Add CRC Code

Ver.1.00.00.000. Release Notes

Preface

This tool performs CRC(cyclic redundancy check) on a Motorola S-Type or Intel HEX file generated by Renesas genuine linkage editors[1] and outputs a copy of input file with the CRC code.

This tool works on the following operating systems

Microsoft® Windows® 2000 Professional, Microsoft® Windows® XP
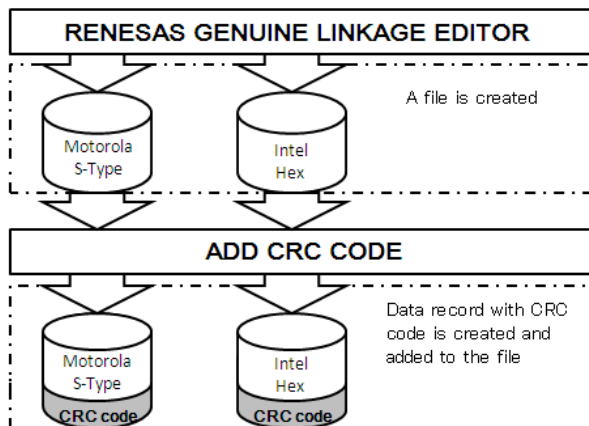
Microsoft® Windows® Vista[2]

Figure 0 Add CRC Code Outline

Notes: *1 Followings are Renesas genuine linkage editors mentioned in the context.

C/C++ Compiler Package for SuperH Family	V.9.02 Release00
C Compiler Package for R32C Series	V.1.01 Release 00
C Compiler Package for M32C Series [M3T-NC308WA]	V.5.41 Release 01
C Compiler Package for M16C Series [M3T-NC30WA]	V.5.43 Release 00
C/C++ Compiler Package for H8SX, H8S, H8 Family	V.6.02 Release00

*2 Microsoft® Windows® is the registered trademark or the trademark of U.S. Microsoft Corporation in the United States and other countries.

The following gives information on the options and error messages of Add CRC Code Ver.1.00.00.000. It also explains how to register this tool to a build phase of High-performance Embedded Workshop.

1. Options

Symbols Used in This Manual:

The following symbols are used in this manual.

< >   …Indicates an item to be specified.

[   ]   …Indicates an item that can be omitted.

…   …Indicates an item that the preceding item can be repeated.

Δ   …Indicates one or more blanks

{ | }   …Indicates that one of the items divided by "|" in "{ }" must be selected.

Format of Command Line:

The format of the command line is as follows.

add_crc_code[{Δ<file name>|Δ<option string>}...]
        <option string>:-<option>=<suboption>

Table 1 is the list of options of this tool. Uppercase letters indicate the abbreviations and characters underlined indicate the defaults.

Table 1   Options

Item	Option	Description
CRC	CRc = <suboption> <suboption> : <address where the result is output> =<target range> [/<polynomial expression>] <address where the result is output> : <address> <target range> : <start address>-<end address>[,...] <polynomial expression> : { CCITT | 16 }	Specifies the following parameters needed to perform CRC (cyclic redundancy check) - an output location of CRC code - target range/s to be calculated - polynomial
Output	OUtput = <file name>	Specifies the name of output file

| Endian | Endian = { big | little } | Specifies the type of endian of generated CRC code |
| Subcommand | SUbcommand =<file name> | Specifies a file with options in it |

CRc

- Command Line Format

  -CRc = <suboption>

  > <suboption>: <address where the result is output>=<target
  >
  > range>[/<polynomial expression>]
  >
  > <address where the result is output>: <address>
  >
  > <target range>: <start address>-<end address>[,...]
  >
  > <polynomial expression>: { CCITT | 16 }

- Description

  This option performs byte-unit CRC(cyclic redundancy check) on data range/s specified in <target range>, and outputs a CRC code to the location specified in <address>. All addresses specified in this option must be in hex format. CRC-CCITT or CRC-16 is selectable as a polynomial expression. The default is CRC-CCITT.

  Here are the values of the two polynomial expressions.

  CRC-CCITT:

  $X^{16}+X^{12}+X^5+1$

  In bit expression: (10001000000100001)

  CRC-16:

  $X^{16}+X^{15}+X^2+1$

  In bit expression: (11000000000000101)

OUtput

- Command Line Format
  -OUtput = <file name>

- Description
  This option specifies an output file name. The content of output file is a copy of input file with CRC code. When this option is omitted, the default name is
  <input file name>+"_1".<default extension>. For example, when a name of input file is "FILE.mot", and there is no output option available, the name of the output file is "FILE_1.mot".

  Notes:
  -Do not specify a name identical to that of the input file when using this option.

Endian

- Command Line Format
  -Endian = {big | little}

- Description
  This option specifies the type of endian applied to CRC code.
  When this option is omitted, the default type is Big endian.

SUbcommand

- Command Line Format
  -SUbcommand = <file name>

- Description
    This option specifies the file with options described in it.

    Example   -subcommand=sbcmd.txt

    Options inside sbcmd.txt should be specified as follows.
        IN.hex
        crc=F00=500-600/16
        -endian=little
        -output=OUT.hex
    Only one option can be stated in a line.

    Notes:
      -Do not specify subcommand option inside the subcommand file.

Example 1   add_crc_code –in.mot -crc=F008=100-F007 –endian=big -output=out.mot

crc option: -crc=F008=100-F007

In this example, the target of CRC is the data range from 0x000100 to 0x00F007.
In in.mot, byte data indicated by gray squares are within the target range.
Since there is no data in the range from 0x000108 to 0x00EFFF, each byte value of
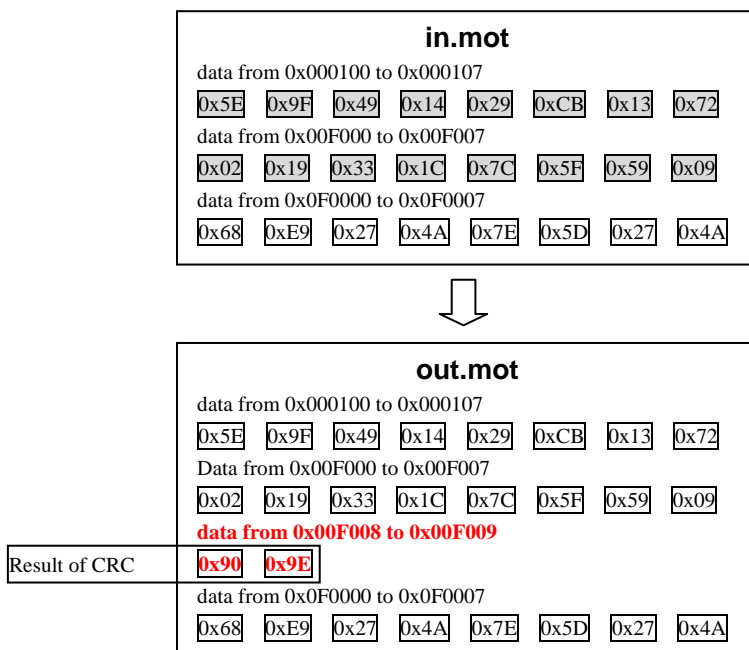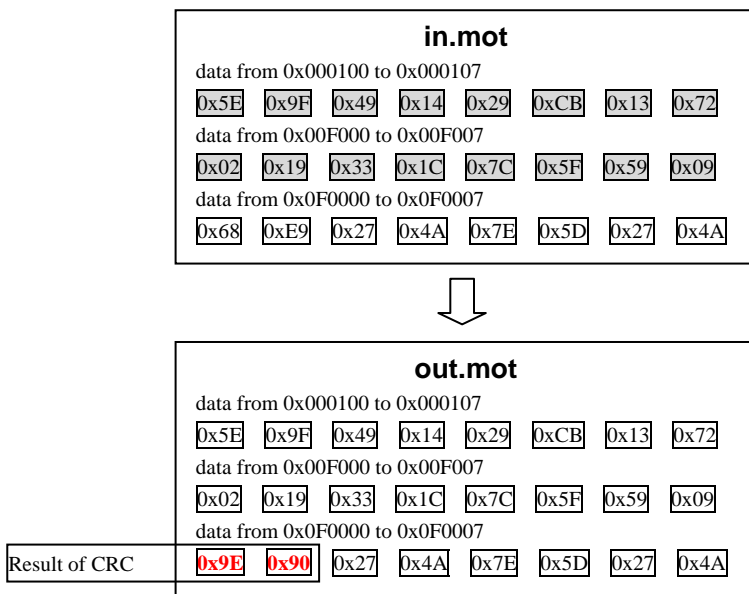the range is assumed to be 0xFF when CRC is performed.

endian option: -endian=big

Endian of CRC code is set to Big endian when it is output to out.mot.

output option: -output=out.mot

CRC code is output to out.mot as 2byte data from 0x00F008 to 0x00F009.
Byte values (0xFF) assumed as data of the range from 0x000108 to 0x00EFFF
during CRC are not output to out.mot.

---

in.mot

data from 0x000100 to 0x000107

| 0x5E | 0x9F | 0x49 | 0x14 | 0x29 | 0xCB | 0x13 | 0x72 |

data from 0x00F000 to 0x00F007

| 0x02 | 0x19 | 0x33 | 0x1C | 0x7C | 0x5F | 0x59 | 0x09 |

data from 0x0F0000 to 0x0F0007

| 0x68 | 0xE9 | 0x27 | 0x4A | 0x7E | 0x5D | 0x27 | 0x4A |

⇩

out.mot

data from 0x000100 to 0x000107

| 0x5E | 0x9F | 0x49 | 0x14 | 0x29 | 0xCB | 0x13 | 0x72 |

Data from 0x00F000 to 0x00F007

| 0x02 | 0x19 | 0x33 | 0x1C | 0x7C | 0x5F | 0x59 | 0x09 |

data from 0x00F008 to 0x00F009

Result of CRC | **0x90** | **0x9E** |

data from 0x0F0000 to 0x0F0007

| 0x68 | 0xE9 | 0x27 | 0x4A | 0x7E | 0x5D | 0x27 | 0x4A |

Example 2   add_crc_code in.mot -crc=F0000=100-107,108-F007 –endian=little
–output=out.mot

crc option: -crc=F0000=100-F007,108-F007
In this example, the targets of CRC are the data range from 0x000100 to 0x00F007
and the data range from 0x000108 to 0x00F007. In in.mot, byte data indicated by
gray squares are within the target ranges. Since there is no data in the range from
0x000108 to 0x00EFFF, each byte value of the range is assumed to be 0xFF when
CRC is performed.

endian option: -endian=little
Endian of CRC code is set to Little endian when it is output to out.mot.
The value of the code is the same as the one in Example 1, but the byte value is
flipped since Little endian setting is valid. The code should be loaded as 2byte data
when checking the value.

output option: -output=out.mot
CRC code is output to out.mot as 2byte data from 0x0F0000. This overwrites the
already existing data from 0x0F0000 to 0x0F0001. Byte values (0xFF) assumed as
data of the range from 0x000108 to 0x00EFFF during CRC are not output to out.mot.

in.mot

data from 0x000100 to 0x000107

0x5E	0x9F	0x49	0x14	0x29	0xCB	0x13	0x72

data from 0x00F000 to 0x00F007

0x02	0x19	0x33	0x1C	0x7C	0x5F	0x59	0x09

data from 0x0F0000 to 0x0F0007

0x68	0xE9	0x27	0x4A	0x7E	0x5D	0x27	0x4A

⇩

out.mot

data from 0x000100 to 0x000107

0x5E	0x9F	0x49	0x14	0x29	0xCB	0x13	0x72

data from 0x00F000 to 0x00F007

0x02	0x19	0x33	0x1C	0x7C	0x5F	0x59	0x09

data from 0x0F0000 to 0x0F0007

Result of CRC

0x9E	**0x90**	0x27	0x4A	0x7E	0x5D	0x27	0x4A

Notes:
- Do not locate CRC code at the address where the code overlaps with the target range of CRC.
- Do not locate CRC code at the address where either upper or lower byte of the code overlaps with the data field of input file.

Sample Code

The sample code shown below is provided to check the result of CRC figured out by the **crc** option. The sample code program should match the result of CRC by **add_crc_code**

When the selected polynomial expression is CRC-CCITT:

```c
typedef  unsigned  char   uint8_t;
typedef  unsigned  short  uint16_t;
typedef  unsigned  long   uint32_t;

uint16_t CRC_CCITT(uint8_t *pData, uint32_t iSize)
{
  uint32_t ui32_i;
  uint8_t  *pui8_Data;
  uint16_t ui16_CRC = 0xFFFFu;

  pui8_Data = (uint8_t *)pData;

  for(ui32_i = 0; ui32_i < iSize; ui32_i++)
  {
    ui16_CRC  = (uint16_t)((ui16_CRC >> 8u) |
                  ((uint16_t)((uint32_t)ui16_CRC << 8u)));
    ui16_CRC ^= pui8_Data[ui32_i];
    ui16_CRC ^= (uint16_t)((ui16_CRC & 0xFFu) >> 4u);
    ui16_CRC ^= (uint16_t)((ui16_CRC << 8u) << 4u);
    ui16_CRC ^= (uint16_t)(((ui16_CRC & 0xFFu) << 4u) << 1u);
  }
  ui16_CRC = (uint16_t)( 0x0000FFFFul &
               ((uint32_t)~(uint32_t)ui16_CRC) );
  return ui16_CRC;
}
```

When the selected polynomial expression is CRC-16:

```
#define POLYNOMIAL 0xa001
               // Generated polynomial expression CRC-16

typedef unsigned char    uint8_t;
typedef unsigned short   uint16_t;
typedef unsigned long    uint32_t;

uint16_t CRC16(uint8_t *pData, uint32_t iSize)
{
  uint16_t crcdData = (uint16_t)0;
  uint32_t data = 0;
  uint32_t i,cycLoop;

  for(i=0;i<iSize;i++){
    data = (uint32_t)pData[i];
    crcdData = crcdData ^ data;
    for (cycLoop = 0; cycLoop < 8; cycLoop++) {
        if (crcdData & 1) {
            crcdData = (crcdData >> 1) ^ POLYNOMIAL;
        } else {
            crcdData = crcdData >> 1;
        }
    }
  }
  return crcdData;
}
```

2. Messages

This tool outputs following messages

L0500 (I) Generated CRC code at "ADDRESS"

CRC code is generated at a location indicated by "ADDRESS"

L1007 (W) Duplicate option : "OPTION"

Duplicate specifications of "OPTION" are found. Only the last specification is effective.

L2000 (E) Invalid option : "OPTION"

"OPTION" is not supported.

L2003 (E) Subcommand option cannot be specified in subcommand file

The subcommand option is specified in a subcommand file. The subcommand option cannot be nested.

L2007 (E) Option "crc" is not specified

Specify "crc" option to use this tool.

L2008 (E) Invalid Address Record Type "Mitsubishi Extended"

HEX format address record exclusive to M32C(NC308WA) is included in the input file.

L2010 (E) Option "OPTION" requires parameter

"OPTION" is specified without the necessary parameter/s.

L2011 (E) Invalid parameter specified in option "OPTION" : "PARAMETER"

"PARAMETER" of "OPTION" is invalid.

L2012 (E) Invalid number specified in option "OPTION" : "VALUE"

"VALUE" of "OPTION" is invalid. Check the range of valid values.

L2013 (E) Invalid address value specified in option "OPTION" : "ADDRESS"

"ADDRESS" specified in "OPTION" is invalid. A hexadecimal address between 0 and FFFFFFFF should be specified.

L2022 (E) Address ranges overlap in option "OPTION" : "START-END"

Data range specified in "OPTION" overlaps with the other data range from "START" to "END".

L3000 (F) No input file

No input file is specified.

L3300 (F) Cannot Open File : "FILE"

Invalid file name "FILE" is specified. Check the file name and its access right.

L3304 (F) Invalid File Format : "FILE"

File format of "FILE" is neither Intel-Hex nor Motolora-S type. Specify the file with one of the mentioned types.

L3315 (F) Invalid "CRC Code" Location

Either upper or lower byte of "CRC Code" overlaps with the data field of the input file. Specify a location where "CRC Code" is completely out of or within the data field.

L3410 (F) Interrupt by user

Interruption by "cntl+C" key is detected from the standard input terminal.

The operation of this tool is aborted.

L4000 (-) Internal error : ("INTERNAL ERROR NO.") "FILE COLUMN NO." / "COMMENT"

Internal error has occurred during the operation of this tool.

3. Guide to Registering Add CRC Code to Build Phase of High-performance Embedded Workshop

This section describes the procedure to register this tool to High-performance Embedded Workshop by using the custom-build function.

1. Register a Build Phase

(1)   Open a project file and select [Build -> Build Phases…] to invoke the [Build Phases] dialog box (Figure 1). Click "Add…" button.
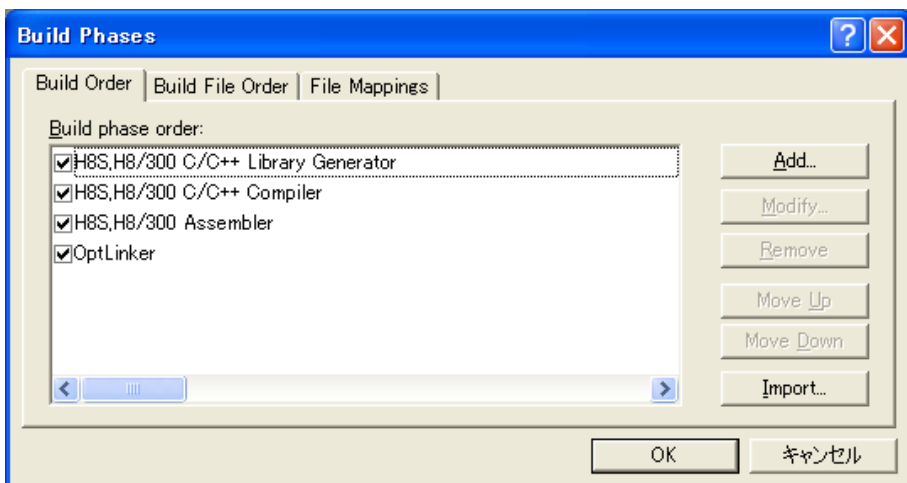

Figure 1 [Build Phases] Dialog Box

(2)　　　The dialog box for creating a new build phase is opened (Figure 2).

　　　Select [Create a new custom phase] and then click "Next >" button.
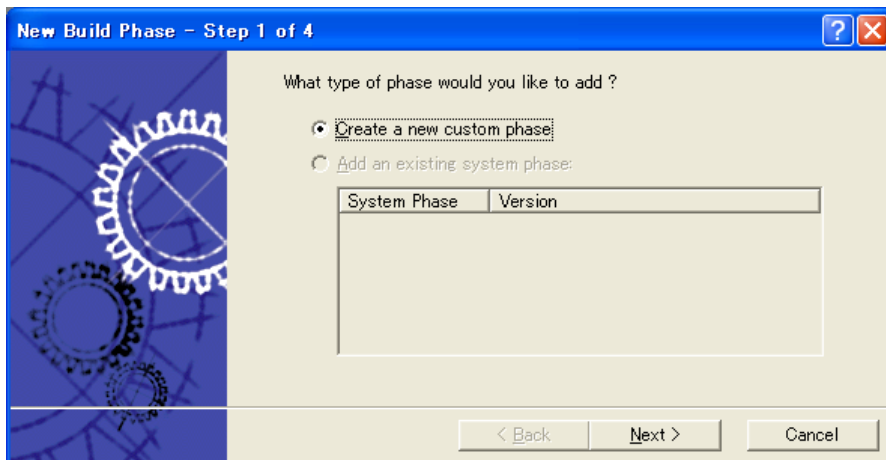
Figure 2　　　[New Build Phase] Dialog Box (Step 1)

(3)　　　The dialog box for selecting a type of a new build phase is opened (Figure 3).

　　　Select [Single phase] and then click "Next >" button.
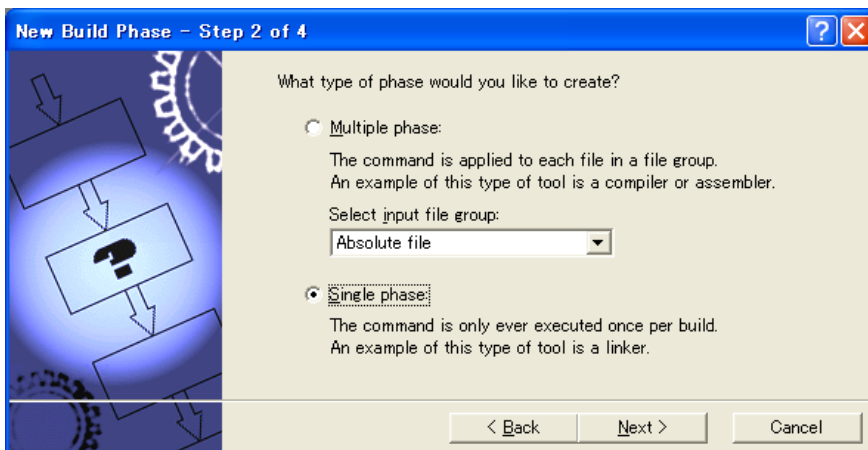
Figure 3　　　[New Build Phase] Dialog Box (Step 2)

(4)   The dialog box for entering information on the new build phase is opened (Figure 4).
        Enter the phase name in the [Phase name] field. Although you can enter any name
        you like, this example assumes the name as "Add CRC Code". Then enter the path to
        a program file in the [Command] field. The path should be entered as below:
            "the directory where the tool has been installed"¥add_crc_code.exe.
        Here in this example the tool is assumed to be installed in:
        "C:¥Program Files¥Renesas¥Hew¥Tools¥Renesas¥H8¥6_2_0¥bin"

Enter the following settings:
Phase name:
    Add CRC Code
Command (excluding parameters):
    "C:¥Program Files¥Renesas¥Hew¥Tools¥Renesas¥H8¥6_2_0¥bin¥add_crc_code.exe"
    If a file name or path includes characters other than alphanumeric characters, enclose the
    entire string with double-quotation marks ("") or press the [Browse…] button to directly select
    the file from the [Select Executable File] dialog box.
Default options:
    None. The setting will be explained later at " 2. Setting Options".
Initial directory:
    Do not change the default setting.

When all the settings are entered, click "Next >" button.

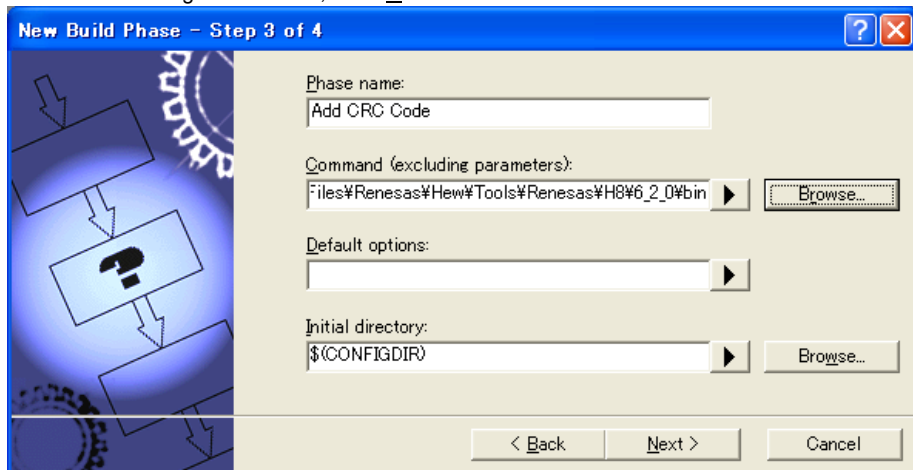
Figure 4   [New Build Phase] Dialog Box (Step 3)

(5)   The dialog box for setting environment variables required for the phase is opened
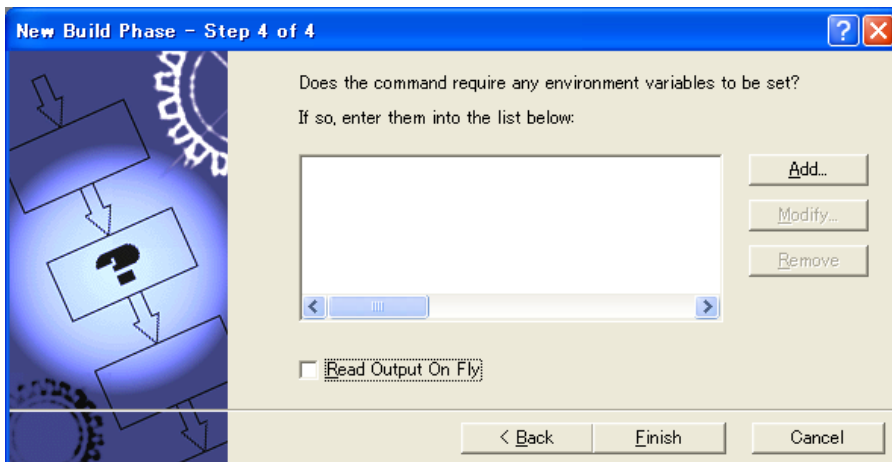   (Figure 5), but leave this field blank and click [Finish] button.

Figure 5   [New Build Phase] Dialog Box (Step 4)

After the [Finish] button is clicked, [Build Phases] dialog box is opened. Make sure that the build
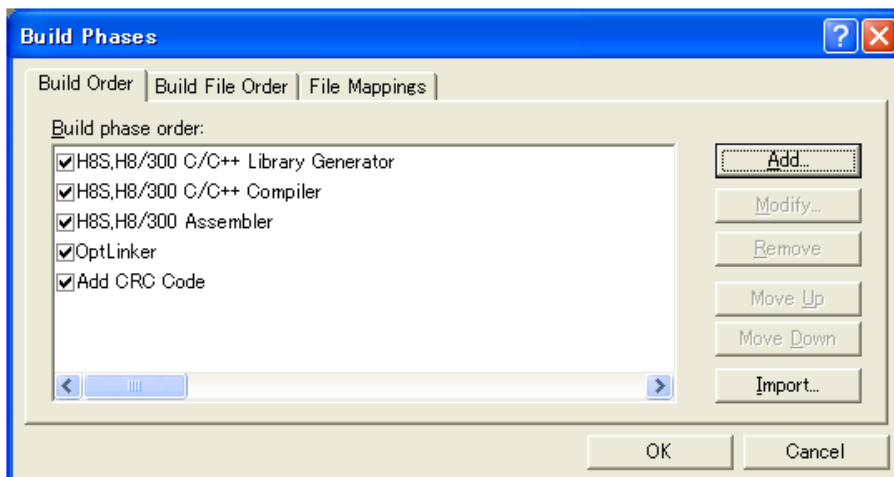phase of Add CRC Code is located after that of linkage editor (Figure 6).

Figure 6   Build Order of Add CRC Code

Click [OK] button to validate the settings. The registration of the tool to High-performance Embedded Workshop is now complete. Select [File -> Save Workspace] to save the current settings.

2. Setting Options

Here is the example of specifying options of Add CRC Code.
Select [Add CRC Code…] that has been added to the [Build] menu (Figure 7).

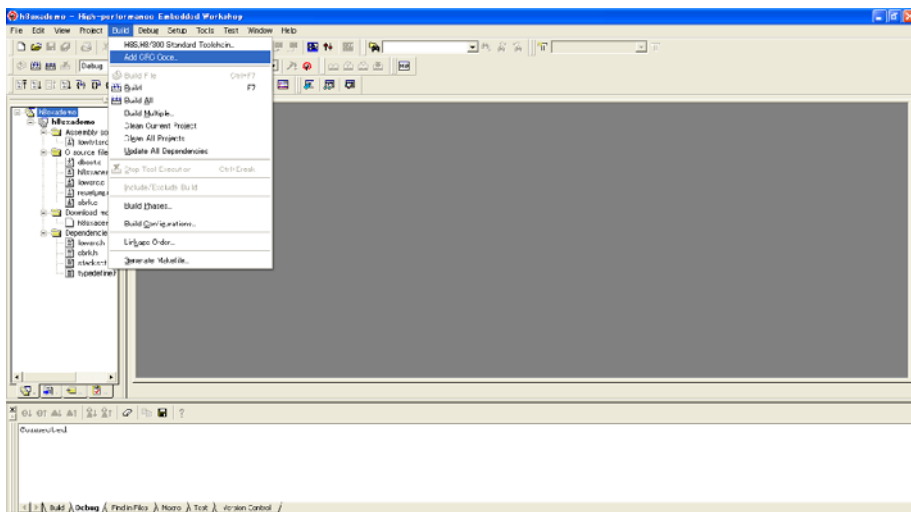Figure 7 Setting Options [1]

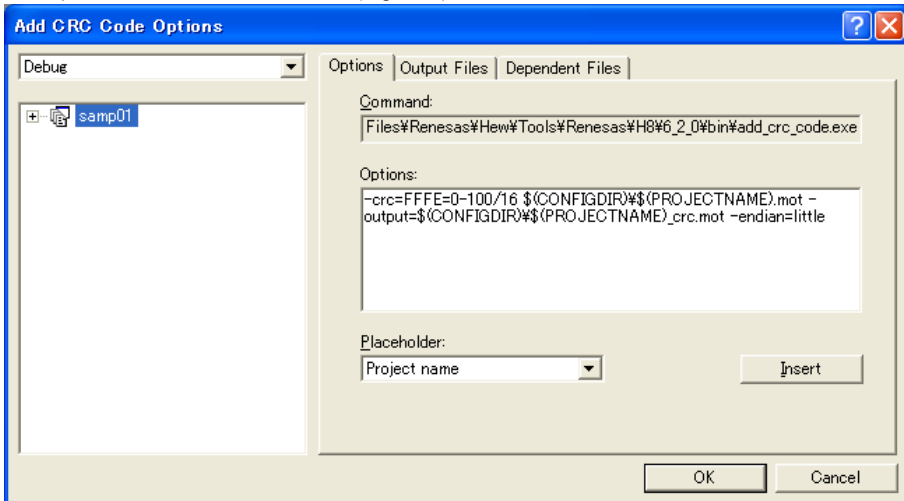The options should be set as follows (Figure 8)

Figure 8   Add CRC Code Options

-crc=FFFE=0-100/16

   This option specifies the address where CRC code will be located, the range where calculation will be performed and the polynomial used to calculate the code.
   Please refer to the chapter "1. Options" for more info on the option.

$(CONFIGDIR)¥$(PROJECTNAME)_crc.mot

   This option specifies the input file. Apply settings appropriate for your project.

-output=$(CONFIGDIR)¥$(PROJECTNAME)_crc.mot

   This option specifies the output file. Apply settings appropriate for each project.

–endian=little

   This option specifies the endian of CRC code.

The registration of Add CRC Code to a build phase of High-performance Embedded Workshop is now completed. Motolora S-type with CRC code is output when a build is performed.

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