LOWW(_b+0x00002)
    mulh
    movw bc, ax
    movw ax, hl
    addw ax, de
    addw ax, bc
    movw !LOWW(_c+0x00002), ax
    pop hl
    ret
```

```

<Code generated by V1.04.00>
_func01:
    push hl
    movw bc, !LOWW(_a)
    pop ax
    push bc
    movw ax, !LOWW(_b)
    movw hl, ax                ;
    mulhu
    movw !LOWW(_c), ax
    push bc
    pop de                    ;
    movw bc, !LOWW(_a+0x00002)
    movw ax, hl                ;
    mulh
    movw hl, ax                ;
    pop bc
    push bc
    movw ax, !LOWW(_b+0x00002)
    mulh
    addw ax, hl                ;
    addw ax, de                ;
    movw !LOWW(_c+0x00002), ax
    pop hl
    ret

```

(2) Improved performance for some standard library functions

The performance of functions for character and character string operations has been improved.

2.1.2 Improvements to the feature for checking source code against MISRA-C:2012 rules

[Professional edition]

The following rule numbers have been added to those which can be designated as arguments of the `-misra2012` option, which selects checking by the compiler of source code against the specified MISRA-C:2012 rules.

[Mandatory rules] **9.1**

[Required rules] **2.2 , 3.2 , 5.1 , 5.6 , 5.7 , 5.8 , 8.3 , 12.2**
21.1 , 21.2 , 21.3 , 21.4 , 21.5 , 21.6 , 21.7 , 21.8 , 21.9 , 21.10

[Advisory rules] **5.9 , 8.9**

The following are the numbers of MISRA-C:2012 rules against which the V1.02.00, V1.03.00, and V1.04.00 compilers can check source code for compliance.

<i>Rule classification (number of rules in the standard)</i>	<i>V1.02.00</i>	<i>V1.03.00</i>	<i>V1.04.00</i>
Mandatory rules (10)	3	3	4
Required rules (101)	31	58	76
Advisory rules (32)	7	21	23
Total number of rules (143)	41	82	103

2.1.3 Improved functionality for the .VECTOR directive

Writing the interrupt vector table and interrupt handlers in separate files is now possible.

2.1.4 Extension to the #pragma inline_asm directive

The .public directive can now be included in functions for which the #pragma inline_asm directive is specified. This enables reference to the same external labels by different functions written in assembly language.

Note that the labels for which the .public directive is specifiable are restricted to those which have also been defined in a function for which the #pragma inline_asm directive has been specified.

2.1.5 Change to the specification of the -subcommand linkage option

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

2.1.6 Change to the specifications of the -vinfo and -list linkage options

When the -vinfo option is specified, the specification has been changed so that errors are suppressed to the extent that it is possible when the variable/function 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 -vinfo option, symbol information is output to a linkage map file.

2.1.7 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 V1.04.00 or a later version of CC-RL, CC-RL will generate the warning messages shown below and operate as the evaluation edition.

W0561014 License manager is not installed

W0511183 License manager is not installed.

2.1.8 Rectified points for caution

Points for caution on the following three items no longer apply. For details, refer to Tool News.

- Programs which include loops that should be iterated more than once (CCRL#012)
- Updating of Values of Array Elements, Structure Members, or Union Members Not being Reflected (CCRL#013)
- The loop that has the operation expression of which result is decremented by one (CCRL#014)

2.1.9 Other changes and improvements

Other major changes and improvements are described below.

(a) Restriction on the output of bit manipulation instructions

In versions earlier than V1.04.00, the compiler automatically determined the output of bit manipulation instructions from the level of optimization and the statements in source code. In V1.04.00, users can control the output. For details on the conditions for output, refer to the CC-RL Compiler User's Manual.

(b) Improved prevention of internal errors

A problem with an internal error during building has been corrected.

Chapter 3 Points for Caution

Please refer to the user's manual for caution regarding V1.04.00 of the CC-RL compiler.

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