CodeWarrior Development Studio for Microcontrollers V10.x HC(S)08/RS08/S12Z Build Tools Utilities Manual

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Table of Contents

Introduction

I SmartLinker

IV Decoder Utility

V Maker Utility

-Y: Write Disassembled Listing with Source And All Comments (Decoder) 414

C Messages 417

Types of Generated Messages 417
Message Details. 417
Linker Message List 418
L1: Unknown "<message>" occurred 418
L2: Message overflow, skipping <kind> messages 419
L50: Input file '<file>' not found 419
L51: Cannot open statistic log file <file> 419
L52: Error in command line <cmd> 420
L53: Message <Id> is not used by this version. The mapping of this message is ignored. 420
L54: Option <Option> 421
L56: Option value overridden for option <OptionName 421
L64: Line Continuation occurred in <FileName> 421
L65: Environment macro expansion message " for <variablename> 422
L66: Search path <Name> does not exist 423
L1000: <command name>=""> not found 423
L1001: <command name>=""> multiply defined 424
L1003: Only a single SEGMENTS or SECTIONS block is allowed 424
L1004: <Token> expected 425
L1005: Fill pattern will be truncated (>0xFF) 426
L1006: <Token> not allowed 426
L1007: <character> not allowed in file name (restriction) 427
L1008: Only single object allowed at absolute address 428
L1009: Segment Name <segment name>=""> unknown 429
L1010: Section Name <section name>=""> unknown 431
L1011: Incompatible segment qualifier: <qualifier1> in previous segment and <qualifier> in <segment name>=""> 433
L1012: Segment is not aligned on a <bytes> boundary 435
L1013: Section is not aligned on a <bytes> boundary 436
L1015: No binary input file specified 436
L1016: File <filename> found twice 437
L1017: Section <Object/Section> in module <ModuleName> is incompatible with previous usages of this section 438
L1018: Checksum error 439
L1019: Checksum error: starting address 0x<Address> not aligned with

checksum size <Address> 439
L1020: Checksum error: size of checksum area 0x<Address> to 0x<Address> res aligned with the checksum size <Address> 440
L1021: Checksum error: Memory Overlap of 0x<Address> - 0x<Address> and 0x<Address> 440
L1022: Checksum error: Start Address 0x<Address> is greater than End Address 0x<Address> 440
L1023: Object <object> spans multiple pages 441
L1037: ***** Linking of <Linkparameterfile> failed **** 441
L1038: Success. Executable file written to <absfile> 441
L1052: User requested stop 442
L1100: Segments <segment1 name>=""> and <segment2 name>=""> overlap 442
L1102: Out of allocation space in segment <segment name>=""> at address <first address="" free>=""> 444
L1103: <section name>=""> not specified in the PLACEMENT block . . 445
L1104: Absolute object <Object name>=""> overlaps with segment <Segment name>=""> 446
L1105: Absolute object <object name>=""> overlaps with another absolutely allocated object or with a vector 449
L1106: <Object name>=""> not found 450
L1107: <Object name>=""> not found 451
L1108: Initializing of Vector <Name> failed because of <Reason> 453
L1109: <Segment name>=""> appears twice in SEGMENTS block 453
L1110: <Segment name>=""> appears twice in PLACEMENT block . . . 454
L1111: <Section name>=""> appears twice in PLACEMENT block 455
L1112: The <Section name>=""> section has segment type <Type> (illegal) 456
L1113: The <Section name>=""> section has segment type <Segment qualifier>=""> (illegal) 458
L1114: The <Section name>=""> section has segment type <Segment qualifier>=""> (initialization problem) 460
L1115: Function <Function name>=""> not found 462
L1116: Function <Function name>=""> not found 463
L1117: <Object name>=""> allocated at absolute address <Address> overlaps with sections placed in segment <Segment name>=""> 463
L1118: Vector allocated at absolute address <Address> overlaps with another vector or an absolutely allocated object 465
L1119: Vector allocated at absolute address <Address> overlaps with sections placed in segment <Segment name>=""> 466

L2080: 10 bit offset out of range (0 <= <offset> <= 1023) 544
L2081: Illegal allocation of BIT segment ('<objname>':0x<address>..0x<endaddress> => 0x20..0x3F, 0x400..0x43F) 545
L2082: 4 bit offset out of range (-7 <= <offset> <= 15) 545
L2083: 11 bit offset out of range (-2048 <= <offset> <= 2047) 546
L2084: Can't solve reference to object <name> 546
L2085: Can't solve reference to internal object 547
L2086: Cannot switch to segment <segName>. (Offset to big) 547
L2087: Object file position error in <objname> 547
L2088: Procedure <funcname> not correctly defined 547
L2089: Internal: Code size of <objname> incorrect (<data> <objsize>) . . 548
L2090: Internal: Failed to write procedures for <modulename> 548
L2091: Data allocated in ROM can't exceed 32KByte 548
L2092: Allocation of object <objname> failed 549
L2093: Variable <varname> (objectfile <objfile>) appears in module <module1> and in module <module2> 549
L2094: Object <varname> (objectfile <objfile>) appears in module <module1> and in module <module2> 549
L2096: Overlap variable <Name> not allocated 550
L2097: Additional overlap variable <Name> allocated 550
L2098: The label <labelname> cannot be resolved because of a recursion. . . 550
L2103: Linking succeeded. Executable is written to <absfile> 551
L2104: Linking failed 551
L2150: Illegal fixup offset (low bits) in <object> with offset <offset> to <object> 551
L2151: Fixup out of range (<low> <= <offset> <= <high>) in <object> with offset <offset> to <object> 552
L2201: Listing file could not be opened 552
L2202: File for output s could not be opened 553
L2203: Listing of link process to <listfile> 553
L2204: Segment is not allocated to any section 553
L2205: ROM libraries cannot have a function main (<main>) 553
L2206: ROM libraries cannot have an INIT function (<init>) 554
L2207: <main> not found 554
L2208: No copydown created for initialized object <Name>. Initialization data lost. 554
L2251: Link parameter file <prmfile> not found 555
L2252: Illegal syntax in link parameter file: <syntaxerror> 555
L2253: <definition> not present in link parameter file 555

L2254: <definition> is multiply defined in link parameter file 556
L2257: Both stacktop and stacksize defined 556
L2258: No stack definition allowed in ROM libraries 557
L2259: No main function allowed in ROM libraries 557
L2300: Segment <segmentname> not found in any objectfile 557
L2301: Segment <segmentname> must always be present 557
L2303: Segment <seg1> has to be allocated into <seg2> 558
L2304: <segmentname> appears twice in the <deflist> definition list 558
L2305: In link parameter file: The segment has the section type <type> (illegal) 558
L2306: Section <<seg1start>,<seg1end>> and Section <<seg2start>,<seg2end>> overlap 559
L2307: SSTACK cannot be allocated on more than one section 559
L2308: Size of Stack (STACKSIZE = 0x<stacksize>) exceeds size of segment SSTACK (=0x<segmentsize>) 559
L2309: STACKTOP-command specifies 0x<stacktop> which is not in SSTACK (0x<stackstart>..0x<stackend>) 559
L2310: The STACKTOP definition is incompatible with SSTACK being part of a list of segments 560
L2311: STACKTOP or STACKSIZE missed 560
L2312: Stack not initialized 560
L2313: All <segtype>_BASED segments must fit in a range of 64 kBytes . . . 560
L2314: A <segtype>_BASED segment must not have an address less than <address> 561
L2315: A <segtype>_BASED segment must not have an address bigger than <address> 561
L2316: All SHORT <segtype>_BASED segments must fit in a range of <range> Bytes (<startadr> - <endadr> > 256 Bytes) 561
L2317: All non far segments have to be allocated on one single page 561
L2318: Cannot split _OVERLAP 562
L2400: Memory model mismatch: <model1> (previous files) and model <model2> in module <objfile> 562
L2401: Target CPU mismatch: <cpu1> (previous files) and <cpu2> in module <objfile> 562
L2402: Incompatible flags or compiler options: <flags> 563
L2403: Incompatible flags or compiler options: <flags> 563
L2404: Unknown processor: <processor> in module <modulename> . . .563
L2405: Illegal address range in link parameter file. In the <model> memory model data must fit into one page 564

L2406: More than one data page is used. Segment <segname> is in page 0 . . 564
L2407: More than one data page is used in <memorymodel> memory model. The data page is defined by the placement of the stack 564
L2408: Illegal address range in link parameter file. In <memorymodel> memory model the code page must be page zero 565
L2409: Multiple links are illegal: <object1>(module <module1>) links to <link1>(module <toModule1>) and to <link2>(module <toModule2>) . . 565
L2410: Unresolved external <object> (imported from <module>) 565
L2412: Dependency '<object>' description: " 565
L2413: Align STACKSIZE from <oldSize> to <newSize> 566
L2414: Stacksize not aligned. Is <oldsize>, expected to be aligned to <expectedsize> 566
L2415: Illegal dependency of '<object>' 567
L2416: Illegal file name '<Filename>' 567
L2417: Object <objname> refers to non existing segment number <segnumber> 567
L2418: Object <objname> allocated in segment <segname> is not allocated according to the segment attribute <attrname> 568
L4000: Could not open object file (<objFile>) in NAMES list 569
L4001: Link parameter file <PRMFile> not found 569
L4002: Unable to determine object file format for <PRMFile>. NAMES section missing? Use -F option to specify format. 570
L4003: Linking <PRMFile> as HIWARE format link parameter file 570
L4004: Linking <PRMFile> as ELF/DWARF format link parameter file . 571
L4005: Illegal file format of object file (<objFile>) 571
L4006: Failed to create temporary file 571
L4007: Include file nesting to deep in link parameter file 572
L4008: Include file <includefile> not found 572
L4009: Command <Command> overwritten by option <Option> 572
L4010: Burner file creation error " 573
L4011: Failed to generate distribution file because of <reason> 573
L4012: Failed to generate distribution file because of distribution segment not found or not alone in placement 573
L4013: Function <function> is not in the distribution segment 574
L4014: The processor <processor> is not supported by the linker optimizer . 574
L4015: Section <section> has no IBCC_NEAR or IBCC_FAR flag 575
L4016: No section in the segment has an IBCC_NEAR flag . 576

L4017: Failed to generate distribution file because there are no functions in the distribution segment 576
L4018: The sections in the distribution segment have not enough memory for all functions 577
L4019: Function <function name>=""> has a near flag and cannot be distributed 577
L4020: Not enough memory in the non banked sections of the distribution segment 578
L4021: Incompatible derivative: <Deriv0> in previous files and <Deriv1> in current file 578
L4022: HexFile not found: <Filename> 579
L4023: Hexfile error " in file '<Filename>' 579
L4024: No information available for segment '<name>'. 579
L4025: This limited version allows only <num> <limitKind> 580
L4026: Incompatible compile-time options: different HCS12XE memory mappings found in object files 580
L4027: Incompatible compile-time options: different HCS12XE memory mappings found in object files 581
L4028: Section '<SectionName>' has no DATA_NEAR or DATA_FAR flag . 581
L4029: No objects in the distribution segment '' 581
L4030: Failed to generate data distribution file because of distribution segment '<SegmentName>' not found or not alone in placement. 582
L4032: No section in the segment <SegmentName> has a DATA_NEAR flag 582
L4033: Not enough memory in the section of the distribution segment for object <ObjectName> 582
L4101: Preprocessor failure because of '<Reason>'. 583
L4102: Computation of total memory size per memory type (e.g. _SEG_TOTAL_RW) unavailable in Hiware format 583
L4104: Library file '<FileName>' should be recompiled with option <Reason> 584
L4105: Library file <Filename> not found 584
L4106: Startup file '<FileName>' should be recompiled with option <Reason> 584
L4107: Linker implicitly allocates objects of '<section>' after section '<section>'. 584
L4108: Section '<SectionName>' is assigned to multiple segments or pages . 585
L4109: Link from function <ObjectName> to <> is disables as it initiates in-

Introduction

CodeWarrior IDE Utilities

The HC08/RS08/S12Z Build Tools Utilities Manual describes the following five CodeWarrior IDE utilities:

- SmartLinker
- Burner
- Libmaker
- Decoder
- Maker

SmartLinker

The CodeWarrior IDE SmartLinker utility merges various object files of an application into one absolute file (or `.ABS` file) that can be converted to an S-Record or an Intel® Hex file, using the Burner utility or loading the file into the target using the Downloader/ Debugger.

This utility is a smart linker as it links only those objects that are actually used by your application. The SmartLinker generates either Freescale or `ELF` absolute files.

Burner

The CodeWarrior IDE Burner utility converts an `.ABS` file into a file that can be handled by an EPROM burner.

Libmaker

The CodeWarrior IDE Libmaker utility creates and maintains object file libraries.

Decoder

The CodeWarrior IDE ELF/Freescale Decoder utility disassembles object files, absolute files and libraries in the Freescale object file format or ELF/DWARF format, along with S-Record files.

Maker

The CodeWarrior IDE Maker utility implements the UNIX make command with a Graphical User Interface (GUI). In addition, you can use Maker to build Modula-2 applications as well as maintain C/C++ projects.

Starting CodeWarrior Utilities

You can start all of the utilities described in this book from executable files located in the `prog` folder of your CodeWarrior IDE installation. The executable files are:

- `linker.exe`: SmartLinker
- `burner.exe`: Burner
- `libmaker.exe`: Libmaker
- `decoder.exe`: Decoder
- `maker.exe`: Maker

A standard full installation of the HC08/RS08 CodeWarrior IDE places the executable files in the location:

<*CWInstallDir*>`\MCU\prog`

For S12Z derivatives, the executable files are located at:

<*CWInstallDir*>`\MCU\S12lisa_Tools`

where <*CWInstallDir*> is the directory where the CodeWarrior software is installed.

To start any CodeWarrior Utility, double-click on the appropriate executable(`.exe`) file.

SmartLinker

This chapter describes the SmartLinker utility. The linker merges the various object files of an application into one absolute file (or `.ABS` file). The file is called *absolute file* because it contains absolute, not relocatable code. You can convert this `.ABS` file to an S-Record or an Intel® Hex file using the Burner program or load the `.ABS` file into the target using the Downloader/Debugger.

The Linker is a smart linker. It links only those objects that are actually used by your application.

This linker is able to generate either Freescale or ELF absolute files. For compatibility purposes, the Freescale input syntax is also supported when ELF absolute files are generated.

Purpose of Linker

Linking is the process of assigning memory to all global objects (functions, global data, strings, and initialization data) needed for a given application and combining these objects into a format suitable for downloading into a target system or an emulator.

The linker is a smart linker. It links only those objects that are actually used by the application. The unused functions and variables do not occupy any memory in the target system. Other optimizations that reduce memory requirements include storing initialized parts of global variables in compact forms, and reserving memory only once for equal strings.

Product Features

The most important features supported by the SmartLinker are:

- Complete control over the placement of objects in memory: You can allocate different groups of functions or variables to different memory areas (Segmentation; see the *Segments* and *Sections* chapters).
- Linking to objects already allocated in a previous link session (ROM libraries).

NOTE The code for application startup is a separate file written in inline assembly and can be easily adapted to your particular needs. In this manual, the startup file is called `startup`. However, this is a generic file name that has to be replaced by the real target startup file name. See the `README.TXT` file in the appropriate subdirectory of the installation `LIB` directory for more details about memory models and associated startup codes.

- Mixed-language linking: You can mix Modula-2, assembly, and C object files, even in the same application.
- Vector initialization.

Section Contents

This section consists of the following chapters:

- SmartLinker User Interface — Describes the features of the SmartLinker user interface
- SmartLinker Files — Describes the input and output files used by the SmartLinker
- Linking Issues — Discusses linking features and issues
- SmartLinker Parameter File — Describes the requirements of the SmartLinker parameter file
- ELF Sections — Describes the use of sections and segments for ELF and provides examples using sections to control allocation of variables and functions
- Segments — Describes the use of sections and segments for Freescale
- Program Startup — Describes advanced material on using startup routines
- The Map File — Describes the contents of the map file produced by the link process
- ROM Libraries —Describes creating and using ROM libraries
- Initializing the Vector Table — Describes initializing the vector table

Starting the SmartLinker Utility

All utilities described in this book may be started from executable files located in the `prog` folder of your CodeWarrior IDE installation. The executable files are:

- `linker.exe`: The SmartLinker Utility
- `burner.exe`: The Burner Utility
- `libmaker.exe`: The Libmaker Utility
- `decoder.exe`: The Decoder Utility

- `maker.exe`: Maker: The Make Tool

With a standard full installation of the HC08/RS08 CodeWarrior IDE, the executable files are located at:

<*CWInstallDir*>`\MCU\prog`

For S12Z derivatives, the executable files are located at:

<*CWInstallDir*>`\MCU\S12lisa_Tools`

where *<CWInstallDir>* is the directory where CodeWarrior software is installed.

To start the SmartLinker Utility, double-click on `linker.exe`.

1

SmartLinker User Interface

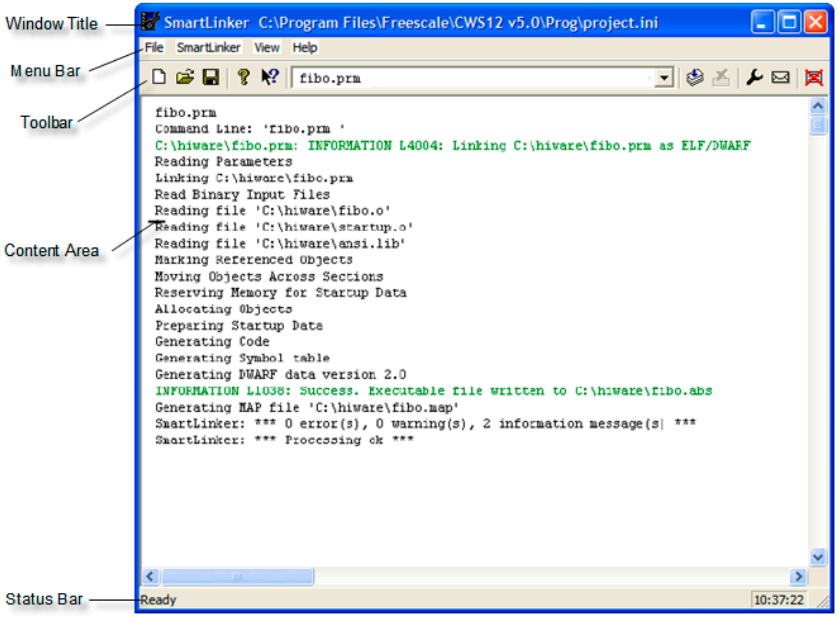
The SmartLinker runs under Win32. You can start the linker from the `prog` folder located in the CodeWarrior installation folder.

NOTE For S12Z architectures, you can start the linker from the `s12lisa_tools` folder located in the CodeWarrior installation folder.

SmartLinker Main Window

The SmartLinker Main window provides a window title, a menu bar, a toolbar, a content area, and a status bar, as shown in the following figure.

Figure 1.1 SmartLinker Main Window



Window Title

The window title displays the project name. If currently no project is loaded, **Default Configuration** appears in the title. An asterisk (*) after the configuration name indicates that some values have changed. The asterisk (*) appears as soon as an option, the editor configuration or the window appearance changes.

Content Area

The Content Area is used as a text container where logging information about the link session is displayed. This logging information consists of:

- The name of the `prm` file which is being linked.
- The complete name (including full path specification) of the files building the application.
- The list of the errors, warnings and information messages generated.

When you drop a file name into the SmartLinker window content area, the corresponding file loads as configuration if the file has the extension `.ini`. Otherwise, the file links with the current option settings (see Specifying the Input File).

All text in the SmartLinker window content area can have context information. The context information consists of two items:

- A file name including a position inside of a file
- A message number

File context information is available for all output lines where a file name is displayed. There are two ways to open the file specified in the file context information in the editor specified in the editor configuration:

- If a file context is available for a line, double-click on a line containing file context information.
- Right-click at the desired line and select **Open file** from the context menu.

NOTE If a file cannot be opened although a context menu entry is present, the editor configuration information is not correct (see the section Editor Settings Tab).

Most messages appear with associated message numbers. There are three ways to open the corresponding entry in the help file:

- Select one line of the message and press *F1*.
- Press *Shift+F1* and then click on the desired message text.

NOTE If the selected line or message text does not have a message number, using either *F1* or *Shift+F1* displays the main help page.

- Right-click the message text and select **Help on** from the context menu. This entry is only available if a message number is available.

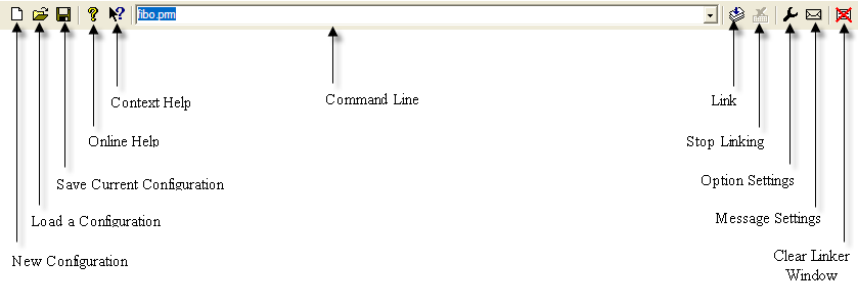
NOTE The **Help on** option is available only when a message number is available.

Messages are colored according to their kind. Errors are red, Fatal Errors are dark red, Warnings are blue, and Information Messages are green.

Main Window Tool Bar

The following figure shows the SmartLinker main window toolbar buttons.

Figure 1.2 SmartLinker Main Window Toolbar



You can use the SmartLinker toolbar buttons to perform various functions in the SmartLinker utility as listed below:

- **New —** Use this button to open a new configuration.
- **Load —** Use this button to load an existing configuration.
- **Save —** Use this button to save the current configuration for the linker.
- **Help —** Use this button to open the online help file.
- **Context Help —** Use this button to open the context help. Pressing this button changes the cursor form and adds a question mark beside the arrow. Clicking any item calls the help for that item. Use the context help to get specific help on menus, toolbar buttons, or on the window area.
- **Command Line —** The **Command Line** history contains the list of the last commands executed. Once a command line has been selected or entered in this combo box, click the **Link** button to execute this command. You can select the command line in the toolbar by pressing the *F2* key.

- **Link —** Use this button to execute the command selected in the **Command Line**.
- **Stop —** Use this button to abort the current link session. If no link session is running, this button is disabled (gray).
- **Options —** Use this button to open the **SmartLinker Option Settings** dialog box.
- **Messages —** Use this button to open the **SmartLinker Message Settings** dialog box.
- **Clear —** Use this button to clear the SmartLinker window content area.

Main Window Status Bar

The following figure shows the SmartLinker main window status bar.

Figure 1.3 SmartLinker Main Window Status Bar

When pointing to a button in the toolbar or a menu entry, the message area displays the function of the button or menu entry.

Main Window Menu Bar

The following table lists the menus that are available in the menu bar:

Table 1.1 SmartLinker Main Window Menus

Menu	Description
File Menu	Contains entries to manage SmartLinker configuration files.
SmartLinker Menu	Contains entries to set SmartLinker options.
View Menu	Contains entries to customize the SmartLinker window output.
Help	A standard Windows Help menu.

File Menu

With the **File** menu, you can save or load the SmartLinker configuration files. A SmartLinker configuration file contains the following information:

- SmartLinker option settings specified in the SmartLinker dialog boxes.

- Message settings which specify which messages to display and which to treat as errors.
- List of the last command line executed and the current command line.
- Window position, size and font.
- Tips of the Day settings, including the enable at startup setting and the current entry.

Configuration files are text files, which have the standard extension `.ini`. You can define as many configuration files as required for your project, and switch between the different configuration files using the **File > Load Configuration** and **File > Save Configuration** menu entry or the corresponding toolbar buttons. The following table describes the **File** menu items.

Table 1.2 File Menu Items Description

Menu Item	Description
Link	Opens **Select File to Link** dialog box, displaying the list of all the `.prm` files in the project directory. Select the input file using the features from the **Select File to Link** dailog box. The selected file links as soon as you close the **Select File to Link** dailog box by clicking **Open**.
New/Default Configuration	Resets the SmartLinker option settings to the default values. The SmartLinker options activate by default.
Load Configuration	Opens **Loading configuration** dailog box, displaying the list of all the `.ini` files in the project directory. Select the configuration file using the features from the **Loading configuration** dailog box. Loads the configuration data stored in the selected file and uses it in a further link session.
Save Configuration	Saves the current settings in the configuration file specified on the title bar.
Save Configuration As	Opens **Saving Configuration as** dailog box, displaying the list of all the `.ini` files in the project directory. Specify the name or location of the configuration file using the features from the **Saving Configuration as** dailog box. Saves the current settings in the specified file as soon as you close the **Saving Configuration as** dailog box by clicking **Save**.
Configuration	Opens the **Configuration** dialog box to specify the editor used for error feedback, which parts to save with a configuration, and environment variable settings.

Table 1.2 File Menu Items Description (*continued*)

Menu Item	Description
• 1 project.ini • 2 project.ini •	Recent project list. Access this list to reopen a recently opened project.
Exit	Closes the SmartLinker.

SmartLinker Menu

The **SmartLinker** menu allows you to customize the SmartLinker. You can graphically set or reset SmartLinker options or define the optimization level you want to reach. The following table describes the **SmartLinker** menu items.

Table 1.3 SmartLinker Menu Item Description

Menu Item	Description
Options	Allows you to define the options which must be activated when linking an input file (see Option Settings Window).
Messages	Opens a dialog box in which you can map the different error, warning or information messages to another message class (see Message Settings Window).
Stop Linking	Stops the currently running linking process. This entry is only enabled (black) when a link process currently takes place. Otherwise, it is gray.

View Menu

The **View** menu allows you to customize the linker window. You can specify whether to display or hide the status bar and the toolbar. You can also define the font used in the window or clear the window. The following table describes the **View** menu items.

Table 1.4 View Menu Item Description

Menu Item	Description
Toolbar	Displays or hides the toolbar in the SmartLinker window.
Statusbar	Displays or hides the status bar in the SmartLinker window.
Log	Allows you to customize the output in the SmartLinker window content area. The following options are available when **Log** is selected: • **Change Font —** Opens a standard font selection dialog box. Applies the options selected in the **Font** dialog box to the SmartLinker window content area. • **Clear Log —** Allows you to clear the SmartLinker window content area.

SmartLinker Configuration

You can open the **Configuration** dialog box by selecting the **File > Configuration** from the menu bar. The SmartLinker **Configuration** dialog box has three tabs, listed as below:

- Editor Settings Tab
- Save Configuration Tab
- Environment Tab

Editor Settings Tab

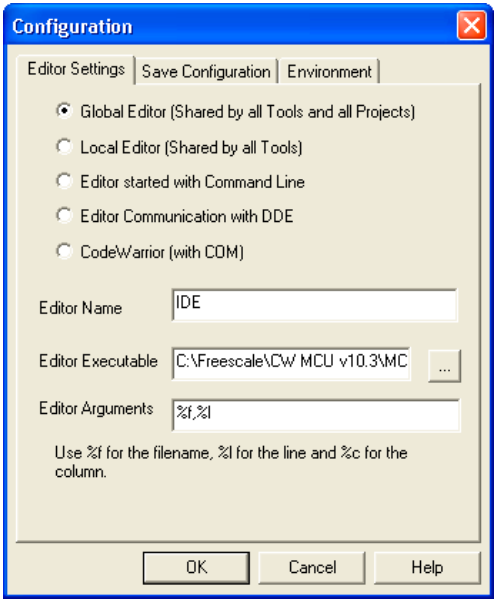
The Configuration dialog box **Editor Settings** tab, as shown in Figure 1.4, has option buttons that let you select an editor type for SmartLinker, or for all tools. Depending on the type of editor selected, the **Editor Settings** tab content changes.

Global Editor Option

Figure 1.4 shows the **Global Editor** option selected in the **Editor Settings** tab.

All tools and projects on one computer share the Global Editor. It is stored in the global initialization file `MCUTOOLS.INI` in the `[Editor]` section of the file. Some Modifiers (editor options) can be specified in the editor command line. Once these options are stored, the behavior of the other tools that use the same entry changes the next time you start the tool.

Figure 1.4 Editor Settings Tab — Global Editor



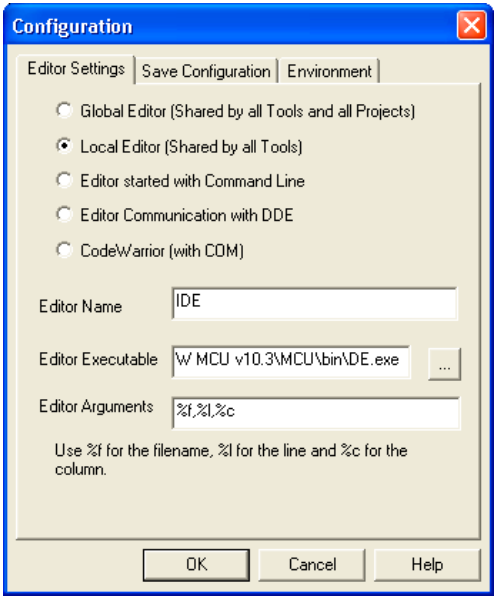
Local Editor Option

Figure 1.5 shows the **Editor Settings** tab with the **Local Editor (Shared by all Tools)** option selected.

All tools using the same project file share the Local Editor. You can specify some Modifiers in the editor command line.

You can edit the Local Editor configuration with the linker. When these entries are stored, the behavior of the other tools using the same entry also changes the next time you start the tool.

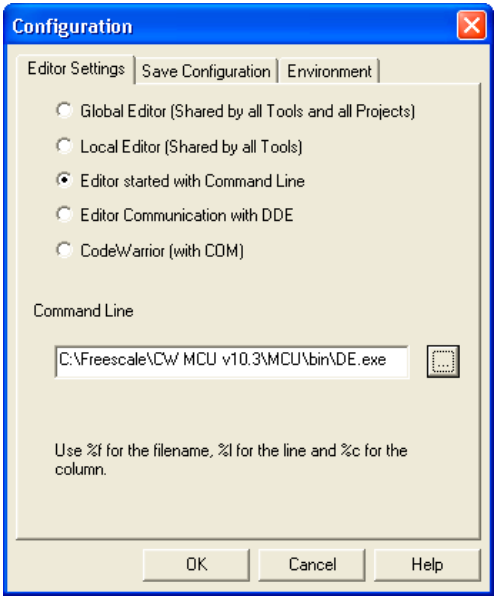
Figure 1.5 Editor Settings Tab — Local Editor



Editor started with Command Line Option

The following figure shows the **Editor Settings** tab with the **Editor started with Command Line** option selected.

Figure 1.6 Editor Settings Tab — Editor started with Command Line



Selecting this editor type associates a separate editor with the SmartLinker for error feedback. The editor configured in the Shell is not used for error feedback.

Enter the command that you want to use to start the editor. The format for the editor command depends on the syntax required to start the editor. You can specify some Modifiers in the editor command line to refer to a line number of the named file.

Example

For Winedit 32-bit versions, use (with an adapted path to the `winedit.exe` file):

```
C:\WinEdit32\WinEdit.exe %f /#:%l
```

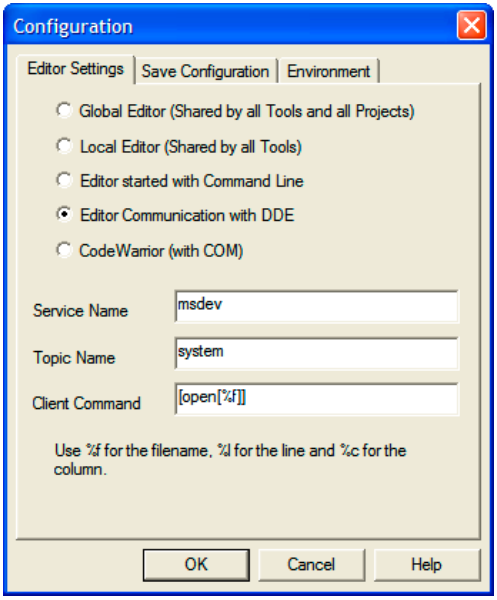
For `write.exe`, use (with an adapted path to the `write.exe` file, note that write does not support line numbers):

```
C:\Winnt\System32\Write.exe %f
```

Editor Communication with DDE Option

The following figure shows the **Configuration** window **Editor Settings** tab with the **Editor Communication with DDE** option selected.

Figure 1.7 Editor Settings — Editor Communication with DDE



You must enter the **Service Name** and **Topic Name** as well as the **Client Command** to be used for a DDE connection to the editor. All entries can have modifiers for file name and line number as explained in the *Modifiers* section below.

Example

For Microsoft Developer Studio use the following setting:

```
Service Name: "msdev"
Topic Name: "system"
ClientCommand: "[open(%f)]"
```

Modifiers

Include some modifiers in the configurations to tell the editor which file to open and at which line.

- The `%f` modifier refers to the name of the file (including path) where the error was detected.
- The `%l` modifier refers to the line number where the message was detected.

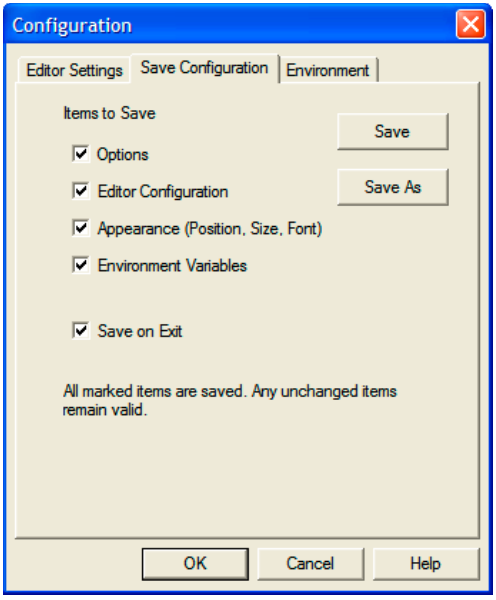
NOTE Only use the `%l` modifier with an editor which can be started with a line number as a parameter. This is not the case for WinEdit version 3.1 or lower or for Notepad. When you work with such an editor, you can start it with the file

name as a parameter and then select the menu entry **Go to** to jump to the line where the message was detected. In that case, the editor command looks like: `C:\WINAPPS\WINEDIT\Winedit.EXE %f`. Check your editor documentation to determine which command line to use to start the editor.

Save Configuration Tab

The following figure shows the Save Configuration tab of the Configuration Window, which contains all of the options for the Save operation.

Figure 1.8 Save Configuration Tab



In the **Save Configuration** tab, use the four checkboxes to choose which items to save to a project file when you save the configuration.

- **Options:** This item relates to the option and message settings. Setting this checkbox stores the current option and message settings in the project file when the configuration is saved. By disabling this checkbox, changes to the option and message settings are not saved and the previous settings remain valid.
- **Editor Configuration:** This item relates to the editor settings. Setting this checkbox stores the current editor settings in the project file when the configuration is saved. By disabling this checkbox, the previous settings remain valid.

- **Appearance:** This item relates to many parts such as the window position (only loaded at startup time) and the command line content and history. Setting this checkbox stores these settings in the project file when the current configuration is saved. By disabling this checkbox, the previous settings remain valid.
- **Environment Variables:** This item relates to the environment variable settings on the Environment tab. Setting this checkbox stores the specified settings in the project file when the current configuration is saved. By disabling this checkbox, the previous settings remain valid.

NOTE Disabling specific options, prevents some parts of a configuration file from being written. For example, when the editor has been configured, the save Editor mark can be removed. Then future save commands no longer modify the options.

- **Save on Exit:** Setting this option makes the linker write the configuration on exit. No dialog box appears to confirm this operation. If this option is not set, the linker does not write the configuration at exit, even if options or other parts of the configuration have changed. No confirmation appears in any case when closing the linker.

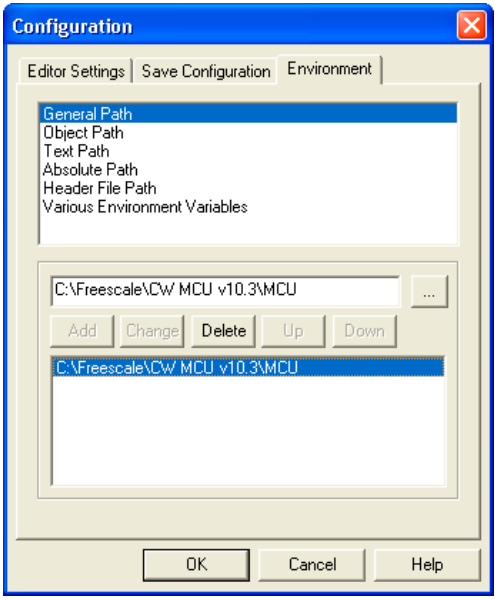
NOTE Most settings are stored only in the project configuration file. The only exceptions are: The recently used configuration list and All settings in this dialog.

NOTE The linker configurations coexist in the same file as the project configuration of the shell. When the shell configures an editor, the linker can read this content out of the project file, if present. The project configuration file of the shell is named `project.ini`. This file name is therefore suggested (but not mandatory) for the linker.

Environment Tab

The **Environment** tab of the **Configuration** window, shown in the following figure, contains all of the options for configuring environment variables.

Figure 1.9 Environment Tab

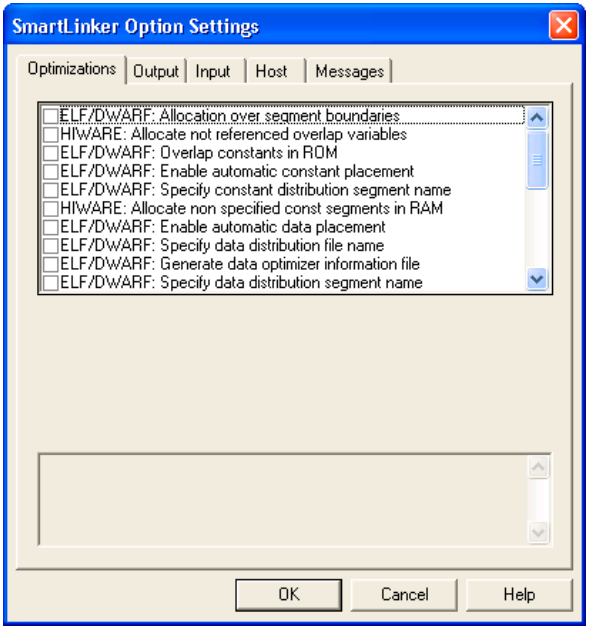


You can define the environment variables for the SmartLinker in the **Environment** tab. Click the **Add** button to add new entries, the **Change** button to change an existing entry, and the **Up** and **Down** button to change the order of the entries.

Option Settings Window

The five tabs of the Options Settings window, shown in the following figure, allow you to set or reset SmartLinker options.

Figure 1.10 Option Settings Window



In addition to the **Optimizations** tab, a tab is provided for each of the four option groups. The following table describes these four tabs.

Table 1.5 Option Settings Group Description

Group	Description
Optimizations	Lists options related to the optimization.
Output	Lists options related to the output files generation (what kind of files to generate).
Input	Lists options related to the input files.
Host	Lists host-specific options.
Messages	Lists options controlling the generation of error messages.

Set a SmartLinker option by checking its checkbox. To obtain a more detailed explanation about a specific option, select the option and then press the key *F1* or the help button. To select an option, click once on the option text. The option text is then highlighted.

When the window is opened, no options are selected. Pressing the *F1* key or the help button shows the help for this window.

Message Settings Window

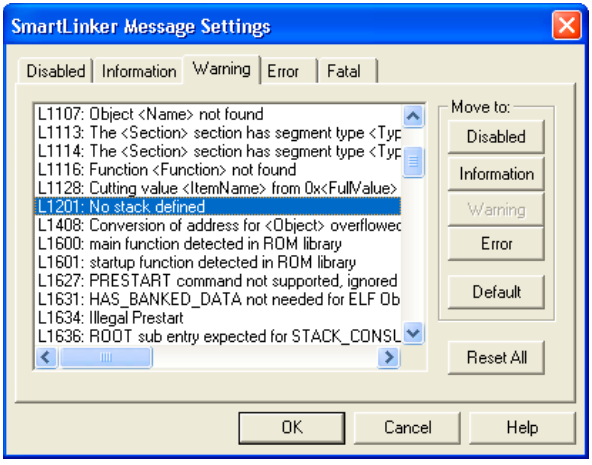
The **SmartLinker Message Settings** dialog box, shown in Figure 1.11, allows you to map messages to a different message class.

Depending on the message class, messages are shown in different colors in the main output area.

Each message has its own leading character ('L' for SmartLinker message) followed by a 4- or 5-digit number. This number allows an easy search for the message in both the manual and on-line help.

A tab is available for each error message class: Disabled, Information, Error, Warning and Fatal. To move a message from one class to another, highlight the message in the list box on the left side, then click the button on the right that corresponds to the new message class.

Figure 1.11 Message Settings Window



The following table describes the message classes available in the **SmartLinker Message Settings** dialog box.

Table 1.6 Message Class Description

Message Class	Description	Color
Disabled	Lists all disabled messages. SmartLinker does not display these messages.	None
Information	Lists all information messages. Information messages inform about action taken by the SmartLinker.	Green
Warning	Lists all warning messages. When such a message is generated, linking of the input file continues and an absolute file is generated.	Blue
Error	Lists all error messages. When an error message is generated, linking of the input file continues but no absolute file is generated.	Red
Fatal	Lists all fatal error messages. When a fatal message is generated, linking of the input file stops immediately. Fatal messages cannot be changed. They are only listed to call context help.	Dark Red

Changing the Message Class

You can configure your own mapping of messages in the different classes using one of the buttons located on the right side of the dialog box. Each button refers to a message class. To change the class associated with a message, select the message in the list box and then click the button associated with the class to which you want to move the message.

Example

To define the warning message **L1201: No stack defined** as an error message:

- Click the **Warning** tab to display the list of all warning messages.
- Click on the string **L1201: No stack defined** in the list box to select the message.
- Click **Error** to define this message as an error message.

NOTE Messages cannot be moved from or to the fatal error class.

NOTE The **Move to** buttons are active only when all selected messages can be moved. Selecting a message which cannot be moved to a specific group disables (grays) the corresponding **Move to** button.

To validate the modifications you have made in the error message mapping, close the **Message Settings** dialog box with the **OK** button. If you close it using the **Cancel** button, the previous message mapping remains valid.

To reset messages to their default, select the messages and click the **Default** button. To reset all messages to the default, click the **Reset All** button.

About Dialog Box

Open the **About SmartLinker** dialog box by selecting the **Help > About** from the menu bar.

The **About SmartLinker** dialog box contains extensive information. The main linker version appears separately on top of the dialog box and the current directory and the versions of subparts of the linker are shown.

In addition, the **About SmartLinker** dialog box contains all information needed to create a permanent license. You can *copy* and *paste* the contents of the **About SmartLinker** dialog box using standard Windows® commands.

Click **OK** to close the dialog box.

During a linking session, the versions of linker subparts cannot be requested. They are displayed only when the linker currently is not processing.

Retrieving Information about an Error Message

You can access information about each message displayed in the list box. Select the message in the list box and then click **Help** button or the *F1* key. An information box opens, which contains a more detailed description of the error message as well as a small example of code producing it. If you select several messages, help for the first is shown. Pressing the *F1* key or the **Help** button when no message is selected shows the help for the first message in the list box.

Specifying the Input File

There are different ways to specify the input file to link. During linking of a source file, the options are set according to the dialog box configuration settings and the options specified on the command line.

Before starting to link a file, make sure you have associated a working directory with your linker. You can use the following methods to link an input file:

- Using the Command Line in the Toolbar to Link
- Using File > Link

- Use Drag and Drop

Using the Command Line in the Toolbar to Link

You can link the input files using the **SmartLinker command line** in the toolbar for, Linking a New File and Linking a Previously Linked File.

Linking a New File

Enter the file name and additional SmartLinker options in the **SmartLinker command line** in the toolbar. The specified file links as soon as you select the **Link** button in the toolbar or press the *Enter* key.

Linking a Previously Linked File

To link a previously linked file in the **SmartLinker command line**:

1. Open the drop down menu in the **SmartLinker command line** to display the previously executed commands.
2. Select a command by clicking on it.
3. Selected command appears in the **SmartLinker command line**.
4. Click the **Link** button in the toolbar to link specified file.

The specified file is linked.

Using File > Link

You can link an input file using **File > Link**, as stated below:

1. Select **File > Link** from the main window menu bar to display **Select File to Link**, a standard open file dailog box with the list of all the `prm` files in the project directory.
2. Browse to get the name of the file you want to link.
3. Select the desired file.
4. Click **Open** in the **Select File to Link** dialog box to link the selected file.

The selected file is linked.

Use Drag and Drop

You can drag a file name from an external software (for example the File Manager/ Explorer) and drop it into the SmartLinker window. The dropped file links as soon as you

release the mouse button in the SmartLinker window. If a file being dragged is a `*.ini` file, it is considered a configuration file and loads immediately but does not link.

NOTE To link a `prm` file with the extension `*.ini` use one of the other methods. Do not use drag and drop.

Message/Error Feedback

After linking there are several ways to check where different errors or warnings have been detected. The following listing shows the default format of the error message.

Listing 1.1 Default Format of the Error Message

```
>>in <FileName>, line <line number>, col <column number>, pos
<absolute position in file>
<Portion of code generating the problem>
<message class><message number>: <Message string>
```

The following listing shows an example of error message.

Listing 1.2 Example Error Message

```
>> in "placemen\tstpla8.prm", line 23, col 0, pos 668
  fpm_data_sec              INTO  MY_RAM2;

END

^
ERROR L1110: MY_RAM2 appears twice in PLACEMENT block
```

See also SmartLinker options for different message formats.

Use SmartLinker Window Information

Once you link a file, the SmartLinker window content area displays the list of all the errors or warnings detected.

Use your usual editor to open the source file and correct the errors.

Using User-Defined Editor

You must first configure the editor for *Error Feedback* in the **Editor Settings** tab in the **Configuration** dialog box. Error feedback performance varies, depending on whether you can start the editor with a line number.

Line Number Specified on Command Line

You can start an editor like WinEdit, V95 or higher, or Codewright with a line number in the command line. When these editors are configured correctly, you can activate them automatically by double clicking on an error message. The configured editor starts, the file where the error occurred opens automatically, and places the cursor on the line where the error was detected.

Line Number Cannot Be Specified on Command Line

An editor like WinEdit V3.1 or lower, Notepad, or Wordpad cannot be started with a line number in the command line. When these editors are configured correctly, you can open them automatically by double clicking on an error message. The configured editor starts and the file where the error occurs opens automatically. To scroll to the position where the error was detected:

1. Open the assembler again.
2. Click the line on which the message was generated. This highlights the line on the screen.
3. Copy the line in the clipboard by pressing **Ctrl + C**.
4. Open the editor again.
5. Select **Search > Find**, the standard **Find** dialog box appears.
6. Copy the content of the clipboard in the Edit box by pressing **Ctrl + V**.
7. Click **Forward** to jump to the position where the error was detected.

The line with the error is highlighted in the editor.

2

SmartLinker Files

This chapter describes the input and output files used by the SmartLinker.

Input Files

This section describes the input files used by the SmartLinker.

Parameter File

The linker takes any file as input; it does not require the file name to have a special extension. However, we suggest that all your parameter file names have extension `.prm`. The SmartLinker searches for the parameter file first in the project directory and then in the directories enumerated in `GENPATH` (see GENPATH: Define Paths to Search for Input Files). The parameter file must be a strict ASCII text file.

Object File

The link parameter file entry `NAMES` specifies the list of files to be linked. Specify additional object files with the `-Add` option (see -Add: Additional Object/Library File).

The linker looks for the object files first in the project directory, then in the directories enumerated in `OBJPATH` (see OBJPATH: Object File Path) and finally in the directories enumerated in `GENPATH` (see GENPATH: Define Paths to Search for Input Files). The binary files must be valid Freescale, ELF\DWARF 1.1 or 2.0 objects, absolute, or library files.

Output Files

This section describes the output files used by the SmartLinker.

Absolute Files

After a successful linking session, the SmartLinker generates an absolute file containing the target code as well as some debugging information. The SmartLinker writes this file to the directory given in the environment variable ABSPATH (see ABSPATH: Absolute Path). If ABSPATH contains more than one path, SmartLinker writes the absolute file in the first directory given; if ABSPATH is not set at all, SmartLinker writes the absolute file in the directory in which the parameter file was found. Absolute files always get the extension .abs.

S-Record Files

After a successful linking session, and if the -B option is present (see -B: Generate S-Record file (SmartLinker)), the SmartLinker generates an S-Record file, which can be burnt into an EPROM. This file contains information stored in all the READ_ONLY sections in the application. The extension for the generated S-Record file depends on the setting from the SRECORD variable (see SRECORD: S Record File Format).

- If SRECORD = S1, the S Record file gets the extension .s1.
- If SRECORD = S2, the S Record file gets the extension .s2.
- If SRECORD = S3, the S Record file gets the extension .s3.
- If SRECORD is not set, the S Record file gets the extension .sx.

The SmartLinker writes this file to the directory given in the ABSPATH environment variable (see ABSPATH: Absolute Path). If ABSPATH contains more than one path, the SmartLinker writes the S-record file in the first directory given; if ABSPATH is not set at all, the SmartLinker writes the S-record file in the directory in which the parameter file was found.

Map Files

After a successful linking session, the SmartLinker generates a map file containing information about the link process. The SmartLinker writes this file to the directory given in the TEXTPATH environment variable (see TEXTPATH: Text Path). If TEXTPATH contains more than one path, SmartLinker writes the map file in the first directory given; if TEXTPATH is not set at all, SmartLinker writes the map file in the directory in which the parameter file was found. Map files always get the extension .map.

Dependency Information

The linker provides useful dependency information in the generated map file. The dependency information shows which objects are used by other objects (functions, variables, etc.).

The dependency information in the linker `map` file is based on fixups/relocations. That is if an object references another object by a relocation, the linker adds this object to the dependency list.

Listing 2.1 Dependency Information Example

```
int hrs;
void tim(void) {
  hrs = 0;
}
```

In `tim` in the above example, the compiler has generated a fixup/relocation to the object `hrs`, so the linker knows that `tim` uses `hrs`. For the next example, `tim` references `tim` itself, because in `tim` there is a fixup to `tim` as well:

Listing 2.2 Dependency Information Example2

```
void tim(void) {
  tim();
}
```

Now the compiler might perform a common code optimization, in which the compiler collects common code into a function to reduce the code size.

NOTE You can switch off this compiler common code optimization.

Listing 2.3 Dependency Information Example3

```
void tim(void) {
  if (hrs == 3) hrs = 0;
  ...
  if (hrs == 3) hrs = 0;
}
```

The compiler may optimize this to:

Listing 2.4 Dependency Information Example4

```
int tim(void) {
  bsr tim:Label:
  ...
  tim_Label:
    if (hrs == 3) hrs = 0;
    return;
```

```
}
```

Here the compiler generates a local branch inside `tim` to a local subroutine. This produces a relocation/fixup into `tim`, that is, for the linker, `tim` references itself.

Error Listing File

If the SmartLinker detects any errors, it creates an error listing file instead of an absolute file. The SmartLinker generates this file into the directory in which the source file was found (see ERRORFILE: Error File Name Specification).

If the SmartLinker window is open, it displays the full path of all binary files read. In case of error, the position and file name where the error occurs appears in the SmartLinker window.

If you started the SmartLinker from WinEdit (with `%f` given on the **SmartLinker command line**) or Codewright (with `%b%e` given on the **SmartLinker command line**), SmartLinker does not generate this error file. Instead it writes the error messages in a special format into a file called `EDOUT`, using the Microsoft format by default. Use WinEdit's **Next Error** or Codewright's **Find Next Error** command to see both error positions and the error messages.

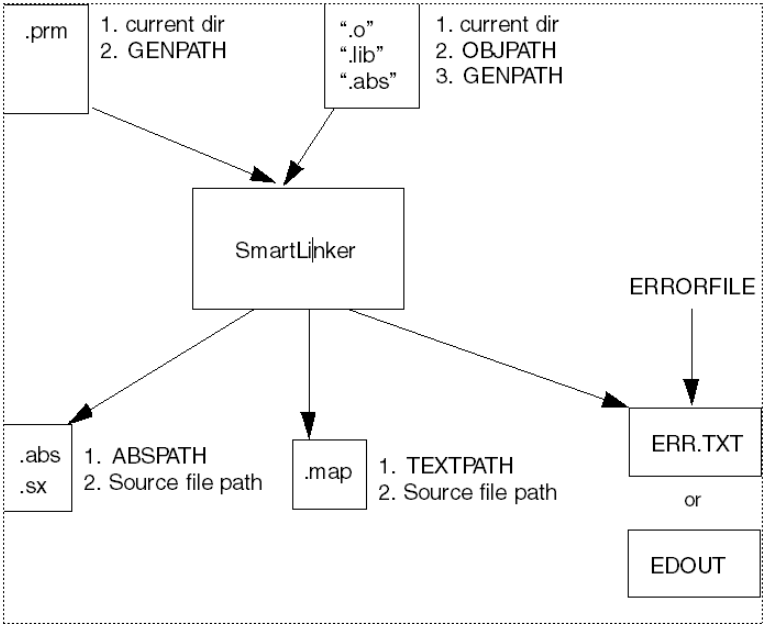
Interactive Mode (SmartLinker Window Open)

If `ERRORFILE` is set, the SmartLinker creates a message file named as specified in this environment variable. If `ERRORFILE` is not set, the SmartLinker generates a default file named `ERR.TXT` in the current directory.

Batch Mode (SmartLinker Window Not Open)

If `ERRORFILE` is set, the SmartLinker creates a message file named as specified in this environment variable. If `ERRORFILE` is not set, the SmartLinker generates a default file named `EDOUT` in the current directory.

Figure 2.1 Error File Creation



3

Linking Issues

Object Allocation

This chapter describes the whole object allocation PLACEMENT Block.

The SEGMENTS Block (ELF)

The `SEGMENTS` Block is optional. It increases the readability of the linker input file and allows you to assign meaningful names to contiguous memory areas on the target board. Memory within such an area shares common attributes:

- Segment Qualifier
- Segment Alignment
- Segment Fill Pattern

You can define two types of segments:

- Physical Segments
- Virtual Segments

Physical Segments

Physical segments are closely related to hardware memory areas.

For example, there may be one `READ_ONLY` segment for each bank of the target board ROM area and another segment covering the whole target board RAM area.

For a simple memory model, you can define a segment for the RAM area and another segment for the ROM area.

Listing 3.1 Physical Segments Example

```
LINK   test.abs
NAMES  test.o startup.o END
SEGMENTS
  RAM_AREA = READ_WRITE 0x00000 TO 0x07FFF;
  ROM_AREA = READ_ONLY  0x08000 TO 0x0FFFF;
END
```

```
PLACEMENT
    DEFAULT_RAM         INTO RAM_AREA;
    DEFAULT_ROM         INTO ROM_AREA;
END

STACKSIZE 0x50
```

For banked memory model you can define a segment for the RAM area, another for the non-banked ROM area and one for each target processor bank.

Listing 3.2 Physical Segments Example 2

```
LINK   test.abs
NAMES  test.o startup.o END

SEGMENTS
  RAM_AREA         = READ_WRITE 0x00000 TO 0x07FFF;
  NON_BANKED_AREA = READ_ONLY  0x0C000 TO 0x0FFFF;
  BANK0_AREA       = READ_ONLY  0x08000 TO 0x0BFFF;
  BANK1_AREA       = READ_ONLY  0x18000 TO 0x1BFFF;
  BANK2_AREA       = READ_ONLY  0x28000 TO 0x2BFFF;
END

PLACEMENT
    DEFAULT_RAM       INTO RAM_AREA;
    _PRESTART, STARTUP,
    ROM_VAR,
    NON_BANKED, COPY  INTO NON_BANKED_AREA;
    DEFAULT_ROM       INTO BANK0_AREA, BANK1_AREA,
                           BANK2_AREA;
END

STACKSIZE 0x50
```

Virtual Segments

You can split a physical segment into several virtual segments, allowing a better structuring of object allocation and allowing you to use some processor-specific properties.

Considering a small memory model, you can define a segment for the direct page area, another one for the rest of the RAM area, and another one for the ROM area.

Listing 3.3 Virtual Segment Example

```
LINK   test.abs
```

```
NAMES  test.o startup.o END

SEGMENTS
  DIRECT_RAM = READ_WRITE 0x00000 TO 0x000FF;
  RAM_AREA   = READ_WRITE 0x00100 TO 0x07FFF;
  ROM_AREA   = READ_ONLY  0x08000 TO 0x0FFFF;
END

PLACEMENT
    myRegister         INTO DIRECT_RAM;
    DEFAULT_RAM        INTO RAM_AREA;
    DEFAULT_ROM        INTO ROM_AREA;
END

STACKSIZE 0x50
```

Segment Qualifier

Different qualifiers are available for segments. The following table describes the available qualifiers:

Table 3.1 Qualifiers and Descriptions

Qualifier	Description
READ_ONLY	Qualifies a segment that allow only read access. Initializes objects within the segment at application loading time.
READ_WRITE	Qualifies a segment that allows both read and write accesses. Initializes objects within such a segment at application startup.
NO_INIT	Qualifies a segment that allows both read and write accesses. Objects within such a segment remain unchanged during application startup. This qualifier may be used for segments referring to a battery-backed RAM. Sections placed in a NO_INIT segment should not contain any initialized variables (variable defined as `int c = 8`).
PAGED	Qualifies a segment that allows both read and write accesses. Objects within such a segment remain unchanged during application startup. Additionally, objects located in two PAGED segments may overlap. This qualifier is used for memory areas that require some user-defined page-switching mechanism. Sections placed in a PAGED segment should not contain any initialized variables (variable defined as `int c = 8`).

NOTE For debugging purposes you may want to load code into RAM areas. Because this code should be loaded at load time, qualify such areas as `READ_ONLY`. For the linker, `READ_ONLY` means that such objects are initialized at program load time. The linker does not know (and does not care) if at runtime the target code writes to a `READ_ONLY` area.

NOTE Anything located in a `READ_WRITE` segment is initialized at application startup time. Locate the application code which does this initialization and any initialization data (init, zero out, copy down) in a `READ_ONLY` section. Do not locate the application code and the initialization data in a `READ_WRITE` section. The program loader can, at program loading time, write the content of `READ_ONLY` sections into a RAM area.

NOTE If an application does not use any startup code to initialize `READ_WRITE` sections, then no such sections should be present in the `prm` file. Instead use `NO_INIT` sections.

Segment Alignment

The default alignment rule depends on the processor and memory model used. You can define your own alignment rule for a segment. The alignment rule defined for a segment block overrides the default alignment rules associated with the processor and memory model.

The alignment rule has the following format (see Table 3.2 for format information):

```
[defaultAlignment] {"["ObjSizeRange":"alignment"]"}
```

Table 3.2 Segment Alignment Format

Format Type	Definition
defaultAlignment	Alignment value for all objects which do not match the conditions of any range defined afterward.
ObjSizeRange	Defines a certain condition. The condition follows the form: • `size`: Applies to objects whose size is equal to `size`. • `< size`: Applies to objects whose size is less than `size`. • `> size`: Applies to objects whose size is greater than `size`. • `<= size`: Applies to objects whose size is less than or equal to `size`. • `>= size`: Applies to objects whose size is greater than or equal to `size` • From `size1` to `size2`: Applies to objects whose size is greater than or equal to `size1` and less than or equal to `size2`.
alignment	Defines the alignment value for objects matching the condition defined in the current alignment block (enclosed in square bracket).

Listing 3.4 Segment Alignment Example

```
LINK   test.abs
NAMES  test.o startup.o END

SEGMENTS
  DIRECT_RAM = READ_WRITE 0x00000 TO 0x000FF
               ALIGN 2 [< 2: 1];
  RAM_AREA   = READ_WRITE 0x00100 TO 0x07FFF
               ALIGN [1:1] [2..3:2] [>=4:4];
  ROM_AREA   = READ_ONLY  0x08000 TO 0x0FFFF;
END

PLACEMENT
    myRegister         INTO DIRECT_RAM;
    DEFAULT_RAM        INTO RAM_AREA;
    DEFAULT_ROM        INTO ROM_AREA;
END

STACKSIZE 0x50
```

The example above:

- Aligns objects in the DIRECT_RAM segment whose size is 1 byte on byte boundaries; aligns all other objects on 2-byte boundaries.
- Aligns objects in the RAM_AREA segment whose size is 1 byte on byte boundaries; aligns objects whose size is equal to 2 or 3 bytes on 2-byte boundaries; aligns all other objects on 4-byte boundaries.
- Default alignment rules apply in the ROM_AREA segment.

Segment Fill Pattern

The default fill pattern for code and data segment is the null character. You can choose to define your own fill pattern for a segment. The fill pattern definition in the segment block overrides the default fill pattern.

NOTE The fill pattern is used to fill up a segment to the segment end boundary.

Listing 3.5 Segment Fill Pattern Example

```
LINK   test.abs
NAMES  test.o startup.o END

SEGMENTS
  DIRECT_RAM = READ_WRITE 0x00000 TO 0x000FF
               FILL 0xAA;
  RAM_AREA   = READ_WRITE 0x00100 TO 0x07FFF
               FILL 0x22;
  ROM_AREA   = READ_ONLY  0x08000 TO 0x0FFFF;
END

PLACEMENT
    myRegister         INTO DIRECT_RAM;
    DEFAULT_RAM        INTO RAM_AREA;
    DEFAULT_ROM        INTO ROM_AREA;
END

STACKSIZE 0x50
```

The example above:

- Initializes alignment bytes between objects in DIRECT_RAM segment with 0xAA.
- Initializes alignment bytes between objects in RAM_AREA segment with 0x22.
- Initializes alignment bytes between objects in ROM_AREA segment with 0x00.

The SECTIONS Block (Freescale + ELF)

The segments block is optional but increases the readability of the linker input file. It allows you to assign meaningful names to contiguous memory areas on the target board. Memory within such an area share the Segment Qualifier attribute:

Two types of segments can be defined:

- Physical Segments
- Virtual Segments

Physical Segments

Physical segments are closely related to hardware memory areas. For example, there may be one `READ_ONLY` segment for each bank of the target board ROM area and another one covering the whole target board RAM area.

For a simple memory model you can define a segment for the RAM area and another one for the ROM area.

Listing 3.6 Physical Segments Example1

```
LINK   test.abs
NAMES  test.o startup.o END

SECTIONS
  RAM_AREA = READ_WRITE 0x00000 TO 0x07FFF;
  ROM_AREA = READ_ONLY  0x08000 TO 0x0FFFF;

PLACEMENT
    DEFAULT_RAM         INTO RAM_AREA;
    DEFAULT_ROM         INTO ROM_AREA;
END

STACKSIZE 0x50
```

For banked memory model you can define a segment for the RAM area, another for the non-banked ROM area and one for each target processor bank.

Listing 3.7 Physical Segments Example2

```
LINK   test.abs
NAMES  test.o startup.o END

SECTIONS
  RAM_AREA        = READ_WRITE 0x00000 TO 0x07FFF;
  NON_BANKED_AREA = READ_ONLY  0x0C000 TO 0x0FFFF;
```

```
   BANK0_AREA       = READ_ONLY  0x08000 TO 0x0BFFF;
   BANK1_AREA       = READ_ONLY  0x18000 TO 0x1BFFF;
   BANK2_AREA       = READ_ONLY  0x28000 TO 0x2BFFF;

PLACEMENT
    DEFAULT_RAM        INTO RAM_AREA;
    _PRESTART, STARTUP,
    ROM_VAR,
    NON_BANKED, COPY   INTO NON_BANKED_AREA;
    DEFAULT_ROM        INTO BANK0_AREA, BANK1_AREA,
                            BANK2_AREA;

END
STACKSIZE 0x50
```

Virtual Segments

A physical segment may be split into several virtual segments, allowing better structuring of object allocation and also allowing the user to take advantage of some processor-specific properties.

Considering a small memory model, you can define a segment for the direct page area, another for the rest of the RAM area and another for the ROM area.

Listing 3.8 Virtual Segment Example

```
LINK   test.abs
NAMES  test.o startup.o END

SECTIONS
  DIRECT_RAM = READ_WRITE 0x00000 TO 0x000FF;
  RAM_AREA   = READ_WRITE 0x00100 TO 0x07FFF;
  ROM_AREA   = READ_ONLY  0x08000 TO 0x0FFFF;

PLACEMENT
    myRegister         INTO DIRECT_RAM;
    DEFAULT_RAM        INTO RAM_AREA;
    DEFAULT_ROM        INTO ROM_AREA;
END

STACKSIZE 0x50
```

Segment Qualifier

The following table describes the available segment qualifiers.

Table 3.3 Qualifiers and Descriptions

Qualifier	Meaning
READ_ONLY	Qualifies a segment that allows only read accesses. Initializes objects within such a segment at application loading time.
CODE ELF only)	Qualifies a code segment in a Harvard architecture in the ELF object file format. For cores with Von Neumann Architecture (combined code and data address space), or for the Freescale object file format, use READ_ONLY instead.
READ_WRITE	Qualifies a segment that allows read and write accesses. Initializes objects within such a segment at application startup.
NO_INIT	Qualifies a segment that allows read and write accesses. Objects within such a segment remain unchanged during application startup. This qualifier may be used for segments referring to a battery-backed RAM. Sections placed in a NO_INIT segment should not contain any initialized variables (variable defined as int c = 8).
PAGED	Qualifies a segment that allows read and write accesses. Objects within such a segment remain unchanged during application startup. Additionally, objects located in two PAGED segments may overlap. This qualifier is used for memory areas, where some user-defined page-switching mechanism is required. Sections placed in a PAGED segment should not contain any initialized variables (variable defined as int c = 8).

NOTE For debugging purposes, you may want to load code into RAM areas. Because this code is loaded at load time, qualify such areas as READ_ONLY. For the linker, READ_ONLY means that such objects are initialized at program load time. The linker does not know (and does not care) if at runtime the target code writes to a READ_ONLY area.

NOTE Anything located in a READ_WRITE segment is initialized at application startup time. Locate the application code which does this initialization and any initialization data (init, zero out, copy down) in a READ_ONLY section. Do not locate the application code and the initialization data in a READ_WRITE section. The program loader can, at program loading time, write the content of READ_ONLY sections into a RAM area.

NOTE If an application does not use any startup code to initialize READ_WRITE sections, then no such sections should be present in the prm file. Instead use NO_INIT sections.

PLACEMENT Block

The PLACEMENT block allows the user to physically place each section from the application in a specific memory area (segment). The sections specified in a PLACEMENT block may be linker-predefined sections or user sections specified in one of the source file building the application.

Organize data into sections:

- Increases application structuring
- Groups common-purpose data together
- Takes advantage of target processor-specific addressing mode

Specifying a List of Sections

When you specify several sections on a PLACEMENT statement, the linker allocates the sections in the order you specify.

Listing 3.9 Sequence Enumeration Example

```
LINK   test.abs
NAMES  test.o startup.o END

SECTIONS
  RAM_AREA   = READ_WRITE 0x00100 TO 0x002FF;
  STK_AREA   = READ_WRITE 0x00300 TO 0x003FF;
  ROM_AREA   = READ_ONLY  0x08000 TO 0x0FFFF;

PLACEMENT
    DEFAULT_RAM, dataSec1,
     dataSec2           INTO RAM_AREA;
    DEFAULT_ROM, myCode INTO ROM_AREA;
    SSTACK              INTO STK_AREA;
END
```

In this example:

- Inside the RAM_AREA segment, the linker allocates the objects defined in the .data section first, then the objects defined in dataSec1 section, then objects defined in dataSec2 section.

- Inside the ROM_AREA segment, the linker allocates objects defined in .text section first, then the objects defined in section myCode.

NOTE Since the linker is case sensitive, the name of the section names specified in the PLACEMENT block must be valid predefined or user-defined section names. For the linker, DataSec1 and dataSec1 are two different sections.

Specifying a List of Segments

When you specify several segments in a PLACEMENT statement, the segments are used in the order they are listed. The linker performs allocation in the first segment in the list until this segment is full. Then allocation continues on the next segment in the list, and so on, until all objects are allocated.

Listing 3.10 Sequence Enumeration - Further Example

```
LINK   test.abs
 NAMES  test.o startup.o END

 SECTIONS
   RAM_AREA         = READ_WRITE 0x00100 TO 0x002FF;
   STK_AREA         = READ_WRITE 0x00300 TO 0x003FF;
   NON_BANKED_AREA = READ_ONLY  0x0C000 TO 0x0FFFF;
   BANK0_AREA       = READ_ONLY  0x08000 TO 0x0BFFF;
   BANK1_AREA       = READ_ONLY  0x18000 TO 0x1BFFF;
   BANK2_AREA       = READ_ONLY  0x28000 TO 0x2BFFF;

 PLACEMENT
     DEFAULT_RAM         INTO RAM_AREA;
     SSTACK              INTO STK_AREA;
     _PRESTART, STARTUP,
     ROM_VAR,
     NON_BANKED, COPY    INTO NON_BANKED_AREA;
     DEFAULT_ROM         INTO BANK0_AREA, BANK1_AREA,
                             BANK2_AREA;
MY_SECTION INTO BANK0_AREA;
 END
```

This example allocates functions implemented in the .text section first, into segment BANK0_AREA. When there is not enough memory available in this segment, allocation continues in segment BANK1_AREA, then in BANK2_AREA. After .text section allocation to BANK0_AREA segment, MY_SECTION section objects are allocated to remainder memory of BANK0_AREA segment.

NOTE As the linker is case sensitive, the name of the segments specified in the `PLACEMENT` block must be valid segment names defined in the `SEGMENTS` block. For the linker, `Ram_Area` and `RAM_AREA` are two different segments.

Allocating User-Defined Sections (ELF)

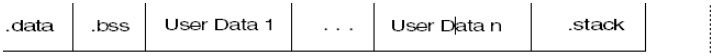
All sections do not need to be enumerated in the placement block. Segment allocation of sections which do not appear in the PLACEMENT Block depends on the section type.

- Sections containing data are allocated next to the `.data` section.
- Sections containing code, constant variables or string constants are allocated next to the section `.text`.

Allocation in the segment where `.data` is placed occurs as follows:

- Allocates objects from `.data` section
- Allocates objects from section `.bss` (if `.bss` is not specified in the `PLACEMENT` block).
- Allocates objects from the first user-defined data section not specified in the `PLACEMENT` block.
- Allocates objects from the next user-defined data section not specified in the `PLACEMENT` block. (This continues until all user-defined data sections are allocated.)
- If the section `.stack` is not specified in the `PLACEMENT` block and is defined with a `STACKSIZE` command, the stack is allocated then.

Figure 3.1 User-Defined Sections (.stack)

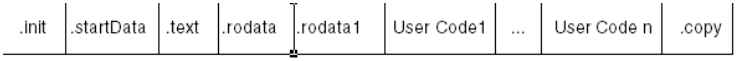


Allocation in the segment where `.text` is placed occurs as follows:

- Allocates objects from `.init` section (if `.init` is unspecified in the `PLACEMENT` block).
- Allocates objects from `.startData` section (if `.startData` is unspecified in the `PLACEMENT` block).
- Allocates objects from `.text` section.
- Allocates objects from `.rodata` section (if `.rodata` is unspecified in the `PLACEMENT` block).

- Allocates objects from `.rodata1` section (if `.rodata1` is unspecified in the `PLACEMENT` block).
- Allocates objects from the first user-defined code section which is unspecified in the `PLACEMENT` block.
- Allocates objects from the next user defined code section, which is unspecified in the `PLACEMENT` block. (This continues until all user defined code sections are allocated.)
- Allocates objects from `.copy` section (if `.copy` is unspecified in the `PLACEMENT` block).

Figure 3.2 User-Defined Sections (.txt)



Allocating User-Defined Sections (Freescale)

All sections do not need to be enumerated in the placement block. The segments where sections, which do not appear in the `PLACEMENT` block, are allocated depends on the type and attributes of the section. The Linker allocates these segments as follows:

- Sections containing code next to the `DEFAULT_ROM` section.
- Sections containing constants only next to the `DEFAULT_ROM` section. Change this behavior using the `-CRam` option (see -CRam: Allocate Non-specified Constant Segments in RAM (ELF)).
- Sections containing string constants next to the `DEFAULT_ROM` section.
- Sections containing data next to the section `DEFAULT_RAM`.

Allocation in the segment where `DEFAULT_RAM` is placed occurs as follows:

- Allocates objects from `DEFAULT_RAM` section
- If the `-CRam` option is specified, allocates objects from `ROM_VAR` section, unless `ROM_VAR` is mentioned in the `PLACEMENT` block.
- Allocates objects from user-defined data sections, which are not specified in the `PLACEMENT` block. If `-CRam` option is specified, allocates constant sections together with non-constant data sections.
- If the `SSTACK` section is not specified in the `PLACEMENT` block and is defined with a `STACKSIZE` command, allocates the stack then.

Figure 3.3 User Defined Sections (DEFAULT_RAM)

Allocation in the segment where DEFAULT_ROM is placed occurs as follows:

- Allocates objects from `_PRESTART` section (if `_PRESTART` is not specified in the `PLACEMENT` block).
- Allocates objects from `STARTUP` section (if `STARTUP` is not specified in the `PLACEMENT` block).
- Allocates objects from `ROM_VAR` section (if `ROM_VAR` is not specified in the `PLACEMENT` block). If `-CRam` option is specified, allocates `ROM_VAR` in the RAM.
- Allocates objects from `SSTRING` (string constants) section (if `SSTRING` is not specified in the `PLACEMENT` block).
- Allocates objects from `DEFAULT_ROM` section
- Allocates objects from all user-defined code sections and constant data sections, which are not specified in the `PLACEMENT` block.
- Allocates objects from `COPY` section (if `.copy` is not specified in the `PLACEMENT` block).

Figure 3.4 User Defined Sections (DEFAULT_ROM)

Initializing Vector Table

Use the `VECTOR` command to perform vector table initialization.

VECTOR Command

This command is specially defined to initialize the vector table.

Use the syntax:

```
VECTOR <Number>
```

In this case, the linker allocates the vector depending on the target CPU. The vector number zero is usually the reset vector, but depends on the target. The linker contains the default start location of the vector table for each target supported.

You can also use the syntax:

```
VECTOR ADDRESS
```

The size of the entries in the vector table depend on the target processor.

The following table describes the VECTOR command syntax.

Table 3.4 VECTOR Command Syntax and Descriptions

Command	Description
`VECTOR ADDRESS 0xFFFE 0x1000`	Indicates that the value `0x1000` must be stored at address `0xFFFE`
`VECTOR ADDRESS 0xFFFE FName`	Indicates that the address of the function `FName` must be stored at address `0xFFFE`.
`VECTOR ADDRESS 0xFFFE FName OFFSET 2`	Indicates that the address of the function `FName` incremented by 2 must be stored at address `0xFFFE`

The last syntax may be very useful when working with a common interrupt service routine.

Smart Linking (ELF)

Because of smart linking, only the objects referenced are linked with the application. The application entry points are:

- The application `init` function
- The `main` function
- The function specified in a `VECTOR` command

Smart linking automatically links all previously enumerated entry points and the objects they referenced with the application.

You can specify additional entry points using the `ENTRIES` command (see ENTRIES: List of Objects to Link with Application) in the `prm` file.

Mandatory Linking of an Object

You can choose to link some non-referenced objects in this application. This may be useful for ensuring that a software version number is linked with the application and stored in the final product EPROM.

This may also be useful for ensuring that a vector table which has been defined as a constant table of function pointers, is linked with the application.

Listing 3.11 Mandatory Linking of an Object Example

```
ENTRIES
  myVar1 myVar2 myProc1 myProc2
END
```

This example specifies the variables `myVar1` and `myVar2` as well as the function `myProc1` and `myProc2` as additional entry points in the application.

NOTE As the linker is case sensitive, the name of the objects specified in the `ENTRIES` block must be objects defined somewhere in the application. For the linker, `MyVar1` and `myVar1` are two different objects.

Mandatory Linking of all Objects Defined in Object File

You can choose to link all objects defined in a specified object file in your application.

Listing 3.12 Mandatory Linking from All Objects Example

```
ENTRIES
  myFile1.o:* myFile2.o:*
END
```

This example specifies all the objects (functions, variables, constant variables or string constants) defined in file `myFile1.o` and `myFile2.o` as additional entry points in the application.

Switching OFF Smart Linking for the Application

You can choose to switch OFF smart linking. All objects are linked in the application.

Listing 3.13 Switching Off SmartLinking Example

```
ENTRIES
  *
END
```

This example switches OFF smart linking for the whole application. That means that all objects defined in one of the binary files building the application are linked with the application.

Smart Linking (Freescale + ELF)

Because of smart linking, only the objects referenced are linked with the application. The application entry points are:

- The application `init` function
- The `main` function
- The function specified in a `VECTOR` command.

The SmartLinker automatically links all previously enumerated entry points and the objects they referenced with the application.

You can specify additional entry points using the `ENTRIES` command (see ENTRIES: List of Objects to Link with Application) in the `prm` file.

Mandatory Linking from an Object

You can choose to link some non-referenced objects in your application. This may be useful for ensuring that a software version number is linked with the application and stored in the final product EPROM.

This may also be useful for ensuring that a vector table, which has been defined as a constant table of function pointers, is linked with the application.

Listing 3.14 Mandatory Linking from an Object Example

```
ENTRIES
  myVar1 myVar2 myProc1 myProc2
END
```

The example above specifies the variables `myVar1` and `myVar2` as well as the function `myProc1` and `myProc2` as additional entry points in the application

NOTE As the linker is case sensitive, the name of the objects specified in the `ENTRIES` block must be objects defined somewhere in the application. For the linker, `MyVar1` and `myVar1` are two different objects.

Mandatory Linking from all Objects Defined in a File

You can choose to link all objects defined in a specified object file in your application. For that purpose, you need only to specify a plus (+) sign after the name of the module in the `NAMES` block.

Listing 3.15 Mandatory Linking from All Objects Example:

```
NAMES
  myFile1.o+ myFile2.o+ start.o ansi.lib
END
```

This example specifies all the objects (functions, variables, constant variables or string constants) defined in file `myFile1.o` and `myFile2.o` as additional entry points in the application.

Binary Files Building an Application (ELF)

You can specify the names of the binary files building an application in the `NAMES` block or in the `ENTRIES` block. Usually a `NAMES` block is sufficient.

NAMES Block

Usually you list all the binary files building the application in the `NAMES` block. You may specify additional binary files using the `-Add` option (see -Add: Additional Object/ Library File). If you specify all binary files by the command line option `-add`, then you must specify an empty `NAMES` block (just `NAMES END`).

Listing 3.16 Names Block Example

```
NAMES
  myFile1.o myFile2.o
END
```

In this example, the binary files `myFile1.o` and `myFile2.o` build the application.

ENTRIES Block

If you specify a file name in the `ENTRIES` block, the linker considers the corresponding file as part of the application, even if it does not appear in the `NAMES` block. The file specified in the `ENTRIES` block may also be present in the `NAMES` block. Names from absolute, ROM library, or library files are not allowed in the `ENTRIES` block.

Listing 3.17 Entries Block Example

```
LINK    test.abs
NAMES   test.o startup.o END

SEGMENTS
```

```
  DIRECT_RAM = READ_WRITE 0x00000 TO 0x000FF;
  STK_AREA   = READ_WRITE 0x00200 TO 0x002FF;
  RAM_AREA   = READ_WRITE 0x00300 TO 0x07FFF;
  ROM_AREA   = READ_ONLY  0x08000 TO 0x0FFFF;
END

PLACEMENT
    myRegister         INTO DIRECT_RAM;
    DEFAULT_RAM        INTO RAM_AREA;
    DEFAULT_ROM        INTO ROM_AREA;
    SSTACK             INTO STK_AREA;
END

ENTRIES
  test1.o:* test.o:*
END
```

In this example, the file `test.o`, `test1.o` and `startup.o` build the application. All objects defined in the module `test1.o` and `test.o` will be linked with the application.

Binary Files Building an Application (Freescale)

You may specify the names of the binary files building an application in the `NAMES` block or in the `ENTRIES` block. Usually a `NAMES` block is sufficient.

NAMES Block

Usually you list all the binary files building the application in the `NAMES` block. You may specify additional binary files using the `-Add` option. If you specify all binary files using the command line option `-Add`, then you must specify an empty `NAMES` block (just `NAMES END`).

Listing 3.18 Names Block Example

```
NAMES
  myFile1.o myFile2.o
END
```

In this example, the binary files `myFile1.o` and `myFile2.o` build the application.

Allocating Variables in OVERLAYS

When your application consists of two distinct parts (or execution units) which never runs at the same time, you can use the linker to overlap the global variables of both parts. To do this in your application source files, you must:

- Define the global variable from the different parts in separate data segments. Do not use the same segment for both execution units.
- Initialize the global variables in both execution units using assignments in the application source code. Do not define global variables with the initializer.

In the `prm` file, you can then define two distinct memory areas with attribute `PAGED`. Memory areas with `PAGED` attributes are not initialized during startup. For this reason they cannot contain any variable defined with the initializer. The linker will not perform any overlap check on `PAGED` memory areas.

The example shown in Listing 3.19 illustrates this.

In your source code support you have `APPL_1` and `APPL_2`, as two execution units:

- All global variables from `APPL_1` are defined in segment `APPL1_DATA_SEG`
- All global variables from `APPL_2` are defined in segment `DEFAULT_RAM` and `APPL2_DATA_SEG`

The `prm` file looks as follows:

Listing 3.19 .prm File Example

```
LINK test.abs

NAMES  test.o appl1.o appl2.o startup.o END

SECTIONS
    MY_ROM    = READ_ONLY  0x800 TO 0x9FF;
    MY_RAM_1  = PAGED      0xA00 TO 0xAff;
    MY_RAM_2  = PAGED      0xA00 TO 0xAff;
    MY_STK    = READ_WRITE 0xB00 TO 0xBFF;

PLACEMENT
    DEFAULT_ROM       INTO  MY_ROM;
    DEFAULT_RAM,
    APPL2_DATA_SEG    INTO  MY_RAM_2;
    APPL1_DATA_SEG    INTO  MY_RAM_1;
    SSTACK            INTO  MY_STK;  /* Stack cannot be allocated in a
PAGED memory area. */
END
```

Overlapping Locals

This section is only for targets which handle allocated local variables like global variables at fixed addresses.

Some small targets do not have a stack for local variables, so the compiler uses pseudo-static objects for local variables. In contrast to other targets which allocate such variables on the stack, the linker must allocate these variables. On the stack, multiple local variables are automatically allocated at the same address at different times. The linker implements a similar overlapping scheme to save memory for local variables.

Listing 3.20 Overlapping Locals Example

```
void f(void) { long fa; ....; }
void g(void) { long ga; ....; }
void main(void) { long lm; f(); g(); }
```

In this example, the functions `f` and `g` are never active at the same time, therefore the local variables `fa` and `ga` can be allocated at the same address.

NOTE When local variables are allocated at fixed addresses, the resulting code is not reentrant. Each function must be called only once. Take special care with interrupt functions: they must not call any function which might be active at the interrupt time. To be on the safe side, interrupt functions usually use a different set of functions than non-interrupt functions.

NOTE To the linker, parameter and spill objects are the same as local variables. All these objects are allocated together.

The linker analyzes the call graph of one root function at a time and allocates all local variables used by all dependent functions at this time. Variables depending on different root functions are allocated non-overlapping except in the case of an `OVERLAP_GROUP` (ELF).

Algorithm

The algorithm for the overlap allocation is quite simple:

1. If current object depends on other objects, first allocate the dependents.
2. Calculate the maximum address used by any dependent object. If none exist, use the base reserved for the current root.
3. Allocate all locals starting at the maximum.

This algorithm is called for all roots. The base of the root is first calculated as the maximum used so far.

Listing 3.21 Algorithm Example

```
void g(long g_par)  { }
void h(long l_par)  { }
void main(void)  {
  char ch;
  g(1);
  h(2);
}
void interrupt 1 inter(void) {
  long inter_loc;
}
```

The function `main` is a root because it is the application main function and `inter` is a root because it is called by an interrupt.

Listing 3.22 Algorithm Object File Format

```
...
SECTIONS
...
  OVERLAP_RAM = NO_INIT 0x0060 TO 0x0068;
...
PLACEMENT
...
    _OVERLAP          INTO OVERLAP_RAM;
...
END
```

NOTE In the ELF object file format the name `_OVERLAP` is a synonym for the `.overlap` segment.

Table 3.5 Algorithm Object File Format

0x60	0x61	0x62	0x63	0x64	0x65	0x66	0x67	0x68
g_par				ch	inter_loc			
l_par								

main starts the algorithm. As h and g depend on main, their parameters g_par and l_par are allocated starting at address 0x60 in the _OVERLAP segment. Next the local ch is allocated at 0x64 because all lower addresses are already used by dependents. After main finishes, the base for the second root is calculated as 0x65, where inter_loc is also allocated.

The following items are considered as root points for the overlapping allocation in the ELF object file format:

- Objects specified in a DEPENDENCY ROOT block
- Objects specified in a OVERLAP_GROUP block
- Application main function (specified with prm file entry MAIN) and application entry point (specified with prm file entry INIT)
- Objects specified in a ENTRIES block
- Absolute objects
- Interrupt vectors
- All objects in non-SmartLinked object files

NOTE The main function (main) and the application entry point (_Startup) are implicitly defined as one OVERLAP_GROUP. In the startup code delivered with the compiler, this saves about *8 bytes* because the locals of Init, Copy, and main overlap. When _Startup itself changes, it needs locals which must be active over the call to main. Define the _Startup function as a single entry in an OVERLAP_GROUP: OVERLAP_GROUP _Startup END

The overlap _OVERLAP section (in ELF, this is also named .overlap) must be allocated in a NO_INIT area. The _OVERLAP section cannot be split into several areas.

Name Mangling for Overlapping Locals

When parameters are passed on the stack, the linker performs caller and callee argument matching by their stack position. For overlapped locals (which include parameters not passed in registers as well), the linker does the matching using the parameter name.

Consider the following example:

Listing 3.23 Name Mangling for Overlapping Locals Example

```
void callee(long i);
void caller(void) {
  callee(1);
}
void callee(long k) {
```

```
}
```

The name `i` of the `callee` declaration does not match the name used in the definition. Actually, the declaration might not specify a name at all. Since the link between the `caller` and `callee` argument uses the name, both must use the same name. Because of this, the compiler generates an artificial name for the callee's parameter: `_calleep0`. The compiler builds this name starting with an underscore (_), appending the function name, appending a `p` and finally the argument number.

NOTE In ELF, there is a second name mangling needed to encode the name of the defining function into its name (see Name Mangling in ELF Object File Format).

Compiler users do not need to know about the name mangling at all. The compiler does it for them automatically.

However, to write functions with overlapping locals in assembler, you must do the name mangling yourself. This is especially important if you are calling C functions from assembler code or assembler functions from C code.

Name Mangling in ELF Object File Format

The ELF Object File Format has no predefined way to specify the function to which an actual parameter belongs, so the compiler does some special name mangling. This adds the function name into the link time name.

In ELF, the name is built the following way:

- If the object is a function parameter, use a `p` followed by the argument number, instead of the object name given in the source file.
- Add the prefix `__OVL_`
- If the function name contains a underscore (_), add the number of characters of the function name followed by a underscore (_). Add nothing if the function name does not contain an underscore.
- Add the function name.
- Add an underscore (_).
- If the object name contains a underscore (_), add the number of characters of the object, followed by one underscore (_). Add nothing if the object name does not contain an underscore.
- Add the object name.

The following listing shows an ELF example.

Listing 3.24 ELF Example

```
    void f(long p) {
      char a;
      char b_c;
    }
```

This generates the following mangled names, as shown in the following listing:

Listing 3.25 Output Generated

```
  p:    "__OVL_f_p0"    (HIWARE format: "_fp0")
  a:    "__OVL_f_a"     (HIWARE format: "a")
b_c:    "__OVL_f_3_b_c" (HIWARE format: "b_c")
```

Defining a Function with Overlapping Parameters in Assembler

This section covers advanced topics which are important only if you plan to write assembler functions using a C calling convention with overlapping parameters.

For example, to define the `callee` function:

Listing 3.26 Defining Callee Function Example

```
void callee(long k) {
  k= 0;
}
```

In assembler, we must first define the parameter with its mangled name. The parameter must be in the `_OVERLAP` section:

Listing 3.27 Defining Parameter Example

```
_OVERLAP: SECTION
callee_p1: DS 4
```

NOTE The `_OVERLAP` section is often allocated in a short segment. If so, use `_OVERLAP: SECTION SHORT` to specify this.

Next, define the function itself:

Listing 3.28 Defining Function Example

```
callee_code: SECTION
callee:
  CLEAR callee_p1,4
  RETURN
```

To avoid processor-specific examples, we assume that there is an assembler macro `CLEAR` which writes as many zero bytes as its second argument to the address specified by its first argument. The second macro `RETURN` generates a return instruction for the processor used. The implementation of these two macros are processor specific and not contained in this linker manual.

Finally, export the `callee` and its argument:

Listing 3.29 Exporting callee Example

```
 XDEF callee
 XDEF callee_p1
```

The following listing shows the whole example in one block.

Listing 3.30 Defining a Function with Overlapping Parameters in Assembler Example

```
;Processor specific macro definition, please adapt to your target
CLEAR:       MACRO
             ...
             ENDM

RETURN:      MACRO
             ...
             ENDM

_OVERLAP:    SECTION
callee_p1:   DS 4

callee_code: SECTION

callee:
             CLEAR callee_p1,4
             RETURN
; export function and parameter
             XDEF callee
             XDEF callee_p1
```

Additional Points to Consider

In the ELF format, the name of the `p1` parameter must be `_OVL_callee_p1` instead of `callee_p1`.

The following listing shows an example for ELF.

Listing 3.31 ELF Example

```
_OVERLAP:       SECTION
_OVL_callee_p1: DS 4

callee_code:    SECTION
callee:
                CLEAR _OVL_callee_p1,4
                RETURN
; export function and parameter
             XDEF callee
             XDEF _OVL_callee_p1
```

Put every function defined in assembler in a separate section, as a linker section containing code corresponds to a compiler function.

The following listing shows an example of two functions in one segment.

Listing 3.32 Two Functions in One Segment Example

```
             XDEF callee0
             XDEF callee1
_OVERLAP:    SECTION
loc0:        DS 4
loc1:        DS 4

code_seg: SECTION
callee0:
             CLEAR loc0,4
             RETURN
callee1:    ; ERROR function should be in separate segment
             CLEAR loc1,4
             RETURN
```

Because `callee0` and `callee1` are in the same segment, the linker treats them as if they were two entry points of the same function. This prevents `loc0` and `loc1` from overlapping and generating additional dependencies.

To correct the problem, put the two functions into separate segments, as shown in the following listing:

Listing 3.33 Two Functions in Seperate Segment Example

```
             XDEF callee0
             XDEF callee1
_OVERLAP:    SECTION
loc0:        DS 4
loc1:        DS 4

code_seg0: SECTION
callee0:
             CLEAR loc0,4
             RETURN
code_seg1: SECTION
callee1:
             CLEAR loc1,4
             RETURN
```

Exporting the function exports the corresponding parameter objects. Locals are usually not exported.

The following listing shows an example of an invalid non-exported parameter definition.

Listing 3.34 Invalid Non-Exported Parameter Definition Example

```
             XDEF callee
_OVERLAP:    SECTION
callee_p1:   DS 4

callee_code: SECTION

callee:
             CLEAR callee_p1,4
             RETURN
```

Because `callee_p1` is not exported, an external `caller` or `callee` will not use the correct parameter. (Actually, the application will not be able to link because of the unresolved external `callee_p1`).

To correct this, export `callee_p1` as well, as shown in the following listing):

Listing 3.35 Exporting callee_p1 Example

```
             XDEF callee
             XDEF callee_p1
_OVERLAP:    SECTION
callee_p1:   DS 4
```

```
callee_code: SECTION

callee:
             CLEAR callee_p1,4
             RETURN
```

Only use function parameters which are actually called. Do not use local variables of other functions. The assembler does not prevent the usage of locals, which is not possible in C. Such additional usages are not taken into account for the allocation and may not work as expected. As a rule, only access objects defined in the _OVERLAP section from one SECTION, unless the object is a parameter. Parameters can be safely accessed from all sections containing calls to the callee and from the section defining the callee.

The following listing shows an example of an invalid use of a local variable.

Listing 3.36 Invalid Use of a Local Variable Example

```
_OVERLAP:     SECTION
loc:          DS 4

callee0_code: SECTION
callee0:
             CLEAR loc,4 ; error:usage of local var loc from two functs
              RETURN

callee1_code: SECTION
callee1:
              CLEAR loc,4 ; error: usage of local var loc from two
functs
              RETURN
```

Instead, use two different locals for two different functions, as shown in the following listing:

Listing 3.37 Valid Use of a Local Variable Example

```
_OVERLAP:     SECTION
loc0:         DS 4; local var of function callee0
loc1:         DS 4; local var of function callee1

callee0_code: SECTION
callee0:
              CLEAR loc0,4 ; OK, only callee 0 uses loc0
              RETURN

callee1_code: SECTION
callee1:
```

```
            CLEAR loc1,4 ; OK, only callee 0 uses loc1
            RETURN
```

In Freescale format, functions defined in assembly *must* access all parameters and locals allocated in the _OVERLAP segment. There must be no unused parameters in the _OVERLAP segment, otherwise, the linker allocates the unused parameter in the overlap area of one of the callers. This object can then overlap with the local variables of other callers. In the ELF format, the binding to the defining function is done by name mangling, so this restriction does not exist.

The following example does not work in the Freescale format because callee_p1 is not accessed:

Listing 3.38 Freescale Unsupported Format Example

```
_OVERLAP:    SECTION
callee_p1:   DS 4; error: parameter MUST be accessed

callee_code: SECTION
callee:
  RETURN
```

To correct this, use the parameter even if it is not needed, as shown in the following listing:

Listing 3.39 Freescale Supported Format Example

```
_OVERLAP:    SECTION
callee_p1:   DS 4; OK parameter is accessed

callee_code: SECTION
callee:
             CLEAR callee_p1,1
             RETURN
```

DEPENDENCY TREE Section in Map File

The DEPENDENCY TREE section in the map file provides useful information about the overlapped allocation.

The following listing shows an example of the DEPENDENCY TREE section in a map file.

Listing 3.40 DEPENDENCY TREE Example

```
volatile int intPending; /* interrupt being handled? */

void interrupt 1 inter(void) {
  int oldIntPending=intPending;
  intPending=TRUE;
  while (0 == read((void*)0x1234)) {}
  intPending=oldIntPending;
}

unsigned char read(void* adr)  {
  return *(volatile char*)adr;
}
```

This code generates the following tree, as shown in the following listing:

Listing 3.41 Output Generated

```
_Vector_1             : 0x808..0x80B
|
+* inter                 : 0x808..0x80B
   | +* oldIntPending        : 0x80A..0x80B
   |
   +* read                  : 0x808..0x809
        +* _readp0              : 0x808..0x809
```

`Vector_1` is for the interrupt vector 1 specified in the C source.

The parameter name `adr` is encoded to `_readp0`, because in C, parameter names may have different names in different declarations, or even no name as in the example.

`Vector_1`, `inter` and `read` all depend on the `adr` parameter of `read`, which is allocated at `0x808` to `0x809` (inclusive). This area is included for all these objects. Only `Vector_1` and `inter` depend on `oldIntPending`, so the area `0x80A` to `0x80B` is only contained in these functions.

Optimizing the Overlap Size

The area of memory used by one function is the area of this function plus the maximum of the areas of all used functions. The branches with the maximum area are marked with an asterisk (*).

When a local variable is added to a function with an asterisk, the whole overlap area grows by the variable size. More useful, when you remove a variable of a function marked with an asterisk, then the size of the overlap may decrease, unless there are several functions

with an asterisk on the same level. When a marked function is using some variables of its own, then splitting this function into several parts may also reduce the overlap area.

Recursion Checks

Assume that, for the previous example, a second interrupt function exists:

Listing 3.42 Recursion Checks Example

```
void interrupt 2 inter2(void) {
  int oldIntPending=intPending;
  intPending=TRUE;
  while (0 == read((void*)0x1235)) {}
  intPending=oldIntPending;
}
```

Now, this produces two dependency trees in the `map` file:

Listing 3.43 Dependency Trees in Generated map File Example

```
 _Vector_2            : 0x808..0x80B
 |
 +* inter2              : 0x808..0x80B
    | +* oldIntPending      : 0x80A..0x80B
    |
    +* read                 : 0x808..0x809
         +* _readp0             : 0x808..0x809

 _Vector_1            : 0x80C..0x80D
 |
 +* inter               : 0x80C..0x80D
    | +* oldIntPending      : 0x80C..0x80D
    |
   +* read               : 0x808..0x809 (see above) (object allocated
in area of another root)
```

The subtree of the `read` function prints only once. The second time, `(see above)` prints instead of the whole subtree. The second remark `(object allocated in area of another root)` is more serious. Both interrupt functions use the same `read` function. If one interrupt handler can interrupt the other handler, then the parameter of the read functions may be overwritten and the first handler can fail. If both interrupts are exclusive, which is common for small processors using overlapped variables, then add this information to the `prm` file to allow an optimal allocation.

Listing 3.44 Example prm file

```
DEPENDENCY
  ROOT inter inter2 END
END
```

The warning disappears and the same tree contains both `inter` and `inter2`:

Listing 3.45 Example Dependency Root

```
DEPENDECY ROOT
|
+* inter2                : 0x808..0x80B
|   | +* oldIntPending        : 0x80A..0x80B
|   |
|   +* read                   : 0x808..0x809
|        +* _readp0               : 0x808..0x809
|
+* inter                  : 0x808..0x80B
    | +* oldIntPending        : 0x80A..0x80B
    |
    +* read                   : 0x808..0x809 (see above)
```

Because `oldIntPending` of both handlers now overlap, this example saves *2 bytes*.

NOTE The linker still handles `Vector_1` and `Vector_2` as additional roots. Because they are allocated using the `DEPENDENCY ROOT`, they have no influence on the generated code. Although the `DEPENDENCY TREE` section in the `map` file still lists their trees, these trees can be safely ignored.

Linker-Defined Objects

The linker supports defining special objects to get the address and size of sections at link time. Objects to be defined by the linker must have as a special prefix one of the strings below and must not be defined by the application at all.

NOTE Because the linker defines C variables automatically when their size is known, the usual variables declaration fails for this feature. For an `extern int __SEG_START_SSTACK;`, the linker allocates the size of an `int`, and does not define the object as address of the stack. Use the following syntax so that the compiler/linker has no size for the object: `extern int __SEG_START_SSTACK[];`

Usual applications of this feature are the initialization of the stack pointer and retrieving the last address of an application to compute a code checksum at runtime.

The object name is built by using a special prefix and then the name of the symbol.

The following tree prefixes are supported:

- __SEG_START_ : start address of the segment
- __SEG_END_ : end address of the segment
- __SEG_SIZE_ : size of the segment

NOTE The __SEG_END_ end address is the address of the first byte behind the named segment.

The linker assumes the remaining text after the prefix to be the segment name. If the linker does not find such a segment, it issues a warning and takes 0 as the address of this object.

NOTE There is no warning issued for predefined segments like SSTACK or OVERLAP, even if these segments are empty and not explicitly allocated. The warning is only issued for user-defined segments.

Because identifiers in C must not contain a period in their name, the Freescale format aliases can be used for the special ELF names. Few of them are SSTACK instead of .stack, DEFAULT_RAM instead of .data, DEFAULT_ROM instead of .text, COPY instead of .copy, ROM_VAR instead of .rodata, STRINGS instead of .rodata1, STARTUP instead of .startData, PRESTART instead of .init , _OVERLAP instead of .overlap, _OVERLAP2 instead of .overlap2. Also, __DOT__ can be prefixed for objects whose names start with period character.

For example, __SEG_START___DOT__common can be used to get start address of .common section.

Listing 3.46 C Source Code

```
#define __SEG_START_REF(a)  __SEG_START_ ## a
#define __SEG_END_REF(a)    __SEG_END_   ## a
#define __SEG_SIZE_REF(a)   __SEG_SIZE_  ## a
#define __SEG_START_DEF(a)  extern char __SEG_START_REF(a) []
#define __SEG_END_DEF(a)    extern char __SEG_END_REF(  a) []
#define __SEG_SIZE_DEF(a)   extern char __SEG_SIZE_REF( a) []

/* To use this feature, first define the symbols to be used: */
  __SEG_START_DEF(SSTACK); // start of stack
  __SEG_END_DEF(SSTACK);   // end of stack
  __SEG_SIZE_DEF(SSTACK);  // size of stack
/* Then use the new symbols with the _REF macros: */
int error;
```

```
void main(void) {
  char* stackBottom= (char*)__SEG_START_REF(SSTACK);
  char* stackTop   = (char*)__SEG_END_REF(SSTACK);
  int stackSize= (int)__SEG_SIZE_REF(SSTACK);
  error=0;
  if (stackBottom+stackSize != stackTop) { // top is bottom + size
    error=1;
  }
  for (;;); /* wait here */
}
```

Listing 3.47 .prm File

```
LINK example.abs
  NAMES  example.o  END
SECTIONS
    MY_RAM = READ_WRITE 0x0800 TO 0x0FFF;
    MY_ROM = READ_ONLY  0x8000 TO 0xEFFF;
    MY_STACK = NO_INIT 0x400 TO 0x4ff;
END
PLACEMENT
    DEFAULT_ROM INTO MY_ROM;
    DEFAULT_RAM INTO MY_RAM;
    SSTACK      INTO MY_STACK;
END
INIT main
```

Listing 3.48 Linker-Defined Symbols

```
__SEG_START_SSTACK    0x400
__SEG_END_SSTACK      0x500
__SEG_SIZE_SSTACK     0x100
```

NOTE To use the same source code with other linkers or old linkers, define the symbols in a separate module for them.

NOTE In C, you must use the address as value, and not any value stored in the variable. So in the previous example, `(int)__SEG_SIZE_REF(SSTACK)` was used to get the size of the stack segment and not a C expression like `__SEG_SIZE_REF(SSTACK)[0]`.

Stack Consumption Computation

The stack consumption computation is a feature of the linker that helps compute the theoretical maximal amount of stack space an application requires at runtime. This estimation can be done for the whole application or for user-specified call sub-trees. The result of the estimation is printed out in the map file along with the corresponding call tree paths. This feature is controlled by the `-StackConsumption` (Listing 3.49) command line option. However, the specific information needed for this feature is issued by the compiler and encoded in the object file.

NOTE Older versions of the compiler may not issue the information. Also, this feature is currently only supported for HC(S)08 derivatives.

STACK_CONSUMPTION Block

When using `-StackConsumption` (Listing 3.49) the linker automatically computes the stack consumption estimation for the application's entry point. This includes, typically the `_Startup` function and the user-provided vector table entries (refer to the `VECTOR` command in Listing 3.51). Since it is not possible to determine at link-time control-flow dependencies between usual functions and interrupt handlers the linker will compute and print the stack consumption for each vector table entry separately.

The linker also supports advanced features to increase the precision of the estimation. These include:

- Adding edges to the call graph; the `FUNCTION_PAIR` directive (Refer Table 3.6).
- Specifying user-defined stack consumption for a function; the `CONSUMPTION` directive (Refer Table 3.6).
- Specifying a custom call sub-tree; the `ROOT` directive (Refer Table 3.6).
- Specifying that a specific interrupt can be raised during the execution of a function; the `INTERRUPT_FUNCTION` directive (Refer Table 3.6).
- Specifying the maximum recursion factor for a function; the `RECURSION_FACTOR` directive (Refer Table 3.6).

Following is the syntax of the `STACK_CONSUMPTION` block.

Listing 3.49 STACK_CONSUMPTION Block Syntax

```
STACK_CONSUMPTION
 ROOT <name1> : <filename>
   [Optional] RECURSION_FACTOR <name>:<filename>  <factor>;
   [Optional] INTERRUPT_FUNCTION <name>:<filename>
<ISR_name>:<filename> <stackSize>;
```

```
END
 [Optional]
 ROOT <name2> : <filename>
 [Optional]RECURSION_FACTOR (<name>) <factor>;
 END
 [Optional] CONSUMPTION <function_name>:<filename> <number>;
 [Optional] FUNCTION_PAIR <caller>:<filename> <callee>:<filename>
<stackSize>;
END
```

NOTE `<filename>` is only required when the referred symbol has local binding. For example, a C static function. A single function or a chain of functions that induce a loop in the call graph.

The following table describes the `STACK_CONSUMPTION` block directives.

Table 3.6 STACK_CONSUMPTION Block Directives

Descriptive	Description
ROOT <name1> : <filename>	`<name>` Specifies the name of the function for which the total stack effect is to be computed. Object File name `<filename>` in which `ROOT` can also be defined. This directive is not mandatory. The application entry point is used as root if none is explicitly provided. Also, it is possible to specify multiple roots.
RECURSION_FACTOR <name>:<filename> <factor>;	`<factor>` Specifies the recursive factor of the specified function that is the maximum number of recursive calls a function makes for one execution of its caller. The functions that cause indirect recursivity can also be specified. This should exclude the last `caller` - `callee` pair causing recursion (Refer Section Example 2a). The scope of this directive is restricted to the ROOT in which it is defined.

Table 3.6 STACK_CONSUMPTION Block Directives (*continued*)

Descriptive	Description
`INTERRUPT_FUNCTION <name>:<filename> <ISR_name>:<filename> <stackSize>;`	Specifies that the interrupt handler `ISR_name` can be raised during execution of the function name. The amount of stack consumed by the function name up to the point where the interrupt occurs must be specified by the `stackSize` parameter (use the stack consumption of the name function if not sure).
`CONSUMPTION <function_name>:<filename> <number>;`	Specifies the stack size of function is an integer value.This directive should be written after specifying all ROOT entries. The stack size mentioned with this directive for a function applies to whole application and overrides the value internally computed by the linker.
`FUNCTION_PAIR <caller>:<filename> <callee>:<filename> <stackSize>;`	Alters the linker-computed call graph by adding an edge between caller and callee. The cost of this edge will be stackSize. This parameter should contain the amount of stack consumed by caller up to the point where callee is called. An use case for this directive would be an application that contains function pointers being passed as arguments. The directive should be at the end after specifying all ROOT entries. The information given by this directive applies to whole application.

Limitations

Functions written in assembly language are not taken into account when computing the stack consumption. However, the stack usage information can be specified using the `CONSUMPTION PRM` directive.

NOTE The assembly language here does not refer to inline assembly code, but to code written in assembly files, processed by the assembler tool.

Example to Generate Stack Information

Compilation

Consider C source:

`./Sources/main.c`

Listing 3.50 Generating Stack Information Example

```
static int ind_max;
void cc(int c);
void bb(int a, int b);
void aa(int a, int b, int c);

void cc(int c) {
  ind_max += 30;
  aa(10, 20 , 30);
}
void bb(int a, int b) {
  ind_max += 20;
  cc(b);
}

void aa(int a, int b, int c) {
  if (ind_max == 600) {
    return;
  }
  ind_max += 10;
  bb(a,b);
}

void main(void) {
     aa(10,20,30);
}
```

The following table lists the stack usage information generated by compiler in `main.obj` file.

Table 3.7 Stack Usage Information

Caller	Callee	StackSize
main	aa	6
Main	-	4

Table 3.7 Stack Usage Information

Caller	Callee	StackSize
Aa	Bb	4
Aa	-	2
Bb	Cc	4
bb	-	2
Cc	Aa	6
Cc	-	4

Link Process

1. Linker Option to be enabled: `-StackConsumption`
2. Stack Consumption directives included in PRM.

Listing 3.51 Stack Consumption directives included in PRM

```
STACK_CONSUMPTION
ROOT main
RECURSION_FACTOR aa:./Sources/main.obj bb:./Sources/main.obj cc:./
Sources/main.obj 10;
END
END
..
VECTOR 0 _Startup
```

3. Link the application.

Listing 3.52 Partial map file output

```
STACK CONSUMPTION COMPUTATION
1)
main = 148
-------------------------------------------------------
Maximum Stack Usage is calculated for following path:
-------------------------------------------------------
main
|
+-aa
  |
  +-bb
```

```
    |
    +-cc
2)
_Startup = 14
-------------------------------------------------------
Maximum Stack Usage is calculated for following path:
-------------------------------------------------------
_Startup
|
+-main
  |
  +-aa
    |
    +-bb
      |
      +-cc
```

The RECURSION_FACTOR directive specified in PRM is applicable only to ROOT entry main and not the default entry _Startup that is specified in VECTOR PRM directive.

Example to Specify Stack Consumption PRM Directives

This sections describes the examples to specify stack consumption PRM directives.

Recursive Functions — Test Case 1

The following listing shows a Recursive Functions test case.

Listing 3.53 Recursive Functions — Test Case 1

```
void A() { /* This is a recursive function */
..
A();
}
Void main() {
A();
}
```

PRM Directive to be specified:

Listing 3.54 PRM Directive

```
STACK_CONSUMPTION
ROOT main
RECURSION_FACTOR A 10; /* Correct */
```

```
RECURSION_FACTOR A A 10; /* Incorrect */
END
END
```

Recursive Functions — Test Case 2

The following listing shows another Recursive Functions test case.

Listing 3.55 Recursive Functions — Test Case 2

```
void A() {
..
B();
}

Void B() {
..
A();
}

Void main() {
..
A();
}
```

PRM Directive to be specified:

Listing 3.56 PRM Directive

```
STACK_CONSUMPTION
ROOT main
RECURSION_FACTOR A B 10; /* Correct */
RECURSION_FACTOR A B A 10; /* Incorrect */
END
END
```

Function Pointer Passed as Argument to Function — Test Case

The following listing shows a test case of function pointer passed as argument to function.

Listing 3.57 Function Pointer Passed as Argument to Function

```
double next_Div(double d) {
  return d/1.8;
```

```
}

Bool Comp_TrueLarger1(double a, double b) {
  return a+1.0 > b + 1.0;
}

void Test5_Do(double d0, double d1, Bool (*comp)(double a, double b),
double (*next)(double)) {
  while (d1 != 0) {
    if (comp(d0, d1)) {
..
    d0 = next(d0);
..
}

Void main() {
Test5_Do(1.0, 1.1, Comp_TrueLarger1, next_Div);
}
```

PRM Directive specification, as shown in the following listing:

Listing 3.58 PRM Directive

```
STACK_CONSUMPTION
ROOT main
END
FUNCTION_PAIR Test5_Do Comp_TrueLarger 12;
FUNCTION_PAIR Test5_Do next_Div 22;
END
```

Usage of CONSUMPTION Directive — Test Case

shows a test case of usage of `CONSUMPTION` directive.

Listing 3.59 Usage of CONSUMPTION Directive

```
Void main() {
  Asm_func(); /* Call to an assembly function defined in test.asm*/
}
```

Stack usage of main to `Asm_func` is given by compiler in object file but assembler does not provide stack usage of `Asm_func` routine. `CONSUMPTION` directive can be added to specify the stack usage of `Asm_func`.

PRM Directive specification, as shown in the following listing:

Listing 3.60 PRM Directive

```
STACK_CONSUMPTION
ROOT _Startup
END
CONSUMPTION Asm_func 100;
END
```

Checksum Computation

The linker invokes the computation of a checksum in two ways:

- `prm` file-controlled checksum computation:

  The `prm` file specifies which kind of checksum to compute over which area and where to store the resulting checksum. This method gives full flexibility, but also requires more user-configuration effort. With this method the linker only computes the actual checksum value; the application code must ensure that the areas specified in the prm file match the areas computed at runtime.

- Automatic linker-controlled checksum computation:

  With this method, the linker generates a data structure containing all information to compute the checksum. The linker lists all ROM areas, computes the checksum and stores it, together with area and type information, in a data structure which can then be used at runtime to verify the code.

Table 3.8 Comparison of Checksum Computation Methods

Attribute	prm File Controlled	Automatic Linker Controlled
Complexity	Needs some configuration prm file needs adaptations	Easy to use. Call _Checksum_Check
Robustness	Values used in prm file and source code must match. All areas to be checked must be listed in prm and source code.	Good. Nothing (or few things) to configure
Control	Everything in full user control.	Poor. Can be controlled only when segment must be checked.

Table 3.8 Comparison of Checksum Computation Methods (*continued*)

Attribute	prm File Controlled	Automatic Linker Controlled
Target Memory Usage	Good. Only uses necessary memory.	Needs more memory because of control data structure.
Execution Time	Depends on method. Checks all areas as code size is unknown.	Depends on method. Checks only needed areas.

prm File-Controlled Checksum Computation

Special commands in the `prm` file can instruct the linker to compute the checksum over some explicitly specified areas. All necessary information for this is specified in the `prm` file, as shown in the following listing.

Listing 3.61 Example prm file

```
CHECKSUM
    CHECKSUM_ENTRY
        METHOD_CRC_CCITT
        OF       READ_ONLY   0xE020 TO 0xEEFF
        OF       READ_ONLY   0xEF00 TO 0xFEFF
        INTO     READ_ONLY   0xE010 SIZE 2
        UNDEFINED 0xff
    END
END
```

See the CHECKSUM: Checksum Computation (ELF) linker command description for the exact syntax to used in the `prm` file and also for more examples.

Automatic Linker-Controlled Checksum Computation

The linker tracks all the memory areas used by an application, therefore this method uses this knowledge to generate a data structure, which then can be used at runtime to validate the complete code. The linker provides this information in the same way it provides copy down and zero out information.

The linker automatically generates the checksum data structure if the startup data structure has two have additional fields:

Listing 3.62 Checksum Data Structure Example

```
extern struct _tagStartup {
....
     struct __Checksum* checkSum;
     int nofCheckSums;
....
```

The header file `checksum.h` defines the structure `__Checksum`:

Listing 3.63 Checksum Data Structure Example2

```
struct __Checksum {
    void* start;
    unsigned int len;
#if _CHECKSUM_CRC_CCITT
    _CheckSum2ByteType checkSumCRC_CCITT;
#endif
#if _CHECKSUM_CRC_16
    _CheckSum2ByteType checkSumCRC16;
#endif
#if _CHECKSUM_CRC_32
    _CheckSum4ByteType checkSumCRC32;
#endif
#if _CHECKSUM_ADD_BYTE
    _CheckSum1ByteType checkSumByteAdd;
#endif
#if _CHECKSUM_XOR_BYTE
    _CheckSum1ByteType checkSumByteXor;
#endif
};
```

The linker allocates `__checksum` structure in a `.checksum` section, placed after all the other code or constant sections. As the `.checksum` section itself must not be checked, it must be the last section in a SECTION list.

The linker issues `checksum` information for all used segments in the `prm` file. However, if some segments are filled with a `FILL` command, then this fill area is not included.

The linker derives `checksum` types to be computed by using the field names of the `__Checksum` structure. Usually only one alternative is present, but the linker can compute `checksum` in any combination of `checksum` methods.

Automatic Structure Detection

The linker reads the debug information of the module containing `_tagStartup` to detect which checksums to generate and how to build the structure. This ensures that the structure used by the compiler always matches the structure the linker generates.

The linker contains the structure field names and the name `__Checksum` of the checksum structure. These names cannot be changed. Adapt the structure field types to your needs.

.checksum Section

The `.checksum` section must be the last section in a placement. It may be after the `.copy` section. If it is not mentioned in the `prm` file, the linker automatically allocates space for the `.checksum` section when needed.

The `checksum` areas do not cover `.checksum` itself.

Partial Fields

The `__Checksum` structure can also contain `checkSumWordAdd`, `checkSumLongAdd`, `checkSumWordXor` and `checkSumLongXor` fields to compute checksums with larger element sizes. However, as the FILL areas are not considered, the `len` field might not be a multiple of the element size. When this happens, assume the missing bytes are equal to zero. Because this is not handled in the provided example code, automatic generated word, long size add, or XOR checksums are not officially supported.

Runtime Support

The `checksum.h` file contains functions, prototypes, and utilities to compute the various checksums. The corresponding source file is `checksum.c`. Look at `checksum.c` to find out how to compute the various checksums. The automatic generated checksum feature does not need any customer code.

To verify that the checksums are valid, perform the simple call:

```
_Checksum_Check(_startupData.checkSum,
_startupData.nofCheckSums);
```

The following listing shows a sample function call with required variable definitions needed in the customer code with the respective linker PRM. Use this as an example to verify that the `prm` file generated the checksums.

Listing 3.64 Checksum entry in linker PRM file

```
...
```

```
CHECKSUM
  CHECKSUM_ENTRY
    METHOD_CRC8
    OF READ_ONLY 0xF00C TO 0xF02B
    OF READ_ONLY 0xFE8000 TO 0xFE800F
    INTO READ_ONLY 0xF300 SIZE 1
    UNDEFINED 0xFF
  END
END
…
```

Listing 3.65 Customer code

```
const struct __ChecksumArea areas[] = {
   {(const void * __far)(0x7FF00C), 0x20} ,
   {(const void * __far)(0x7F8000), 0x10}
};

#define N_MEM_AREAS 2 /* Total number of memory areas present in const
struct __ChecksumArea areas[] */
#define DEFAULT_CRC8_POLY     0x9B
#define DEFAULT_CRC8_INIT     0xFF
#define CHECKSUM_STORAGE_CRC8          (*(unsigned char*)0x7FF300)

void main() {
...
  if (_Checksum_CheckAreasCRC8(areas , N_MEM_AREAS, DEFAULT_CRC8_POLY
,DEFAULT_CRC8_INIT ) == CHECKSUM_STORAGE_CRC8) {
    result = TRUE;
  }
...
}
```

`Checksum.c` file has routines prefixed with `_Checksum_CheckAreas` as utilities to compute a single checksum over multiple memory areas.

The following code adds the new data structure `__ChecksumArea` to `checksum.h` with respect to the calculation of single checksum for multiple memory areas.

Listing 3.66 Code Adding __ChecksumArea to checksum.h

```
struct __ChecksumArea {
  _CHECKSUM_ConstMemBytePtr start;
  unsigned int len;
};
```

Linking an Assembly Application

Use the `prm` file or the SmartLinker to link an Assembly application, when warnings can be ignored.

prm File

When an application consists of assembly files only, you can simplify the linker `prm` file. The simplified prm file requires:

- No startup structure.
- No stack initialization, because the source file directly initializes the stack.
- No main function.
- An entry point in the application.

Listing 3.67 prm File Example

```
LINK   test.abs
NAMES  test.o test2.o END
SECTIONS
  DIRECT_RAM = READ_WRITE 0x00000 TO 0x000FF;
  RAM_AREA   = READ_WRITE 0x00300 TO 0x07FFF;
  ROM_AREA   = READ_ONLY  0x08000 TO 0x0FFFF;
PLACEMENT
    myRegister         INTO DIRECT_RAM;
    DEFAULT_RAM        INTO RAM_AREA;
    DEFAULT_ROM        INTO ROM_AREA;
END
INIT Start                    ; Application entry point
VECTOR ADDRESS 0xFFFE Start ; Initialize Reset Vector
```

This example:

- Allocates all data sections defined in the assembly input files in the `RAM_AREA` segment.
- Allocates all code and constant sections defined in the assembly-input files in the `ROM_AREA` segment.
- Defines the `MyStart` function as the application entry point and also specifies it as a reset vector. `MyStart` must be XDEFed in the assembly source file.

Warning Messages

An assembly application does not need any startup structure or root function.

You can ignore the following two warnings:

```
WARNING: _startupData not found
WARNING: Function main not found
```

Smart Linking

When you link an assembly application, the linker performs smart linking on section level instead of object level. That links whole sections containing referenced objects with the application. An example of SmartLinking follows:

Listing 3.68 Assembly Source File

```
           XDEF entry
dataSec1: SECTION
data1:    DCB 1
dataSec2: SECTION
data2:    DCB 2
codeSec:  SECTION
entry:
           NOP
           NOP
           LDX  #data1
           LDA #56
           STA  0, X
loop:      BRA loop
```

Listing 3.69 SmartLinker prm File

```
LINK   test.abs
NAMES  test.o END

SECTIONS
  RAM_AREA   = READ_WRITE 0x00300 TO 0x07FFF;
  ROM_AREA   = READ_ONLY  0x08000 TO 0x0FFFF;
PLACEMENT
    DEFAULT_RAM      INTO RAM_AREA;
    DEFAULT_ROM      INTO ROM_AREA;
END
INIT entry
VECTOR ADDRESS 0xFFE entry
```

This example:

- Defines the function `entry` as application entry point and also specifies it as a reset vector.

- Links the data section `dataSec1` defined in the assembly input file with the application because `data1` is referenced in `entry`. Allocates `dataSec1` in the `RAM_AREA` segment at address 0x300.
- Links the code section `codeSec` defined in the assembly-input file with the application because `entry` is the application entry point. Allocates `codeSec` in the `ROM_AREA` segment at address 0x8000.
- Does NOT link the data section `dataSec2` defined in the assembly input file with the application, because the `data2` symbol is never referenced.

You can switch smart linking OFF for your application. In that case all of the assembly code and all objects link with the application.

For the previous example, the following prm file switches smart linking OFF:

Listing 3.70 ELF Format prm File

```
LINK   test.abs
NAMES  test.o END

SEGMENTS
  RAM_AREA   = READ_WRITE 0x00300 TO 0x07FFF;
  ROM_AREA   = READ_ONLY  0x08000 TO 0x0FFFF;
END
PLACEMENT
    DEFAULT_RAM        INTO RAM_AREA;
    DEFAULT_ROM        INTO ROM_AREA;
END
INIT entry
VECTOR ADDRESS 0xFFE entry
ENTRIES * END
```

Listing 3.71 Freescale Format prm File

```
LINK   test.abs
NAMES  test.o+ END

SEGMENTS
  RAM_AREA   = READ_WRITE 0x00300 TO 0x07FFF;
  ROM_AREA   = READ_ONLY  0x08000 TO 0x0FFFF;
END
PLACEMENT
    DEFAULT_RAM        INTO RAM_AREA;
    DEFAULT_ROM        INTO ROM_AREA;
END
INIT entry
```

```
VECTOR ADDRESS 0xFFFE entry
```

These examples:

- Define the `entry` function as application entry point and specify it as a reset vector.
- Allocate the `dataSec1` data section defined in the assembly input file in the `RAM_AREA` segment at address `0x300`.
- Allocate the `dataSec2` data section defined in the assembly input file next to the `dataSec1` section at address `0x302`.
- Allocate the `codeSec` code section defined in the assembly-input file in the `ROM_AREA` segment at address `0x8000`.

LINK_INFO (ELF)

Some compilers support writing additional information into the ELF file. This information consists of a topic name and specific content.

```
#pragma LINK_INFO BUILD_NUMBER "12345"
```

```
#pragma LINK_INFO BUILD_KIND "DEBUG"
```

The compiler then stores this information into the ELF object file. The linker checks if different object files contain the same topic name with different content. If so, the linker issues a warning.

Finally, the linker issues all LINK_INFOs into the generated output ELF file.

Use this feature to warn you about linking incompatible object files together. Also the debugger can use this feature to pass information from header files used by the compiler into the generated application.

The linker currently has no internal knowledge about specific topic names.

4

SmartLinker Parameter File

The SmartLinker's parameter file is an ASCII text file. For each application you have to write such a file. It contains linker commands specifying how the linking is to be done. This section describes the parameter file in detail, giving examples you may use as templates for your own parameter files. You might also want to look at the parameter files for the examples included in your installation.

Parameter File Syntax

The following is the EBNF syntax of the parameter file:

Listing 4.1 EBNF Syntax of the Parameter File

```
ParameterFile={Command}
Command= LINK NameOfABSFile [AS ROM_LIB]
| NAMES ObjFile {ObjFile} END
| SEGMENTS {SegmentDef} END
| PLACEMENT {Placement} END
| (STACKTOP | STACKSIZE) exp
| MAPFILE MapSecSpecList
| ENTRIES EntrySpec {EntrySpec} END
| VECTOR (InitByAddr | InitByNumber)
| INIT FuncName
| MAIN FuncName
| HAS_BANKED_DATA
| OVERLAP_GROUP {FuncName} END
| DEPENDENCY {Dependency} END
| CHECKSUM {ChecksumEntry} END
where:
NameOfABSFile= FileName
ObjFile= FileName ["-"]
ObjName= Ident
QualIden = FileName ":" Ident
FuncName= ObjName | QualIdent
MapSecSpecList= MapSecSpec "," {MapSecSpec}
EntrySpec= [FileName":"] (* | ObjName)
MapSecSpec= ALL | NONE | TARGET | FILE | STARTUP | SEC_ALLOC |
SORTED_OBJECT_LIST | OBJ_ALLOC | OBJ_DEP | OBJ_UNUSED | COPYDOWN |
OVERLAP_TREE | STATSTIC
Dependency= ROOT {ObjName} END
```

```
| ObjName USES {ObjName} END
| ObjName ADDUSE {ObjName} END
| ObjName DELUSE {ObjName} END
SegmentDef= SegmentName "=" SegmentSpec ";".
SegmentName= Ident.
SegmentSpec= StorageDevice Relocation Range [Alignment] [FILL
CharacterList] [OptimizeConstants].
ChecksumEntry= CHECKSUM_ENTRY
ChecksumMethod
[INIT Number]
[POLY Number]
OF MemoryArea
INTO MemoryArea
[UNDEFINED Number]
END
ChecksumMethod= METHOD_CRC_CCITT | METHOD_CRC8 | METHOD_CRC16 |
METHOD_CRC32 | METHOD_ADD [SIZE <Size>] | METHOD_XOR.
MemoryArea= StorageDevice Range  StorageDevice= READ_ONLY | CODE |
READ_WRITE | PAGED | NO_INIT.
Range= exp (TO | SIZE) exp
Relocation= RELOCATE_TO Address
Alignment= ALIGN [exp] {"["ObjSizeRange":" exp"]"}
ObjSizeRange= Number | Number TO Number | CompareOp Number
CompareOp= ("<" | "<=" | ">" | ">=")
CharacterList= HexByte {HexByte}
OptimizeConstants= {(DO_NOT_OVERLAP_CONSTS | DO_OVERLAP_CONSTS) {CODE
| DATA}}
Placement= SectionList (INTO | DISTRIBUTE_INTO) SegmentList ";"
SectionList= SectionName {"," SectionName}
SectionName= Ident
SegmentList= Segment {"," Segment}
Segment= SegmentName | SegmentSpec
InitByAddr= ADDRESS Address Vector
InitByNumber= VectorNumber Vector
Address= Number
VectorNumber= Number
Vector= (FuncName [OFFSET exp] | exp) ["," exp]
Ident= <any C style identifier>
FileName= <any file name>
exp= Number
Number= DecimalNumber | HexNumber | OctalNumber
HexNumber= 0xHexDigit{HexDigit}.
DecimalNumber= DecimalDigit{DecimalDigit}
HexByte= HexDigit HexDigit
HexDigit= "0" | "1"| "2" | "3" | "4" | "5" | "6" | "7" | "8" | "9"| "A"
| "B" | "C" | "D" | "E" | "F" | "a" | "b" | "c" | "d" | "e" | "f"
```

```
DecimalDigit= "0" | "1"| "2" | "3" | "4" | "5" | "6" | "7" | "8" | "9"
|
```

Comments can appear anywhere in a parameter file, except where file names are expected. You can use either C style comments or Modula-2 style comments.

To keep your sources portable, do not include paths in file names. Otherwise, if you copy the sources to some other directory, the linker might not find all files needed. The linker uses the paths in the environment variables GENPATH, OBJPATH, TEXTPATH and ABSPATH to decide where to look for files and where to write the output files.

The order of the commands in the parameter file does not matter. However, make sure that you specify the `SEGMENTS` block before the `PLACEMENT` block.

There are a some sections named `.data`, `.text`, `.stack`, `.copy`, `.rodata1`, `.rodata`, `.startData`, and `.init`. Information about these sections can be found in the chapter on predefined sections.

Mandatory SmartLinker Commands

A linker parameter file must contain at least the entries for `LINK` (or using option `-O`), `NAMES`, and `PLACEMENT`. All other commands are optional. The following example shows the minimal parameter file:

Listing 4.2 Minimal Parameter File Example

```
LINK mini.abs  /* Name of resulting ABS file */
NAMES
  mini.o startup.o  /* Files to link */
END
STACKSIZE 0x20       /* in bytes */
PLACEMENT
  DEFAULT_ROM INTO READ_ONLY  0xA00 TO 0xBFF;
  DEFAULT_RAM INTO READ_WRITE 0x800 TO 0x8FF;
END
```

If the CodeWarrior software calls the linker, then the `LINK` command is not necessary. The CodeWarrior plug-in passes the `-O` option with the destination file name directly to the linker. You can see this if you enable **Display generated command lines in message window** in the Linker preference panel in CodeWarrior IDE.

The first placement statement reserves the address range from `0xA00` to `0xBFF` for allocation of read only objects (hence the qualifier `READ_ONLY`).

```
DEFAULT_ROM INTO READ_ONLY 0xA00 TO 0xBFF;
```

The `.text` subsumes all linked functions, all constant variables, all string constants and all initialization parts of variables, and copies them to RAM at startup.

The second placement statement reserves the address range from `0x800` to `0x8FF` for allocation of variables.

```
DEFAULT_RAM INTO READ_WRITE 0x800 TO 0x8FF;
```

The INCLUDE Directive

A special `INCLUDE` directive allows you to split a prm file into several text files, if needed, to separate a target-specific part of a prm file from a common part.

The syntax of the include directive is:

```
IncludeDir= "INCLUDE" FileName.
```

Because the `INCLUDE` directive may be everywhere in the `prm` file, it is not contained in the main EBNF.

Listing 4.3 Include Directive Example

```
LINK mini.abs  /* Name of resulting ABS file */
NAMES
  startup.o  /* startup object file */
  INCLUDE objlist.txt
END
STACKSIZE 0x20       /* in bytes */
PLACEMENT
  DEFAULT_ROM INTO READ_ONLY  0xA00 TO 0xBFF;
  DEFAULT_RAM INTO READ_WRITE 0x800 TO 0x8FF;
END
with objlist.txt:
  mini0.o  /* user object file(s) */
  mini1.o
```

5

ELF Sections

Using sections allows you complete control over object allocation in memory. A section is a named group of global objects (variables or functions) associated with a certain memory area that may be non-contiguous. The objects belonging to a section are allocated in its associated memory range. This chapter describes the use of sections in detail.

There are many different ways to use sections, the most important being:

- Distributing two or more groups of functions and other read-only objects to different ROMs.
- Allocating single functions or variables to a fixed absolute address (for example, to access processor ports using high-level language variables).
- Allocating variables into memory locations where special addressing modes may be used.

Segments and Sections

A *Section* is a named group of global objects declared in the source file, that is, functions and global variables.

A *Segment* is a memory range, not necessarily contiguous.

In the linker's parameter file, each section is associated with a segment so the linker knows where to allocate the objects belonging to a section.

Sections

A section definition always consists of two parts: the definition of the objects belonging to it, and the memory area(s) associated with it, called segments. The object definition is done in the application source files using pragmas or directives (see the *Compiler* or *Assembler* manual). The segment definition is done in the parameter file using the `SEGMENTS` and `PLACEMENT` commands.

Predefined Sections

You can group predefined sections into sections according to the runtime routines:

- Sections for things other than variables and functions: `.rodata1`, `.copy`, `.stack`.
- Sections for grouping large sets of objects: `.data`, `.text`
- A section for placing objects initialized by the linker: `.startData`.
- A section to allocate read-only variables: `.rodata`

NOTE The `.data` and `.text` sections provide default sections for object allocation.

The following paragraphs describe each of these predefined sections.

.rodata1

This predefined section contains all string literals. For example, `This is a string` is allocated in section `.rodata1`. If you associate this section with a segment qualified as `READ_WRITE`, the strings are copied from ROM to RAM at startup.

.rodata

The `.rodata` section contains any constant variable (declared as `const` in a C module or as DC in an assembler module) which is not allocated in a user-defined section. Usually, the `.rodata` section is associated with a `READ_ONLY` segment.

If this section is not mentioned in the `PLACEMENT` block in the parameter file, these variables are allocated next to the `.text` section.

.copy

Initialization data belongs to the `.copy` section. If a source file contains the declaration:

```
int a[] = {1, 2, 3};
```

the hex string `000100020003` (6 bytes), which is copied to a location in RAM at program startup, belongs to the `.copy` segment.

If you allocate the `.rodata1` section to a `READ_WRITE` segment, all strings also belong to the `.copy` section. Any objects in this section are copied at startup from ROM to RAM.

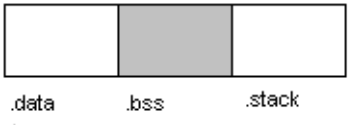
.stack

The runtime stack has its own segment named `.stack`. Always allocate `.stack` to a `READ_WRITE` segment.

.data

This predefined section is the default section for all objects normally allocated to RAM. It is used for variables not belonging to any section or to a section not assigned a segment in the PLACEMENT block in the linker's parameter file. If any of the .bss or .stack sections are not associated with a segment, these sections are included in the .data memory area in the following order:

Figure 5.1 Memory Inclusion Order for .data



.text

This is the default section for all functions. If a function is not assigned to a certain section in the source code or if its section is not associated with a segment in the parameter file, it is automatically added to the .text section. If any of the .rodata, .rodata1, .startData or .init sections are not associated with a segment, these sections are included in the .text memory area.

.startData

The startup description data initialized by the linker and used by the startup routine is allocated to segment .startData. This section must be allocated to a READ_ONLY segment.

.init

The application entry point is stored in the .init section. This section also must be associated with a READ_ONLY segment.

.overlap

Compilers using pseudo-static variables for locals allocate these variables in .overlap. Variables of functions not depending on each other may be allocated at the same place. This section must be associated with a NO_INIT segment.

NOTE The .data and .text sections must always be associated with a segment.

Examples of Using Sections

Examples 1 and 2 illustrate the use of sections to precisely control allocation of variables and functions.

Example 1

This example distributes code into two different ROMs:

Listing 5.1 Using Sections Example1

```
LINK first.ABS
NAMES first.o strings.o startup.o END
STACKSIZE 0x200
SECTIONS
  ROM1 = READ_ONLY 0x4000 TO 0x4FFF;
  ROM2 = READ_ONLY 0x8000 TO 0x8FFF;
PLACEMENT
  DEFAULT_ROM INTO ROM1, ROM2;
  DEFAULT_RAM INTO READ_WRITE 0x1000 TO 0x1FFF;
END
```

Example 2

This example allocates code into battery-buffered RAM:

Listing 5.2 Using Sections Example2

```
/* Extract from source file "bufram.c" */
#pragma DATA_SEG Buffered_RAM
  int done;
  int status[100];
#pragma DATA_SEG DEFAULT
/* End of extract from "bufram.c" */
```

The following shows the associated SmartLinker parameter file:

Listing 5.3 SmartLinker Parameter File

```
LINK bufram.ABS
NAMES
  bufram.o startup.o
END
STACKSIZE 0x200
```

```
SECTIONS
  BatteryRAM = NO_INIT    0x1000 TO 0x13FF;
  MyRAM      = READ_WRITE 0x5000 TO 0x5FFF;
PLACEMENT
  DEFAULT_ROM  INTO READ_ONLY 0x2000 TO 0x2800;
  DEFAULT_RAM  INTO MyRAM;
  Buffered_RAM INTO BatteryRAM;
END
```

6

Segments

Using segments allows you complete control over object allocation in memory. A segment is a named group of global objects (variables or functions) associated with a certain memory area that may be non-contiguous. The objects belonging to a segment are allocated in its associated memory range. This chapter describes the use of segmentation in detail.

There are many different ways to make use of the segment concept, the most important being:

- Distributing two or more groups of functions and other read-only objects to different ROMs.
- Allocating single functions or variables to a fixed absolute address (for example, to access processor ports using high-level language variables).
- Allocating variables in memory locations where special addressing modes may be used.

Segments and Sections

A *Segment* is a named group of global objects declared in the source file, i.e. functions and global variables.

A *Section* is a memory range, not necessarily contiguous.

In the linker's parameter file, each segment is associated with a section so the linker knows where to allocate the objects belonging to a segment.

Segment

A segment definition always consists of two parts: the definition of the objects belonging to it, and the memory area(s) associated with it, called sections. The object definition is done in the source files of the application using pragmas or directives (see the *Compiler* or *Assembler* manual). The section definition is done in the parameter file using the `SECTIONS` and `PLACEMENT` commands (see Parameter File Syntax).

Predefined Segments

Predefined segment can be grouped into segments according to the runtime routines:

- Segments for things other than variables and functions: `STRINGS`, `COPY`, `SSTACK`
- Segments for grouping large sets of objects: `DEFAULT_RAM`, `DEFAULT_ROM`
- A segment for placing objects initialized by the linker: `STARTUP`
- A segment to allocate read-only variables: `ROM_VAR`

NOTE The segments `DEFAULT_RAM` and `DEFAULT_ROM` provide default segments for allocating objects.

The following paragraphs describe each of these predefined segments.

STRINGS

This predefined segment contains all string literals (e.g. `This is a string`). Associate this segment with a segment qualified as `READ_WRITE` to copy the strings from ROM to RAM at startup.

ROM_VAR

The `ROM_VAR` segment contains any constant variable (declared as `const` in a C module or as DC in an assembler module) which is not allocated in a user-defined segment. Usually, the `ROM_VAR` segment is associated with `READ_ONLY` section.

If this segment is not mentioned in the `PLACEMENT` block in the parameter file, the linker allocates these variables next to the `DEFAULT_ROM` segment.

FUNCS

The `FUNCS` segment contains any function code not allocated in a user-defined segment. Usually, the `FUNCS` segment is associated with `READ_ONLY` section.

COPY

Initialization data belongs to the `COPY` segment. If a source file contains the declaration:

```
int a[] = {1, 2, 3};
```

the hex string `000100020003` (6 bytes), which is copied to `a` location in RAM at program startup, belongs to segment `COPY`.

If the STRINGS segment is allocated to a READ_WRITE section, all strings also belong to the COPY segment. The linker copies any objects in this segment from ROM to RAM at startup.

SSTACK

The runtime stack has its own segment named SSTACK. Always allocate SSTACK to a READ_WRITE section.

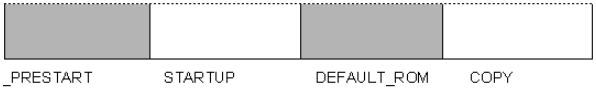
DEFAULT_RAM

This is the default segment for all objects normally allocated to RAM. Use DEFAULT_RAM for variables not belonging to any segment or for variables belonging to a segment not assigned a section in the PLACEMENT block in the linker's parameter file. If you do not associate the SSTACK segment with a section, it is appended to the DEFAULT_RAM memory area.

DEFAULT_ROM

This is the default segment for all functions. If a function is not assigned to a certain segment in the source code or if its segment is not associated with a section in the parameter file, it is automatically added to DEFAULT_ROM segment. If any of the _PRESTART, STARTUP, or COPY segments is not associated with a section, the linker includes these segments in the DEFAULT_ROM memory area in the following order:

Figure 6.1 DEFAULT_ROM Segment Memory Order



STARTUP

The startup description data initialized by the linker and used by the startup routine is allocated to the STARTUP segment. This segment must be allocated to a READ_ONLY section.

_PRESTART

The application entry point is stored in the segment _PRESTART. This segment must also be associated with a READ_ONLY section.

_OVERLAP

This segment contains pseudo-static local variables, which are for non-reentrant functions.

The linker analyzes the call graph (that is, it keeps track of which function calls which other functions) and chooses distinct memory areas in the `_OVERLAP` segment if it detects a call dependency between two functions. If it doesn't detect such a dependency, it may overlap the memory areas used for local variables of two separate functions.

There are cases in which the linker cannot determine whether a function calls another function, especially in the presence of function pointers. If the linker detects a conflict between two functions, it issues an error message.

In the ELF object file format, the name `.overlap` is a synonym for `_OVERLAP`.

NOTE The `DEFAULT_RAM` and `DEFAULT_ROM` segments must always be associated with a section.

VIRTUAL_TABLE_SEGMENT

The compiler generates virtual function tables if virtual functions are used. Because classes often are declared in header files, each implementation file including such header files with classes containing virtual member functions, may generate virtual function tables. These tables are constant by default and may be allocated in ROM.

To simplify this, the compiler places all virtual tables into a special segment named `VIRTUAL_TABLE_SEGMENT`. You can use this in the linker parameter file to allocate the virtual tables into ROM:

```
DEFAULT_ROM, ROM_VAR, VIRTUAL_TABLE_SEGMENT INTO MY_ROM
```

Additionally, the linker uses this segment name to avoid duplicate definitions of virtual function tables in your linked application.

7

Program Startup

This section deals with advanced material. First-time users may skip this section; standard startup modules taking care of common cases are delivered with the programs and examples. It suffices to include the startup module in the files to link in the parameter file. For more information about the names of the startup modules and the different variants see the file `readme.txt` in the LIB directory subfolders.

NOTE The code shown in this chapter is example code. To understand what the startup modules for your environment do, be sure to look at the files in the installation.

Prior to calling the application's root function (`main`), one must:

- initialize the processor's registers,
- zero out memory, and
- copy initialization data from ROM to RAM.

Depending on the processor and the application's needs, different startup routines may be necessary.

There are standard startup routines for every processor and memory model. They are easy to adapt to your particular needs because all these startup routines are based on a startup descriptor containing all information needed. Different startup routines differ only in the way they make use of that information.

This section covers the following topics:

Startup Descriptor (ELF)

The startup descriptor of the linker is declared in code similar to that shown below. Note that depending on architecture or memory model your startup descriptor may be different.

Listing 7.1 ELF Startup Descriptor Example

```
typedef struct{
  unsigned char *_FAR beg;int size;
} _Range;

typedef struct _Copy {
  int size; unsigned char * far dest;
} _Copy;

typedef void (*_PFunc)(void);

typedef struct_LibInit {
  _PFunc  *startup;   /* address of startup desc */
} _LibInit;

typedef struct _Cpp {
  _PFunc  initFunc;      /* address of init function */
} _Cpp;


extern struct _tagStartup {
   unsigned char   flags;
   _PFunc          main;
   unsigned short  stackOffset;
   unsigned short  nofZeroOuts;
   _Range          *pZeroOut;
   _Copy           *toCopyDownBeg;
   unsigned short  nofLibInits;
   _LibInit        *libInits;
   unsigned short  nofInitBodies;
   _Cpp            *initBodies;
   unsigned short  nofFiniBodies;
   _Cpp            *finiBodies;
} _startupData;
```

The linker expects, somewhere in your application, a declaration of the variable `_startupData`, that is:

```
struct _tagStartup _startupData;
```

The linker initializes the fields of this `struct` and allocates `_startupData` in ROM in `.startData` section. If there is no declaration of this variable, the linker does not create a startup descriptor. In this case, there is no `.copy` section, and the stack is not initialized. Furthermore, global C++ constructor and ROM libraries are not initialized.

The following table shows the semantics for these fields.

Table 7.1 ELF Startup Descriptor Field Semantics

Field Name	Description
`flags`	Contains some flags which can be used to detect special conditions at startup. Currently uses two bits. Linking the application as a ROM library sets bit 0 equal to 1. Bit 1 is set when no stack specification is made. Startup code tests Bit 1 (with mask 2) to determine whether to initialize the stack pointer.
`main`	Function pointer set to application's root function. In a C program, this usually is function `main` unless a `MAIN` entry exists in the parameter file, specifying some other function as root. In a ROM library, `main` is zero. Standard startup code jumps to this address once initialization is over.
`stackOffset`	Valid only if `(flags & 2) == 0`. Contains the initial value of the stack pointer.
`nofZeroOuts`	Number of `READ_WRITE` segments to fill with zero bytes at startup. Not required if you do not have any RAM memory area, which requires initializing at startup. When not present in the startup structure, `pZeroOut` must not be present either.
`pZeroOut`	Pointer to a vector with elements of type `_Range`. It has exactly `nofZeroOuts` elements, each describing a memory area to be cleared. Not required if you do not have any RAM memory area, which requires initializing at startup. When not present in the startup structure, `nofZeroOuts` must not be present either.

`toCopyDownBeg`	Contains the address of the first item which must be copied from ROM to RAM at runtime. All data to be copied is stored in a contiguous piece of ROM memory and has the following format:
	`CopyData = {Size`$_{[t]}$ `TargetAddr {Byte}`^{Size} `Alignment} 0x0`$_{[t]}$`.`
	`Alignment= 0x0[0..7].`
	Size is a binary number whose most significant byte is stored first. Not required if you do not have any RAM memory area, which requires initializing at startup. Alignment is used to align the next size and `TargetAddr` field. Number of alignment bytes depends on processor's capability to access unaligned data. For small processors, there is usually no alignment. Size t of `Size[t]` and `0x0[t]` depends on target processor and memory model.

Table 7.1 ELF Startup Descriptor Field Semantics (*continued*)

Field Name	Description
`nofLibInits`	Number of ROM libraries linked with the application that must be initialized at startup. Not required if you do not link any ROM library with your application. When not present in startup structure, `libInits` must not be present.
`libInits`	Vector of pointers to the `_startupData` records of all ROM libraries in the application. Contains exactly `nofLibInits` elements. These addresses are needed to initialize the ROM libraries. Not required if you do not link any ROM library with your application. When not present in the startup structure, `nofLibInits` must not be present.
nofInitBodies	Number of C++ global constructors which must be executed prior to invoking application root function. Not required if application does not contain a C++ module. When not present in startup structure, `initBodies` must not be present.
`initBodies`	Pointer to a vector of function pointers containing addresses of the global C++ constructors in the application, sorted in calling order. Contains exactly `nofInitBodies` elements. If application does not contain any C++ modules, the vector is empty. Not required if application does not contain any C++ module. When not present in the startup structure, `nofInitBodies` must not be present either.
`nofFiniBodies`	Number of C++ global destructors which must be executed after the invocation of application root function. Not required if application does not contain a C++ module. When not present in startup structure, `finiBodies` must not be present either. If application root function does not return, `nofFiniBodies` and `finiBodies` can both be omitted.
finiBodies	Pointer to a vector of function pointers containing addresses of global C++ destructors in the application, sorted in calling order. Contains exactly `nofFiniBodies` elements. If an application does not contain any C++ modules, the vector is empty. Not required if application does not contain a C++ module. When not present in startup structure, `nofFiniBodies` must not be present either. If application root function does not return, `nofFiniBodies` and `finiBodies` can both be omitted.

User-Defined Startup Structure (ELF)

You can define your own startup structure. That means you can remove the fields, which are not required for your application, or move the fields inside of the structure. If you change the startup structure, it is your responsibility to adapt the startup function to match the modification.

Example

If you have no RAM area to initialize at startup, no ROM libraries and no C++ modules in the application, you can define the startup structure as follows:

Listing 7.2 ELF User-Defined Startup Structure Example1

```
extern struct _tagStartup {
    unsigned short  flags;
    _PFunc          main;
    unsigned short  stackOffset;
} _startupData;
```

Adapt the startup code in the following way:

Listing 7.3 ELF User-Defined Startup Structure Example2

```
extern void near _Startup(void) {
/*  purpose:  1)  initialize the stack
              2)  call main;
    parameters: NONE */
  do { /* forever: initialize the program; call the root-procedure */
    INIT_SP_FROM_STARTUP_DESC();
   /* Here user defined code could be inserted,
       the stack can be used
    */
    /* call main() */
    (*_startupData.main)();
  } while(1); /* end loop forever */
}
```

NOTE Do not change the name of the fields in the startup structure. You are free to remove fields inside of the structure, but respect the names of the different fields or the SmartLinker may not initialize the structure correctly.

User-Defined Startup Routines (ELF)

There are two ways to replace the standard startup routine with one of your own:

- You can provide a startup module containing a function named `_Startup` and link it with the application in place of the startup module delivered.
- You can implement a function with a name other than `_Startup` and define it as the entry point for your application using the command `INIT`:

```
INIT function_name
```

In this case, function `function_name` is the startup routine.

Startup Descriptor (Freescale)

The Freescale startup descriptor of the linker is declared as below.

NOTE Descriptor declaration may vary depending on architecture or memory model.

Listing 7.4 Freescale Startup Descriptor Example

```
typedef struct{
  unsigned char  *beg; int size;
} _Range;

typedef void (*_PFunc)(void);

extern struct _tagStartup{
  unsigned           flags;
  _PFunc             main;
  unsigned           dataPage;
  long               stackOffset;
  int                nofZeroOuts;
  _Range             *pZeroOut;
  long               toCopyDownBeg;
  _PFunc             *mInits;
  struct _tagStartup *libInits;
} _startupData;
```

The linker expects, somewhere in your application, a declaration of the variable `_startupData`, that is:

```
struct _tagStartup _startupData;
```

The linker initializes the fields of this `struct` and allocates the `struct` in ROM in `STARTUP` segment. If you do not declare this variable, the linker does not create a startup

descriptor. In this case, there is no COPY segment, and the stack is not initialized. Furthermore, global C++ constructor and ROM libraries are not initialized.

The following table shows the semantics for these fields.

Table 7.2 Freescale Startup Descriptor Field Semantics

Field Name	Description
flags	Contains some flags, which may be used to detect special conditions at startup. Currently uses two bits. Linking the application as a ROM library sets bit 0 equal to 1. Bit 1 is set when no stack specification is made. Startup code tests flags to determine whether to initialize the stack pointer.
main	Function pointer set to the application's root function. In a C program, usually function main unless a MAIN entry exists in the parameter file specifying some other function as being root. In a ROM library, main is zeroed out. Standard startup code jumps to this address once initialization completes.
dataPage	Used only for processors having paged memory and memory models supporting only one page. In this case, dataPage gives the page.
stackOffset	Valid only if flags == 0. Contains initial stack pointer value.
nofZeroOuts	Number of READ_WRITE segments to fill with zero bytes at startup.
pZeroOut	Pointer to a vector with elements of type _Range. It has exactly nofZeroOuts elements, each describing a memory area to be cleared.
toCopyDownBeg	Contains the address of the first item which must be copied from ROM to RAM at runtime. All data to be copied is stored in a contiguous piece of ROM memory and has the following format: CopyData = {Size[2] TargetAddr {Byte}Size} 0x0[2] Size is a binary number whose most significant byte is stored first.

Table 7.2 Freescale Startup Descriptor Field Semantics (*continued*)

Field Name	Description
`libInits`	Pointer to array of pointers to `_startupData` records of all ROM libraries in the application. These addresses are needed to initialize the ROM libraries. To specify end of the array, the last array element contains the value `0x0000ffff`.
`mInits`	Pointer to array of function pointers containing addresses of the global C++ constructors in the application, sorted in calling order. Array is terminated by a single zero entry.

User-Defined Startup Routines (Freescale)

There are two ways to replace the standard startup routine with one of your own:

- You can provide a startup module containing a function named `_Startup` and link it with the application in place of the startup module delivered.
- You can implement a function with a name other than `_Startup` and define it as the entry point for your application using the command `INIT`:

```
INIT function_name
```

In this case, function `function_name` is the startup routine.

Example of Startup Code in ANSI-C

Normally the startup code delivered with the compiler is provided in HLI for code efficiency reasons. But there is also an ANSI-C version available in the library directory (`startup.c` and `startup.h`). You can use this code for your own modifications or to get familiar with the startup concept.

The code shown here is an example and may be different depending on the actual implementation. See the files in your installation directory.

Listing 7.5 Header File startup.h Example

```
/*************************************************
  FILE    : startup.h
  PURPOSE : data structures for startup
  LANGUAGE: ANSI-C
*************************************************/
#ifndef STARTUP_H
#define STARTUP_H
#ifdef __cplusplus
extern "C" {
```

```
#endif
#include <stdtypes.h>
#include <hidef.h>
/*
  the following data structures contain the data needed to
  initialize the processor and memory
*/

typedef struct{
  unsigned char *beg;
  int size;       /* [beg..beg+size] */
} _Range;

typedef struct _Copy{
  int size;
  unsigned char * dest;
} _Copy;

typedef struct _Cpp {
  _PFunc  initFunc;      /* address of init function */
} _Cpp;

typedef void (*_PFunc)(void);
typedef struct _LibInit{
  struct _tagStartup  *startup; /* address of startup desc */
} _LibInit;
#define STARTUP_FLAGS_NONE    0
#define STARTUP_FLAGS_ROM_LIB (1<<0) /* ROM library */
#define STARTUP_FLAGS_NOT_INIT_SP (1<<1) /* init stack */
#ifdef __ELF_OBJECT_FILE_FORMAT__
/* ELF/DWARF object file format */
/* attention: the linker scans for these structs */
/* to obtain the available fields and their sizes. */
/* So do not change the names in this file. */

extern struct _tagStartup {
  unsigned char flags;         /* STARTUP_FLAGS_xxx     */
  _PFunc         main;         /* first user fct        */
  unsigned short stackOffset;  /* initial stack pointer */
  unsigned short nofZeroOuts;  /* number of zero outs   */
  _Range         *pZeroOut;    /* vector of zero outs   */
  _Copy          *toCopyDownBeg; /* copy down start     */
  unsigned short nofLibInits;    /* number of ROM Libs  */
  _LibInit       *libInits;      /* vector of ROM Libs  */
  unsigned short  nofInitBodies; /* number of C++ inits */
  _Cpp           *initBodies;    /* C+ init funcs       */
  unsigned short  nofFiniBodies; /* number of C++ dtors */
  _Cpp           *finiBodies;    /* C+ dtors funcs      */
```

```
} _startupData;

#else /* HIWARE format */

extern struct _tagStartup {
  unsigned  flags;        /* STARTUP_FLAGS_xxx */
  _PFunc    main;         /* starting point of user code */
  unsigned  dataPage;     /* page where data begins */
  long      stackOffset;  /* initial stack pointer */
  int       nofZeroOuts;  /* number of zero out ranges */
  _Range    *pZeroOut;    /* ptr to zero out descriptor */
  long      toCopyDownBeg;/* address of copydown descr */
  _PFunc    *mInits;      /* ptr to C++ init fcts */
  _LibInit  *libInits;    /* ptr to ROM Lib descriptors */
} _startupData;

#endif

extern void _Startup(void);    /* execution begins here */
/*---------------------------------------------------*/
#ifdef __cplusplus
 }
#endif
#endif /* STARTUP_H */
```

Listing 7.6 Implementation File startup.c Example

```
/***************************************************
  FILE        : startup.c
  PURPOSE     : standard startup code
  LANGUAGE    : ANSI-C / HLI
 ***************************************************/
#include <hidef.h>
#include <startup.h>
/***************************************************/
struct _tagStartup _startupData; /* startup info   */
/*-------------------------------------------------*/
static void ZeroOut(struct _tagStartup *_startupData) {
/* purpose: zero out RAM-areas where data is allocated.*/
  int i, j;
  unsigned char *dst;
  _Range *r;
  r = _startupData->pZeroOut;
  for (i=0; i<_startupData->nofZeroOuts; i++) {
    dst = r->beg;
    j = r->size;
    do {
```

```
      *dst = '\0'; /* zero out */
      dst++;
      j--;
    } while(j>0);
    r++;
  }
}
/*---------------------------------------------------*/
static void CopyDown(struct _tagStartup *_startupData) {
/* purpose: zero out RAM-areas where data is allocated.
   this initializes global variables with their values,
    e.g. 'int i = 5;' then 'i' is here initialized with '5' */
  int i;
  unsigned char *dst;
  int *p;
  /* _startupData.toCopyDownBeg  ---> */
  /*  {nof(16) dstAddr(16) {bytes(8)}^nof} Zero(16) */
  p = (int*)_startupData->toCopyDownBeg;
  while (*p != 0) {
    i = *p; /* nof */
    p++;
    dst = (unsigned char*)*p; /* dstAddr */
    p++;
    do {
      /* p points now into 'bytes' */
      *dst = *((unsigned char*)p); /* copy byte-wise */
      dst++;
      ((char*)p)++;
      i--;
    } while (i>0);
  }
}
/*---------------------------------------------------*/
static void CallConstructors(struct _tagStartup *_startupData) {
/* purpose: C++ requires that the global constructors have
   to be called before main.
   This function is only called for C++ */
#ifdef __ELF_OBJECT_FILE_FORMAT__
  short i;
  _Cpp *fktPtr;

  fktPtr = _startupData->initBodies;
  for (i=_startupData->nofInitBodies; i>0; i--) {
    fktPtr->initFunc(); /* call constructors */
    fktPtr++;
  }
#else
  _PFunc *fktPtr;
```

```
  fktPtr = _startupData->mInits;
  if (fktPtr != NULL) {
    while(*fktPtr != NULL) {
      (**fktPtr)(); /* call constructors */
      fktPtr++;
    }
  }
#endif
}
/*-------------------------------------------------------*/
static void ProcessStartupDesc(struct _tagStartup *);
/*-------------------------------------------------------*/
static void InitRomLibraries(struct _tagStartup *_sData) {
  /* purpose: ROM libraries have their own startup functions
     which have to be called. This is only necessary if ROM
     Libraries are used! */

#ifdef __ELF_OBJECT_FILE_FORMAT__
  short i;
  _LibInit *p;

  p = _sData->libInits;
  for (i=_sData->nofLibInits; i>0; i--) {
    ProcessStartupDesc(p->startup);
    p++;
  }
#else
  _LibInit *p;
  p = _sData->libInits;
  if (p != NULL) {
    do {
      ProcessStartupDesc(p->startup);
    } while ((long)p->startup != 0x0000FFFF);
  }
#endif
}
/*-------------------------------------------------------*/
static void ProcessStartupDesc(struct _tagStartup *_sData) {
  ZeroOut(_sData);
  CopyDown(_sData);
#ifdef __cplusplus
  CallConstructors(_sData);
#endif
  if (_sData->flags&STARTUP_FLAGS_ROM_LIB) {
    InitRomLibraries(_sData);
  }
}
/*-------------------------------------------------------*/
```

```
#pragma NO_EXIT
#ifdef __cplusplus
  extern "C"
#endif
void _Startup (void) {
  for (;;) {
    asm {
      /* put your target specific initialization */
      /* (e.g. CHIP SELECTS) here */
    }
    if (!(_startupData.flags&STARTUP_FLAGS_NOT_INIT_SP)) {
      /* initialize the stack pointer */
      INIT_SP_FROM_STARTUP_DESC(); /* defined in hidef.h */
    }
    ProcessStartupDesc(&_startupData);
    (*_startupData.main)(); /* call main function */
  } /* end loop forever */
}
/*------------------------------------------------------*/
```

Startup Code and Effect of Pragmas

The `_Startup` is not affected by the pragmas placed on it in 'C' source. The compiler places `_Startup` in `.text` section by default or other section if it is overriden by pragma. Linker places `_Startup` in `.init` (alias `PRESTART`) section and also `_all_` other functions of startup source that go to `.text` section (or other section) in startup source are placed in .init section. If `.init` section is not allocated to any segment in `PLACEMENT` block of linker command file then linker automatically places `.init` section in segments assigned to `DEFAULT_ROM` (or `.text`) section. Consider the following example:

Listing 7.7 Example — Startup Code and Effect of Pragmas

```
'C' startup source:
#pragma CODE_SEG NON_BANKED
Void _Startup() {..}
Void Init() {..}
Void loadByt() {..}

Linker parameter file:
PLACEMENT
..
NON_BANKED INTO ROM; /*ROM is non-banked memory*/ DEFAULT_ROM INTO
PAGE0, PAGE1; /* PAGE0, PAGE1 are banked areas */ ..
```

```
END
```

In above case, `_Startup`, `Init` and `loadByte` functions are put in `NON_BANKED` section by the compiler. Linker forcefully places `_Startup` function in `.init` (alias `PRESTART`) section and also all functions that go to `NON_BANKED` section in startup source are placed in `.init` section. Since `.init` is not allocated to any segment in `PLACEMENT` block of `PRM`, linker places `.init` section in segments (`PAGE0` OR `PAGE1`) assigned for `DEFAULT_ROM` (or `.text`).

8

The Map File

When linking completes successfully, the linker writes a protocol of the link process to a list file called a `map` file. The name of the map file is the same as that of the `.ABS` file, but with extension `.map`. The linker writes the `map` file to the directory given by the `TEXTPATH` environment variable (see TEXTPATH: Text Path).

Map File Contents

The following table describes the sections contained in the map file.

Table 8.1 Map File Contents

Section Name	Description
`TARGET`	Names the target processor and memory model.
`FILE`	Lists names of all files from which objects were used or referenced during link process. In most cases, these are the same names listed in linker parameter file between keywords `NAMES` and `END`. If a file refers to ROM library or program, lists all object files used by ROM library or program with indentation.
`STARTUP`	Lists prestart code and values used to initialize startup descriptor `_startupData`. Startup descriptor is listed member by member with the initialization data at the right side of the member name.
`SEGMENT ALLOCATION`	Lists segments in which at least one object was allocated. At right side of the segment name there is a pair of numbers, which give the address range in which the objects belonging to the segment were allocated.
`OBJECT ALLOCATION`	Contains names of all allocated objects and their addresses. Objects are grouped by module. ROM library addresses are followed by an `@` sign. In this case the absolute file contains no code for the object (if it is a function), but the object's address was used for linking. A string object address followed by a dash "–" indicates that the string is a suffix of some other string. For example, if strings `abc` and `bc` are present in the same program, the string `bc` is not allocated and its address is the address of `abc` +1.

Table 8.1 Map File Contents (*continued*)

Section Name	Description
OBJECT DEPENDENCY	Lists every function and variable that uses other global objects and the names of these global objects.
DEPENDENCY TREE	Shows, in a tree format, all detected dependencies between functions. Also displays overlapping Locals displayed at their defining function.
UNUSED OBJECTS	Lists all objects found in object files that were not linked.
COPYDOWN	Lists all blocks that are copied from ROM to RAM at program startup.
STATISTICS	Delivers statistical information, like the number of bytes of code in the application.

NOTE If linking fails because there are objects which were not found in any object file, no `map` file is written.

9

ROM Libraries

The SmartLinker supports linking to objects to which addresses were assigned in previous link sessions. Packages of already linked objects are called ROM libraries. Creation of a ROM library only slightly differs from the linkage of a normal program. ROM libraries can then be used in subsequent link sessions by including them into the list of files between `NAMES` and `END`.

Examples for the use of ROM libraries are:

- If you use a set of related functions in different projects.

  It may be convenient to burn thoroughly tested library functions into ROM. We call such a set of objects (functions, variables and strings) at fixed addresses a ROM library.

- If you have a set of modules known to be error free and unchanging.

  To shorten the time needed for downloading, one can build a ROM library with modules known to be error free and that do not change. Such a ROM library must be downloaded only once, before beginning the tests of the other application modules.

- If the system allows you to download one program while another program is present in the target processor.

  The most prominent example is the monitor program. The linker facility described here enables an application program to use monitor functions.

This chapter contains the following topics:

Creating a ROM Library

To create a ROM library, the keywords `AS ROM_LIB` must follow the `LINK` command in the linker parameter file. With the `ENTRIES` command, the linker includes only the given objects (functions and variables) in the ROM library. Without an `ENTRIES` command, the linker writes all exported objects to the ROM library. In both cases the ROM library also contains all global objects used by those functions and variables.

Since a program cannot consist of a ROM library alone, a ROM library must not contain a function `main` or a `MAIN` or `INIT` command, and the commands `STACKSIZE` and `STACKTOP` are ignored.

Besides all the application modules which form a ROM library, you must also define the variable `_startupData` in the ROM library. The library includes a module containing only a definition of this variable.

ROM Libraries and Overlapping Locals

To allocate overlapping variables, all dependencies between functions must be known at link time. For ROM libraries, the linker is unaware of the dependencies between the objects in the ROM library. Therefore local variables of functions inside of the ROM library cannot overlap locals of the other modules. Instead, the ROM library must use a separate area for the `.overlap/_OVERLAP` segment which is not used in the main application.

Using ROM Libraries

This section describes various activities involved when using ROM libraries.

Suppressing Initialization

To link to a ROM library, add the name of the ROM library to the list of files in the `NAMES` section (see NAMES: List Files Building the Application) of the linker parameter file. Add a dash (–) immediately after the ROM library name (no blank between the last character of the file name and the dash) to prevent the startup routine from initializing the ROM library.

You can include an unlimited number of ROM libraries in the list of files to link, as long as no two ROM libraries use the same object file. If two ROM libraries contain identical objects (coming from the same object file) and both are linked in the same application, the linker reports an error, because allocating the same object more than once is not allowed.

Example Application

In this example, we want to build and use a ROM library named `romlib.lib`. In this example the ROM library contains only one object file with one function and one global variable.

Listing 9.1 Header File Example

```
/* rl.h */
#ifndef __RL_H__
#define __RL_H__

char RL_Count(void);
```

```
  /* returns the actual counter and increments it */

#endif
```

Below is the implementation. Note that somewhere in the ROM library we must define an object named `_startupData` for the linker. We will use this startup descriptor to initialize the ROM library.

Listing 9.2 Startup Descriptor Example

```
/* rom library (RL_) rl.c */
#include "rl.h"
#include <startup.h>

struct _tagStartup _startupData; /* for linker */

static char RL_counter; /* initialized to zero by startup */

char RL_Count(void) {
  /* returns the actual counter and increments it */
  return RL_counter++;
}
```

After compiling `rl.c` we can now link it and build a ROM library using the following linker parameter file. The main difference between a normal application linker parameter file and a parameter file for ROM libraries is the `AS ROM_LIB` keyword in the `LINK` command.

Listing 9.3 Linker Parameter File Example

```
/* rl.prm */
LINK romLib.lib AS ROM_LIB

NAMES rl.o END

SECTIONS
    MY_RAM = READ_WRITE  0x4000 TO 0x43FF;
    MY_ROM = READ_ONLY   0x1000 TO 0x3FFF;

PLACEMENT
    DEFAULT_ROM, ROM_VAR, STRINGS  INTO  MY_ROM;
    DEFAULT_RAM                    INTO  MY_RAM;
END
```

In this example, RAM starts at 0x4000 and ROM starts at 0x1000. By default the linker generates startup descriptors for ROM libraries too. The startup descriptors are used to

zero out global variables or to initialize global variables with initialization values. Additionally, C++ constructors and destructors may be called. This process is called *Module Initialization*.

To switch off Module Initialization for a single object file in the above linker parameter file, add a dash (–) at the end of each object file. For the above example this is:

```
NAMES rl.o- END
```

After building the ROM library, the linker generates a map file. The following listing shows an extract of this file. The linker also generates a startup descriptor at (in this case) address 0x1000 to initialize the ROM library.

Listing 9.4 Map File Example

```
*****************************************************
STARTUP SECTION
-----------------------------------------------------

Entry point: none
_startupData is allocated at 1000 and uses 44 Bytes


extern struct _tagStartup{
    unsigned flags                              3
    _PFunc   main                            103C ()
    unsigned dataPage                           0
    long     stackOffset                     4202
    int      nofZeroOuts                        1
    _Range   pZeroOut ->            4000        2
    long     toCopyDownBeg                   102C
    _PFunc   mInits   ->                     NONE
    void *   libInits ->                     NONE
} _startupData;


*****************************************************
SEGMENT-ALLOCATION SECTION
-----------------------------------------------------

Segmentname            Size Type    From       To  Name

FUNCS                    14  R      102E     1041  MY_ROM
COPY                      2  R      102C     102D  MY_ROM
STARTUP                  2C  R      1000     102B  MY_ROM
DEFAULT_RAM               2 R/W     4000     4001  MY_RAM


*****************************************************
```

```
OBJECT-ALLOCATION SECTION
-------------------------------------------------------

Type:     Name:                          Address:  Size:

MODULE:             -- rl.o --
- PROCEDURES:
          RL_Count                           102E     14


- VARIABLES:
          _startupData                       1000     2C
          RL_counter                         4000      2
```

Now we want to use the ROM library from our application, as in the following listing.

Listing 9.5 Simple Application Example

```
/* main application using ROM library: main.c */
#include "rl.h"

int cnt;

void main(void) {
  int i;

  for (i=0; i<100; i++) {
    cnt = RL_Count();
  }
}
```

After compiling `main.c` we can link it with our ROM library, as in Listing 9.6.

Listing 9.6 Linking Example

```
LINK main.abs

NAMES  main.o romlib.lib startup.o ansi.lib END

SECTIONS
    MY_RAM = READ_WRITE  0x5000 TO 0x53FF;
    MY_ROM = READ_ONLY   0x6000 TO 0x6FFF;

PLACEMENT
    DEFAULT_ROM, ROM_VAR, STRINGS  INTO  MY_ROM;
    DEFAULT_RAM                    INTO  MY_RAM;
END
```

```
STACKSIZE  0x200
```

Depending on your CPU configuration and memory model you may need to use a startup object file other than `startup.o` and a library other than `ansi.lib`. Additionally you must choose the right startup object file. For efficiency reasons most of the startup files implemented in HLI are optimized for a specific target. To save ROM usage, they do not support ROM libraries in the startup code. As long as no Module Initialization is needed, this is not a problem. To use the Module Initialization feature (as in our example), we use the ANSI-C implementation in the library directory (`startup.c`). Because this startup file may not be delivered in every target configuration, you must compile the `startup.c` startup file as well.

After linking to `main.abs`, you get a map file. The following listing shows an extract of this file.

Listing 9.7 Map File after Linking Example

```
****************************************************
STARTUP SECTION
----------------------------------------------------
Entry point: 0x6000
Linker generated code (at 0x6000) before calling __Startup:
MOVE #0x2700, SR
JMP 0x61A0
_startupData is allocated at 600A and uses 48 Bytes

extern struct _tagStartup{
    unsigned flags                              0
    _PFunc   main                            603C (_main)
    unsigned dataPage                           0
    long     stackOffset                     5202
    int      nofZeroOuts                        1
    _Range   pZeroOut ->            5000        2
    long     toCopyDownBeg                   603A
    _PFunc   mInits   ->                     NONE
    void *   libInits ->                     1000
} _startupData;

****************************************************
SEGMENT-ALLOCATION SECTION
----------------------------------------------------
Segmentname           Size Type    From       To  Name

FUNCS                  184  R      603C     61BF  MY_ROM
COPY                     2  R      603A     603B  MY_ROM
STARTUP                 30  R      600A     6039  MY_ROM
```

```
_PRESTART                 A  R      6000     6009  MY_ROM
SSTACK                  200 R/W     5002     5201  MY_RAM
DEFAULT_RAM               2 R/W     5000     5001  MY_RAM
****************************************************
OBJECT-ALLOCATION SECTION
----------------------------------------------------
Type:     Name:                           Address:  Size:
VECTOR
          value:        0                       0      4
          &_Startup                             4      4


MODULE:             -- main.o --
- PROCEDURES:
          main                                603C     26

- VARIABLES:
          cnt                                 5000      2


MODULE:             -- X:\FREESCALE\DEMO\M68KC\rl.o --
- PROCEDURES:
          RL_Count                            102E     14 @

- VARIABLES:
          __startupData                       1000     2C @
          RL_counter                          4000      2 @


MODULE:             -- startup.o --
- PROCEDURES:
          ZeroOut                             6062     50
          CopyDown                            60B2     54
          ProcessStartupDesc                  6142     3E
          HandleRomLibraries                  6106     3C
          Start                               6180     20
          _Startup                            61A0     20

- VARIABLES:
          _startupData                        600A     30
```

The linker marks objects linked from the ROM library (`RL_Count`, `RL_counter`) with an @ in the `OBJECT-ALLOCATION-SECTION`. The linker in this case generates a startup descriptor at address `0x600A` which points, with field `libInits`, to the startup descriptor in our ROM library at address `0x1000`.

NOTE The `main.abs` file does NOT include the code/data of the ROM library, thus they are NOT downloaded during downloading of `main.abs`, and must be downloaded separately (e.g., with an EEPROM).

10

Initializing the Vector Table

You can initialize the vector table in the assembly source file or in the linker parameter (`prm`) file. We recommend initializing it in the `prm` file. This chapter covers the following topics:

- Using SmartLinker prm File
- Using a Relocatable Section in the Assembly Source File
- Using an Absolute Section in the Assembly Source File

Using SmartLinker prm File

Initializing the vector table from the `prm` file allows you to initialize single entries in the table. You can decide if you want to initialize all the entries in the vector table or not.

You must implement the labels or functions to insert into the vector table in the assembly source file. All these labels must be published, otherwise they cannot be addressed in the linker `prm` file.

Listing 10.1 Using SmartLinker prm File Example

```
XDEF IRQFunc, XIRQFunc, SWIFunc, OpCodeFunc, ResetFunc

DataSec: SECTION
Data:  DCB 5 ; Each interrupt increments another element of the table.

CodeSec: SECTION
; Implementation of the interrupt functions.

IRQFunc:
          LDA #0
          BRA int

XIRQFunc:
          LDA #2
          BRA int

SWIFunc:
          LDA #4
          BRA int
```

```
OpCodeFunc:
          LDA #6
          BRA int

ResetFunc:
          LDA #8
          BRA entry

int:
       ADD #Data  ; Load address of symbol Data in X
       TAX        ; X <- address of the appropriate element in the table
       INC 0, X   ; The table element is incremented
       RTI

entry:
        LDHX #$AFE
        TSX
loop:   BRA loop
```

NOTE The functions `IRQFunc`, `XIRQFunc`, `SWIFunc`, `OpCodeFunc`, `ResetFunc` are published. This is required because they are referenced in the linker `prm` file.

NOTE As the HC08 processor automatically pushes all registers onto the stack on occurrence of an interrupt, the interrupt functions do not need to save and restore the registers being used.

NOTE You must terminate all interrupt functions with an RTI instruction.

Initialize the vector table using the `VECTOR ADDRESS` linker command.

Listing 10.2 Initializing Vector Table Example

```
LINK test.abs
NAMES
  test.o
END

SECTIONS
  MY_ROM  = READ_ONLY  0x0800 TO 0x08FF;
  MY_RAM  = READ_WRITE 0x0B00 TO 0x0CFF;

PLACEMENT
  DEFAULT_RAM        INTO MY_RAM;
```

```
  DEFAULT_ROM        INTO MY_ROM;
END

INIT ResetFunc
VECTOR ADDRESS 0xFFF2 IRQFunc
VECTOR ADDRESS 0xFFF4 XIRQFunc
VECTOR ADDRESS 0xFFF6 SWIFunc
VECTOR ADDRESS 0xFFF8 OpCodeFunc
VECTOR ADDRESS 0xFFFE ResetFunc
```

NOTE The statement `INIT ResetFunc` defines the application entry point. Usually, this entry point is initialized with the same address as the reset vector.

NOTE The statement `VECTOR ADDRESS 0xFFF2 IRQFunc` tells the linker to write the address of function `IRQFunc` at address `0xFFF2`.

Using a Relocatable Section in the Assembly Source File

Initializing the vector table in the assembly source file requires initializing all the entries in the table. Unused interrupts must be associated with a standard handler.

You must implement the labels or functions to insert into the vector table in the assembly source file. You can define the vector table in an assembly source file in an additional section containing constant variables.

Listing 10.3 Using a Relocatable Section in the Assembly Source File Example1

```
          XDEF ResetFunc
DataSec: SECTION
Data:    DCB 5  ; Each interrupt increments an element of the table.
CodeSec: SECTION
; Implementation of the interrupt functions.
IRQFunc:
           LDA #0
           BRA int
XIRQFunc:
           LDA #2
           BRA int
SWIFunc:
           LDA #4
           BRA int
```

```
OpCodeFunc:
          LDA #6
          BRA int
ResetFunc:
          LDA #8
          BRA entry
DummyFunc:
          RTI
int:
          ADD #Data
          TAX
          INC 0, X
          RTI
entry:
          LDHX #$AFE
          TSX
loop:     BRA loop

VectorTable:SECTION
; Definition of the vector table.
IRQInt:         DCW IRQFunc
XIRQInt:        DCW XIRQFunc
SWIInt:         DCW SWIFunc
OpCodeInt:      DCW OpCodeFunc
COPResetInt:    DCW DummyFunc; No function attached to COP Reset.
ClMonResInt:    DCW DummyFunc; No function attached to Clock
                               ; MonitorReset.
ResetInt      : DC.W ResetFunc
```

NOTE Each constant in the section `VectorTable` is defined as a word (2-byte constant), because the entries in the HC08 vector table are 16 bits wide.

NOTE The previous example initializes the constant `IRQInt` with the address of the label `IRQFunc`.

NOTE All the labels specified as initialization values must be defined, published (using `XDEF`) or imported (using `XREF`) before the vector table section. No forward reference is allowed in `DC` directive.

Now place the section at the expected address, using the linker parameter file.

Listing 10.4 Using a Relocatable Section in the Assembly Source File Example2

```
LINK test.abs
```

```
NAMES  test.o+ END

SECTIONS
  MY_ROM  = READ_ONLY  0x0800 TO 0x08FF;
  MY_RAM  = READ_WRITE 0x0A00 TO 0x0BFF;
/* Define the memory range for the vector table */
  Vector  = READ_ONLY  0xFFF2 TO 0xFFFF;
PLACEMENT
  DEFAULT_RAM         INTO MY_RAM;
  DEFAULT_ROM         INTO MY_ROM;
/* Place the section 'VectorTable' at the appropriated address. */
  VectorTable  INTO Vector;
END

INIT ResetFunc
```

NOTE The statement `Vector = READ_ONLY 0xFFF2 TO 0xFFFF` defines the memory range for the vector table.

NOTE The statement `VectorTable INTO Vector` tells the linker to load the vector table into the read-only memory area `Vector`. This allocates the constant `IRQInt` at address `0xFFF2`, the constant `XIRQInt` at address `0xFFF4`, and so on, and allocates the constant `ResetInt` at address `0xFFFE`.

NOTE The statement `NAMES test.o+ END` switches smart linking OFF in the module `test.o`. If this statement is missing in the prm file, the vector table never links with the application, because it is never referenced. The SmartLinker only links the referenced objects in the absolute file.

Using an Absolute Section in the Assembly Source File

Initializing the vector table in the assembly source file requires initializing all the entries in the table. Unused interrupts must be associated with a standard handler.

You must implement the labels or functions to insert into the vector table in the assembly source file. You can define the vector table in an assembly source file in an additional section containing constant variables.

Listing 10.5 Using Absolute Section in Assembly Source File Example1

```
XDEF ResetFunc
DataSec: SECTION
Data:    DCB  ; Each interrupt increments an element of the table.
CodeSec: SECTION
; Implementation of the interrupt functions.
IRQFunc:
          LDA #0
          BRA  int
XIRQFunc:
          LDA #2
          BRA  int
SWIFunc:
          LDA #4
          BRA  int
OpCodeFunc:
          LDA #6
          BRA  int
ResetFunc:
          LDA #8
          BRA  entry
DummyFunc:
          RTI
int:
          ADD #Data
          TAX
          INC 0, X
          RTI
entry:
          LDHX #$AFE
          TSX
loop:     BRA loop

               ORG $FFF2
; Definition of the vector table in an absolute section
; starting at address
;  $FFF2.
IRQInt:        DCW IRQFunc
XIRQInt:       DCW XIRQFunc
SWIInt:        DCW SWIFunc
OpCodeInt:     DCW OpCodeFunc
COPResetInt:   DCW DummyFunc; No function attached to COP Reset.
ClMonResInt:   DCW DummyFunc; No function attached to Clock
                           ; MonitorReset.
ResetInt     : DCW ResetFunc
```

NOTE Each constant in the section `VectorTable` is defined as a word (2-byte constant), because the entries in the HC08vector table are 16 bits wide.

NOTE In the previous example initializes the constant `IRQInt` with the address of the label `IRQFunc`.

NOTE All the labels specified as initialization value must be defined, published (using `XDEF`) or imported (using `XREF`) before the vector table section. No forward reference is allowed in `DC` directive.

NOTE The statement `ORG $FFF2` specifies that the next section must start at address `$FFF2`.

Listing 10.6 Using Absolute Section in Assembly Source File Example2

```
LINK test.abs
NAMES
  test.o+
END

SEGMENTS
  MY_ROM  = READ_ONLY  0x0800 TO 0x08FF;
  MY_RAM  = READ_WRITE 0x0A00 TO 0x0BFF;
PLACEMENT
  DEFAULT_RAM         INTO MY_RAM;
  DEFAULT_ROM         INTO MY_ROM;
END

INIT ResetFunc
```

NOTE The statement `NAMES test.o+ END` switches smart linking OFF in the module `test.o`. If this statement is missing in the `prm` file, the vector table never links with the application, because it is never referenced. The SmartLinker links only the referenced objects in the absolute file.

II

Burner Utility

Introduction

The CodeWarrior IDE burner utility converts an .ABS file into a file that can be handled by an EPROM burner. The Burner is available as either:

- An interactive burner with a graphical user interface (GUI).
- A batch burner that accepts commands either from a command line or in a command file. It can then be invoked by the Make Utility.

This section consists of the following chapters:

- Interactive Burner GUI: Description of GUI
- Batch Burner Language: Description of Batch Burner Language (BBL)

Product Highlights

The burner utility:

- Has a powerful user interface
- Has available on-line help
- Offers flexible message management
- Has 32-bit application
- Can generate S-Record, Binary, or Intel Hex files
- Can split the application into different EEPROMS (1-, 2- or 4-byte bus width)
- Has an interactive (GUI) and batch language interface (Batch Burner)
- Uses a powerful Batch Burner Language with various commands, including:
  - baudRate, busWidth, CLOSE, dataBit, destination, DO, ECHO, ELSE, END, fillByte, FOR, format, header, IF, len, OPENCOM,

OPENFILE, origin, parity, PAUSE, range, SENDBYTE, SENDWORD, SLINELEN, SRECORD, swapByte, THEN, TO, and undefByte.

- Supports Freescale and ELF/DWARF Object File Format, S-Records and Intel Hex Files as input
- Supports a serial programmer attached to a serial port with various configuration settings

Starting the Burner Utility

You can start all of the utilities described in this book from executable files located in the Prog folder of your IDE installation. The executable files are:

- linker.exe The SmartLinker Utility
- burner.exe The Burner Utility
- libmaker.exe The Libmaker Utility
- decoder.exe The Decoder Utility
- maker.exe Maker: The Make Tool

With a standard full installation of the HC08/RS08 CodeWarrior IDE, the executable files are located at:

<*CWInstallDir*>\MCU\prog

For S12Z derivatives, the executable files are located at:

<*CWInstallDir*>\MCU\S12lisa_Tools

where <*CWInstallDir*> is the directory where CodeWarrior software is installed.

To start the Burner Utility, double-click the burner.exe file.

11

Interactive Burner GUI

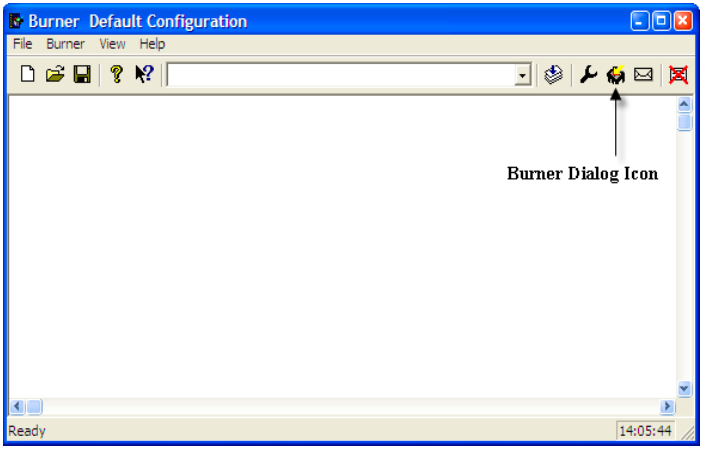
You can use the interactive burner graphic user interface (GUI) to burn your EEPROM instead of writing a batch burner language file. Within the GUI you can set all parameters and receive the output needed for a batch burner language file. You can then use the commands displayed on the Burner Dialog Box Command File tab in a make file.

This chapter covers the following topics:

Burner Default Configuration Window

When you start the Burner, the **Burner Default Configuration** window opens.

Figure 11.1 Burner Default Configuration Window



To open the burner dialog box, click the **Burner Dialog** icon in the toolbar or select the Burner Dialog option from the Burner list menu.

You can also access the burner dialog box with the following command line option:

```
burner.exe -D
```

Burner Dialog Box

The Burner dialog box consists of three tabs:

- Input/Output Tab
- Content Tab
- Command File Tab

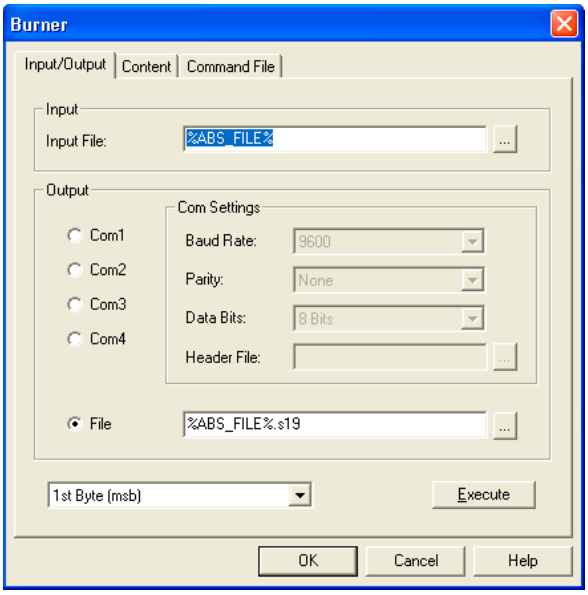
The Burner uses the last burn session values as initial values for the Burner dialog box tabs. The Burner writes the values to the `project.ini` file in the `[BURNER]` section.

Input/Output Tab

In the I**nput/Output** tab, specify which file you want the burner to use for input and where to write the output. Click the **Execute** button to start the operation.

Output from the burn process usually goes to a PROM burner connected to the serial port. You can also redirect output to a file written in either Intel Hex format, as Freescale S-Records or as plain binary.

Figure 11.2 Burner Dialog Box Input/Output Tab



Input Group

Specify the input file in the **Input File** text field. The browse button on the right side is used to browse for a file. The following file types are supported:

- Absolute files produced by linker. The absolute file format may be either Freescale or ELF/DWARF
- S-Record File
- Intel Hex File

The corresponding Batch Burner command is SENDBYTE: Transfer Bytes or SENDWORD: Transfer Word.

To specify the input file, you can use the `%ABS_FILE%` macro to pass `ABS_FILE` using an environment variable. See Environment Variable Details.

For example:

```
-ENV" ABS_FILE=file_name"
```

Output Group

The burner writes output to a serial port (Com1, Com2, Com3 or Com4) or a file.

File

Select the *File* option button to write output to a file. In the corresponding text box, enter the output file name or browse for an existing file.

The corresponding Batch Burner command is OPENFILE: Open Output File.

If you use the macro `%ABS_FILE%` for the input file, you can add an extension to automatically generate the output file.

Example:

```
%ABS_FILE%.s19
```

Com1, Com2, Com3, Com4

To write the output to a serial port, select an available port and define the communication settings.

The corresponding Batch Burner command is OPENCOM: Open Output Communication Port.

Com Settings Group

Writing output to a serial port (Com1, Com2, Com3 or Com4) specifies Baud Rate, Parity, Data bits and Header File in the list boxes and text box of the Com Settings group.

Table 11.1 Serial Port Specifications

Name	Available Options	Corresponding Batch Burner Command
Baud Rate	Supported Baud Rates: 300, 600, 1200, 2400, 4800, 9600, 19200 and 38400	baudRate: Baudrate for Serial Communication
Parity	Set communication parity to none, even or odd.	parity: Set Communication Parity
Data Bits	Set number of data bits transferred to 7 or 8 bits.	dataBit: Number of Data Bits
Header File	Use to specify an initialization file for the PROM burner. File is sent to PROM burner byte by byte (binary), without modification, before anything else.	header: Header File for PROM Burner

Execute Group

The Execute group selects a data width and writes data.

1. From the list menu select the byte or word to write:
   - 1st Byte (msb)
   - 2nd Byte
   - 3rd Byte
   - 4th Byte
   - 1st Word
   - 2nd Word
2. Click the **Execute** command button to write the data.

   Depending on the data width chosen, you may have to send the result to more than one output file.

   Example: Format is **S Record** and data bus is **2 Bytes**

   This generates two output files. Data for the first Byte (msb) is sent to a file named `fibo_1.s19` and data for the second byte is sent to `fibo_2.s19`.
3. Select **1st Byte** *(msb)*

   If your data bus is 2 bytes wide, the code is split into two parts:
   - Selecting **1st Byte** (*msb*) and clicking *Execute* transfers the even part of the data (corresponding to D8 to D15).

- Selecting **2nd Byte** transfers the odd part, which corresponds to LSB or D0 to D7.

If the data bus is 4 bytes wide:

- **1st Byte** *(msb)* transfers D24 to D31
- **4th Byte** sends the LSB (D0 to D7).

If using 16-bit EPROMs, select one of the Word formats. If necessary, you can exchange the high and low byte. Check **Swap Bytes** in the **Content** tab of the Burner dialog box.

4. Click **Execute** to transfer the code bytes, if you select a data bus width of 1 byte.

The corresponding Batch Burner commands are SENDBYTE: Transfer Bytes and SENDWORD: Transfer Word.

Content Tab

Use the **Content** tab in the **Burner** dialog box to specify the data format and range to be written.

Figure 11.3 Burner Dialog Box Content Tab

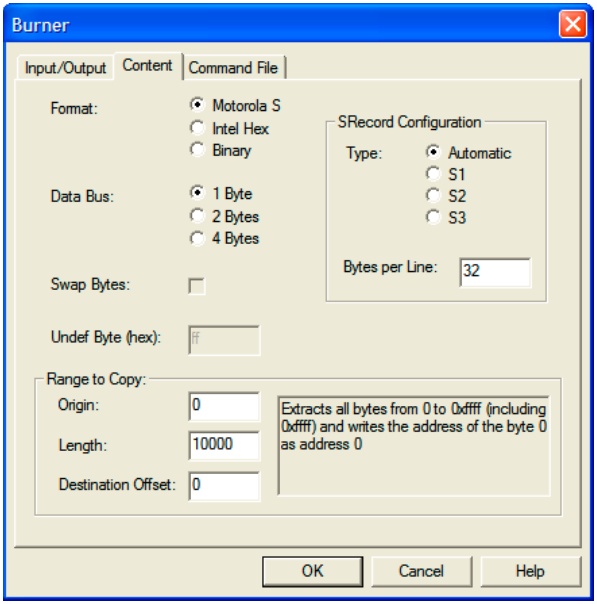


Table 11.2 Content Tab Group Details

Group Name	Use	Available Options	Corresponding Batch Burner Command
Format	Use to select an output format	S Records Intel Hex Files Binary Files	format: Output Format
SRecord Configuration	Use to select type of SRecord and bytes per line to be written OR Use to configure the number of bytes per SRecord line. Useful when using tools with restricted capacity.	automatic, S1 S2 S3	SRECORD: S-Record Type SLINELEN: SRecord Line Length
Data Bus	Use to select a Data Bus width	1, 2 or 4 bytes	busWidth: Data Bus Width
Swap Bytes Checkbox	Use to enable swapping bytes. Available if data bus is 2 or 4 bytes		swapByte: Swap Bytes
Undef Byte Textbox	For a binary output file, normally all undefined bytes in output are written as 0xFF. If desired, another pattern can be specified.		undefByte: Fill Byte for Binary Files
Range to Copy	Use to specify the range to copy. Text box explains result.	origin (start), length, offset	Range to Copy Group

Range to Copy Group

To understand range to copy group, consider the following example:

If your application is linked at address `$3000` to `$4000` and the EPROM is at address `$2000` (Origin) and Length is `$2000`, the code will start at address `$1000` relative to the

EPROM. If the EPROM is at address `$3000` (Origin) and Length is `$1000`, it is filled from the start.

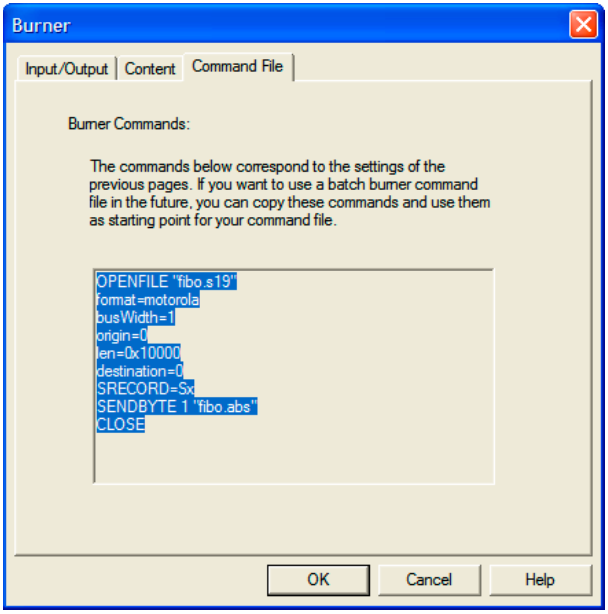
Table 11.3 Range to Copy Group Details

Textbox	Use	Corresponding Batch Burner Command
Origin Textbox	Set to EEPROM start address in system.	origin: EEPROM Start Address
Length	Enter range of program code to be copied.	len: Length to be Copied
Destination Offset	Enter additional offset to add to resulting S Record or Intel Hex File. For example, if you set *Origin* to `0x3000` and *Destination Offset* to `0x1000`, then written address is `0x4000`.	destination: Destination Offset

Command File Tab

The **Command File** tab of the Burner dialog box displays a summary of your settings as Batch Burner commands. You can select and copy the commands for use in make files or Batch Burner Language (`.bbl`) files.

Figure 11.4 Burner Dialog Box Command File Tab



If you use the selection displayed on the **Command File** tab in a make file, you must either place everything on a single line or use the line continuation character (\ ) as shown.

Listing 11.1 Using Line Continuation Character (\ ) Example

```
burn:
  $(BURN) \
    OPENFILE "fibo.s19" \
    format = freescale \
    origin = 0xE000 \
    len = 0x2000 \
    busWidth = 1
```

12

Batch Burner Language

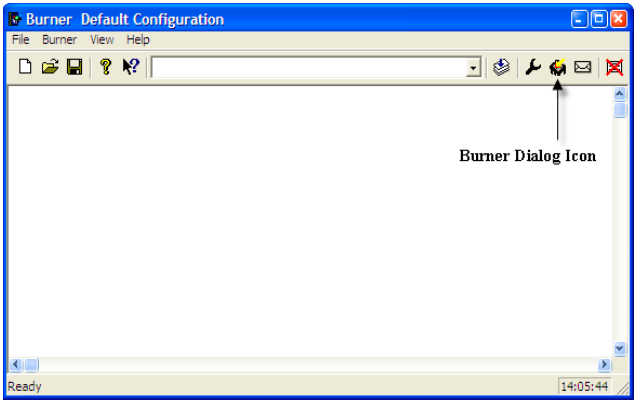
This chapter describes the Batch Burner Language (BBL). The topics covered here are as follows:

- Batch Burner User Interface
- Syntax of Burner Command Files
- Batch Burner with Makefile

Batch Burner User Interface

Starting the Burner utility displays the window shown in the following figure.

Figure 12.1 Burner Default Configuration Window



To use the Batch Burner, type in your batch burner commands on the command line, specify a file using the `-F` option on the command line, or use a startup option:

```
-Ffibo.bbl
```

or

```
OPENFILE "fibo.s19" origin=0xE000 len=0x2000 SENDBYTE 1
"fibo.abs"
```

You can also specify options and burner commands with the burner program:

```
burner.exe -Ffibo.bbl
```

You can use the Burner directly from a make file, as shown in the following listing:

Listing 12.1 Using Burner Directly from Make File

```
burn:
  $(BURN) \
    OPENFILE "fibo.s19" \
    format = freescale \
    origin = 0xE000 \
    len = 0x2000 \
    busWidth = 1
    SENDBYTE 1 "fibo.abs"
```

Syntax of Burner Command Files

The following example shows the syntax of burner commands.

Listing 12.2 Example of Burner Command File Syntax

```
StatementList = Statement {Separator Statement}.
Statement = [IfSat | ForStat | Open | Send | Close | Pause
             | Echo | Format | SFormat | Origin | Len
             | BusWidth | Parity | SwapByte | Header
             | BaudRate | DataBit | UndefByte
             | Destination | AssignExpr | SLineLen].
IfStat = "IF" RelExpr "THEN" StatementList
            ["ELSE" StatementList] "END".
Assign = (“=” | “:=”).
ForStat = "FOR" Ident Assign SimpleExpr "TO" SimpleExpr
              "DO" StatementList "END".
Open = ("OPENFILE" String) | ("OPENCOM" SimpleExpr).
Send = ("SENDBYTE" | "SENDWORD") SimpleExpr String.
Close = "CLOSE".
Pause = "PAUSE" [String].
Echo = "ECHO" [String].
Format = “format” Assign (“freescale” | “intel” | “binary”).
SFormat = “SRECORD” Assign (“Sx” | “S1” | “S2” | “S3”).
Origin = “origin” Assign SimpleExpr.
Len = “len” Assign SimpleExpr.
BusWidth = “busWidth” Assign (“1” | “2” | “4”).
Parity = “parity” Assign (“none” | “even” | “odd”).
SwapByte = “swapByte” Assign (“yes” | “no”).
Header = “header” Assign string.
BaudRate = “baudRate” Assign ( “300” | “600” | “1200”
                             | “2400” | “4800” | “9600”
```

```
                                | "19200" | "38400").
DataBit = "dataBit" Assign ("7" | "8").
UndefByte = "undefByte" Assign SimpleExpr.
Destination = "destination" Assign SimpleExpr.
SLineLen = "SLINELEN" Assign SimpleExpr.
AssignExpr = Ident Assign SimpleExpr.
RelExpr = SimpleExpr {RelOp SimpleExpr}.
RelOp = "=" | "==" | "#" | "<>" | "!=" | "<"
          | "<=" | ">" | ">=".
SimpleExpr = ["+" | "-"] Term {AddOp Term}.
AddOp = "+" | "-".
Term = Number | String | Ident.
Number = 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | {Number}
Ident = "i".
String = '"' {char} '"'.
```

NOTE The identifier used in a `FOR` statement must be called `i`.

Command File Comments

Command files accept both ANSI-C style or Modula-2 style comments.

```
/* This is a C like comment */
(* This is a Modula-2 like comment *)
```

Specify assignments using ANSI-C or Modula-2 syntax:

```
dataBit := 2 (* Modula-2 like *)
dataBit = 2 /* C like */
```

Specify constant format using either ANSI-C or Modula-2 syntax:

```
origin = 0x1000 /* C like */
origin := 1000H (* Modula-2 like *)
```

Batch Burner with Makefile

In a makefile, you can use the burner in two different ways. The first way is to specify a command file:

```
BURNER.EXE -f "<CmdFile>"
```

The second way is to directly specify commands on the command line:

```
BURNER.EXE SENDBYTE 1 "InFile.abs"
```

If the commands are long, you can use line continuation characters in your make file , as shown in the following listing.

Listing 12.3 Using Line Continuation Character for Long Commands Example

```
burn:
  $(BURN) \
    OPENFILE "fibo.s19" \
    format = freescale \
    origin = 0xE000 \
    len = 0x2000 \
    busWidth = 1
```

If you use the second method, you can include parameter initialization in the `DEFAULT.ENV` file located in the working directory. This reduces the length of the command line parameters, which are limited to 65535 bytes. Variables that can be specified using environment variables are listed in the following listing.

Listing 12.4 Variables that can be specified using Environment Variables

```
header=
format=freescale
busWidth=1
origin=0
len=0x10000
parity=none
undefByte=0xff
baudRate=9600
dataBit=8
swapByte=no
```

The example above shows the default values but any legal value can be assigned (see Batch Burner Commands). For further details, see the example in the following section.

Command File Examples

The following examples show how to write a command file. The following listing shows a command file for conditional and repetitive statements.

If the symbol # appears in a string it is replaced by the value of `i`.

Listing 12.5 Sample Command File for Conditional and Repetitive Statements

```
ECHO
ECHO " I can count... and I can take decisions"
FOR i = 0 TO 8 DO
```

```
    IF i == 7 THEN
       ECHO "This is the number seven"
    ELSE
       ECHO "#"
    END
    IF i == 3 THEN
       ECHO "This was the number three"
    END
END
```

The following listing shows a command file for redirecting the output to a file. To redirect output, use the command `OPENFILE`.

Listing 12.6 Command File for Redirecting Output

```
ECHO
ECHO "Programming 2 EPROMs with 3 files"
ECHO "the first byte of the word goes into the first EPROM"
ECHO "the second byte of the word goes into the second EPROM"
PAUSE "Hit any key to continue"
  format = freescale
  busWidth = 2
  origin = 0
  len = 0x3000
FOR i = 1 TO 2 DO
    PAUSE "Insert EPROM n# and press <return>"
    OPENFILE "prom#.bin"
       origin = 0X
       SENDBYTE i "demo1.abs"
       origin = origin + 0x500
       SENDBYTE i "demo2.abs"
       origin = origin + 0x500
       SENDBYTE i "demo3.abs"
    CLOSE
END
```

The following listing shows a command file for redirecting the output to a serial port. Use the `OPENCOM` command to redirect the output to a serial port.

Listing 12.7 Command File for Redirecting Output to Serial Port

```
ECHO
ECHO "I can also program 16-bit EPROMs with header"
PAUSE "Hit any key to continue"
header = "init.prm"
format = intel
busWidth = 2
```

```
origin = 0x0
len = 0x1000
OPENCOM 1 /* here com1, com2, com3 or com4 could be used*/
SENDWORD 1 "fbin1.map"
CLOSE
```

The following listing shows a command file for calling the burner from a makefile. After compiling and linking the application, the burner prepares the generated code to be burned into two EPROMs, one containing the odd bytes (`fibo_odd.s1`) and the other the even bytes (`fibo_eve.s1`).

Listing 12.8 Command File for Calling Burner from makefile

```
makeall:
  $(COMP) $(FLAGS)     fibo.c
  $(LINK)              fibo.prm
  burner.exe OPENFILE "fibo_odd.s1" \
    busWidth=2 SENDBYTE 1 "fibo.abs"
  burner.exe OPENFILE "fibo_eve.s1" \
    busWidth=2 SENDBYTE 2 "fibo.abs"
```

NOTE For all parameters not specified in the parameter list, the burner uses default values or the values specified by environment variables.

III

Libmaker Utility

Introduction

This section describes the Libmaker, a utility program for creating and maintaining object file libraries. Using libraries can speed up linking since fewer files are involved, and also helps in structuring large applications.

Libraries may be given in the linker parameter file instead of object files.

This section consists of the following chapters:

- Libmaker Interface: Description of the GUI.

User Interface

Libmaker provides:

- Graphical User Interface (GUI)
- Command-Line User Interface
- Online Help
- Flexible Message Management
- 32-bit Application
- Builds libraries with Freescale or ELF/DWARF object files
- Error Feedback
- Easy integration with other tools (e.g. CodeWarrior IDE, CodeWright, MS Visual Studio, WinEdit)

Starting the Libmaker Utility

You can start tools (compiler/linker/assembler/decoder/) using:

- Windows Explorer
- Icon on the desktop
- Icon in a program group
- Batch/command files
- Other tools (Editor, Visual Studio)

You can start all of the utilities described in this book from executable files located in the `Prog` folder of your IDE installation. The executable files are:

- `linker.exe` The SmartLinker Utility
- `burner.exe` The Burner Utility
- `libmaker.exe` The Libmaker Utility
- `decoder.exe` The Decoder Utility
- `maker.exe` Maker: The Make Tool

With a standard full installation of the HC08/RS08 CodeWarrior IDE, the executable files are located at:

<*CWInstallDir*>`\MCU\prog`

For S12Z derivatives, the executable files are located at:

<*CWInstallDir*>`\MCU\S12lisa_Tools`

where <*CWInstallDir*> is the directory where CodeWarrior software is installed.

To start the Libmaker Utility, double-click on `libmaker.exe`. The **Libmaker Default Configuration** window appears.

Interactive Mode

If you start the libmaker with no input (no options or input files), then the graphical user interface is active (interactive mode). This is usually the case if you start the tool using Explorer or an icon.

13

Libmaker Interface

This chapter describes the libmaker interface, and covers the following topics:

- Startup Command Line Options
- Command Line Interface
- Libmaker Graphic User Interface

Startup Command Line Options

There are special options for tools which can only be specified at tool startup (while launching the tool), e.g. they cannot be specified interactively:

Use `-Prod` (see -Prod: Specify Project File at Startup (PC) (No d, no m)) to specify the current project directory or file, for example:

```
libmaker.exe -Prod=C:\Program Files\Freescale\CodeWarrior
for Microcontrollers V10.x\demo\myproject.pjt
```

There are other options used to launch the tool and open its dialog boxes. Those dialogs are available in the compiler/assembler/burner/maker/linker/decoder/libmaker:

- `-ShowOptionDialog`: This startup option opens the tool option dialog.
- `-ShowMessageDialog`: This startup option opens the tool message dialog.
- `-ShowConfigurationDialog`: This opens the *File* > *Configuration* dialog.
- `-ShowBurnerDialog`: Opens burner dialog (burner only)
- `-ShowSmartSliderDialog`: Opens smart slider dialog (compiler only)
- `-ShowAboutDialog`: Opens the tool about box.

These options open dialogs in which you can specify tool settings. When you click the *OK* button in the dialog, Libmaker stores the settings in the current project settings file. Example:

```
C:\Program Files\Freescale\CodeWarrior for Microcontrollers
V10.x\prog\libmaker.exe -ShowOptionDialog
-Prod=c:\demos\myproject.pjt
```

Command Line Interface

Libmaker provides both a command line interface and an interactive interface. If you do not specify any arguments on the command line, a window appears.

Libmaker Commands

When you start Libmaker, it opens a window and prompts for arguments. The arguments may be given on a command line in the format shown in the following listing.

Listing 13.1 Libmaker Argument Format

```
LibCommand       =  Creation
                    | AppendFiles
                    | RemoveFiles
                    | List
                    | "@" FileName.
Creation          =  FileName AddList "=" LibName.
AddList           =  {"+" FileName}.
AppendFile        =  LibName AddList "=" LibName.
RemoveFiles       =  LibName SubList ["=" LibName].
SubList           =  "-" FileName {"-" FileName}.
List                =  LibName "?" FileName.
```

Libmaker uses the environment variable `OBJPATH` when looking for object or library files, or writing the library file. It uses the environment variable `TEXTPATH` when looking for a command file or writing the listing file.

Managing Libraries

All the commands below are supposed to be in a libmaker command file (text file with the commands in it, line by line). Alternatively you can pack the commands into the `-Cmd` option (see -Cmd: Libmaker Commands) and pass it to the libmaker directly (e.g. from a make file). For example:

```
a.o + b.o = c.lib
```

This can be written as an option to the libmaker as:

```
libmaker.exe -Cmd(a.o + b.o = c.lib)
```

As it is difficult to create a command line with the '+' operator in a make utility, the libmaker supports the alternative syntax without the '+' operator:

```
 -Cmd(a.o + b.o = c.lib)
```

This can also be written as:

```
-Cmd(a.o b.o = c.lib)
```

Building a Library

Building a library collects all the given object files and/or libraries into one new library, given after the equal sign:

```
file1.o + file2.o + mylib.LIB = ourlib
```

NOTE To create a library, there must be at least two files to the left of the equal sign.

Adding Files to a Library

Adding files to an existing library works the same as building a library:

```
ourlib.LIB + file3.o = ourlib
```

Removing a File from a Library

You can also remove one or more files from a library:

```
ourlib.LIB - file1.o = ourlib
```

This removes the object file `file1.o` from the library.

Creating a New Library

You can create a new library:

```
ourlib - file1.o = hislib
```

In this case, the original library `ourlib` is *not* overwritten.

Extracting a File from a Library

Use the following code line to extract a file from a library.

```
LibName * ObjName
```

The code line above extracts the object file named `ObjName` from the library. No path is given with the argument `ObjName`. The libmaker writes the object file to the same directory as the library, and does not remove the file from the library. An existing object file with the same name as an extracted object file is overwritten without warning.

Example:

```
mylib.lib * myobj.obj
```

This writes the object file `myobj.obj` into the same directory as `mylib.lib`.

Listing the Contents of a Library

Libmaker also generates an alphabetically sorted list of all exported objects in the library. Enter the name of the library:

```
ourlib.LIB
```

The list file has the same name as the library, but with extension `.LST`. To specify a different name, enter:

```
ourlib.LIB ? mylist.TXT
```

Command Files

Libmaker also supports command files. A command file is a text file containing commands for the libmaker. To use a command file, enter:

```
@mycmds.CMD
```

The libmaker reads the file and interprets the commands line by line.

Batch Mode

If you start the tool with arguments (options and/or input files), then the tool starts in batch mode. For example, you can specify the following line:

```
C:\Program Files\Freescale\CodeWarrior for Microcontrollers
V10.x\PROG\libmaker.exe @mycommands.txt
```

In batch mode, the tool does not open a window. It is displayed in the taskbar while the input is processed and terminates afterwards.

Because it is possible to start 32-bit applications from the command line, you can simply type the commands you want to execute:

```
C:\>C:\Program Files\Freescale\CodeWarrior for
Microcontrollers V10.x\PROG\libmaker.exe -cmd(a.o b.o =
c.lib)
```

You can redirect the message output (`stdout`) of a tool using the normal redirection operators, (e.g. '>' to write the message output to a file):

```
C:\> C:\Program Files\Freescale\CodeWarrior for
Microcontrollers V10.x\PROG\libmaker.exe -h > myoutput.txt
```

Notice that the command line process immediately returns after starting the tool process. It does not wait until the process finishes. To start a process and wait for termination (e.g. for synchronization) use the `start` command under Windows or the `/wait` option (see Windows help: 'help start' for more information):

```
C:\> start /wait C:\Program Files\Freescale\CodeWarrior for
Microcontrollers V10.x\PROG\libmaker.exe -cmd(a.o b.o =
c.lib)
```

Using `start /wait` you can write batch files to process your files.

To redirect the libmaker output to `stderr/stdout` on your DOS shell, use the piper utility:

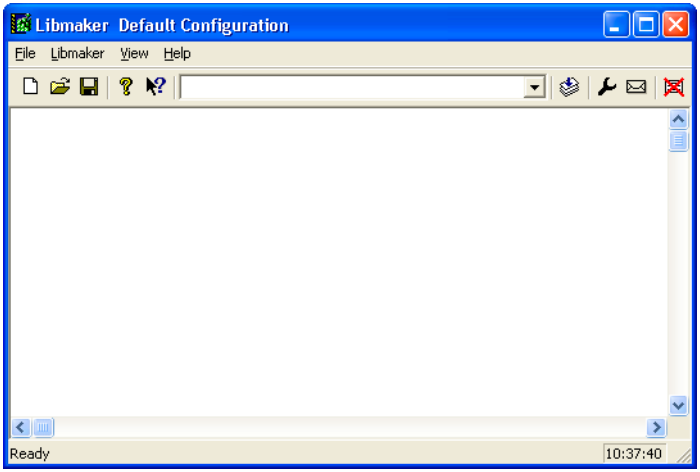
```
C:\> C:\Program Files\Freescale\CodeWarrior for
Microcontrollers V10.x\PROG\piper.exe C:\Program
Files\Freescale\CodeWarrior for Microcontrollers
V10.x\PROG\libmaker.exe -h
```

This directs all the messages to the DOS shell.

Libmaker Graphic User Interface

The Libmaker Default Configuration window appears when you do not specify a file name while starting the application. This window contains a menu bar, toolbar, content area, and status bar.

Figure 13.1 Libmaker Default Configuration WIndow



Libmaker Default Configuration Window

The Libmaker Default Configuration window title displays the application name and project name. If no project is loaded, *Default Configuration* appears. An asterisk (*) after the configuration name indicates that some values have changed.

NOTE Not only option changes, but editor configuration and appearance changes cause the asterisk (*) to appear.

Window Content Area

The content area is a text container that displays logging information about the process session. This information consists of:

- The name of file being processed
- The name (including full path) of files processed (main C file and all files included)
- A list of error, warning and information messages generated
- The size of code generated during the process session

When you drop a file into the application window content area, the corresponding file loads as a configuration file if the file has the extension `.ini`. If not, the file is processed with the current option settings.

Text in the application window content area displays the following information:

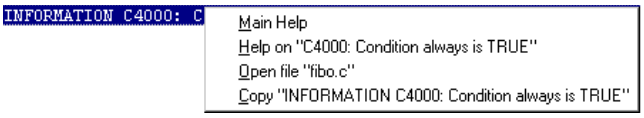
- The file name, including a position inside of file
- A message number

File information is available for text file output. Information is available for all source and include files and messages. If file information is available, double-clicking on the text or message opens the file in an editor; as specified in the editor configuration. Also, you can open a context menu with the right mouse button. The menu contains an *Open* entry if file information is available. If a file cannot be opened although a context menu entry is present, see the Configuration Window Editor Settings Tab section.

The message number is available for any message output. There are three ways to open the corresponding entry in the help file:

- Select one line of the message and press *F1*. If the selected line does not have a message number, F1 displays the main help.
- Press *Shift+F1* and then click on the message text. If the text clicked does not have a message number, this displays the main help.
- Right-click on the message and select **Help on**. This entry is only available if a message number is available.

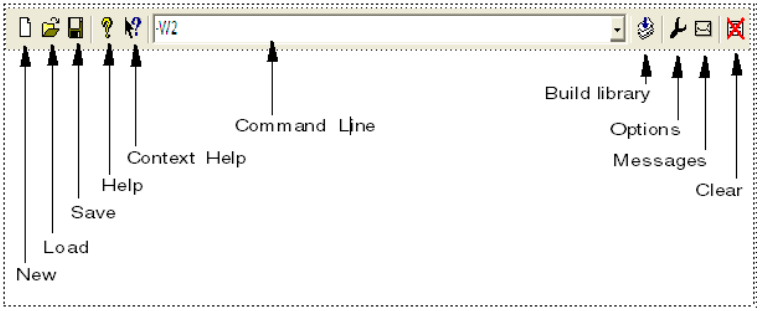
Figure 13.2 Libmaker Help Menu



Window Toolbar

The following figure shows the **Libmaker Default Configuration** window toolbar.

Figure 13.3 Default Configuration Window Toolbar



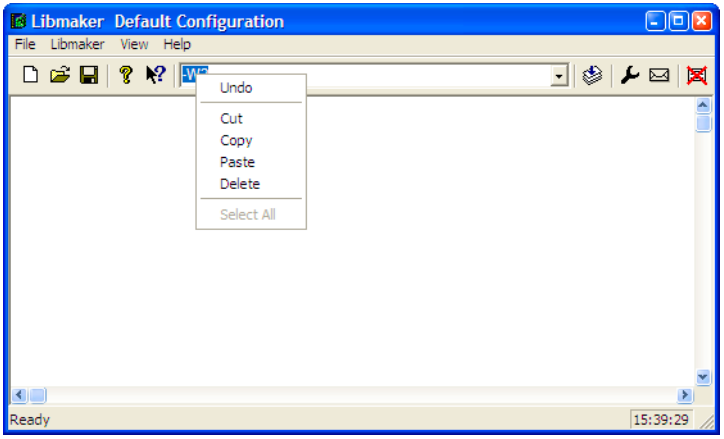
The three icons on the left correspond with *File* menu entries. The next button opens the online help. After clicking the **Context Help** icon (or the shortcut *Shift+F1*), the mouse cursor changes its form and has a question mark beside the arrow. Help is called for the next item clicked. You can click on menus, toolbar buttons and on the window area to get specific help.

The command line history contains a list of commands executed. Once you have selected or entered a command in history, clicking **Build library** executes the command. You may use the keyboard shortcut key *F2* to jump to the command line. Additionally, there is a context menu associated with the command line (see Figure 13.4).

The next two icons opens **Libmaker Option Settings**, and **Libmaker Message Settings** dialog box.

The last icon clears the content area.

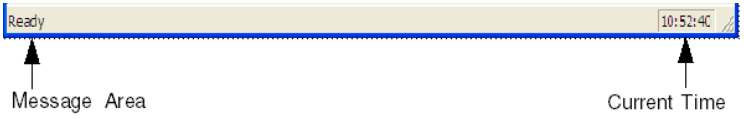
Figure 13.4 Command Line Context Menu



Default Configuration Window Status Bar

Point to a menu entry or icon in the toolbar to display a brief explanation of the button or menu entry in the message area.

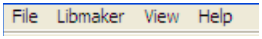
Figure 13.5 Window Status Bar



Default Configuration Window Menu Bar

File, **Libmaker**, **View** and **Help** options are available in the menu bar.

Figure 13.6 Window Menu Bar



The following table describes the functions available in the menu bar:

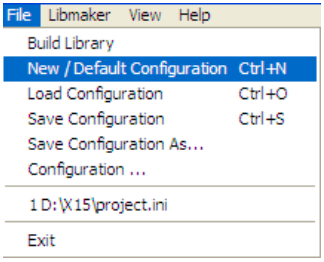
Table 13.1 Menu Bar Functions

Menu entry	Description
File	Contains entries to manage application configuration files.
Libmaker	Contains entries to set application options.
View	Contains entries to customize the application window output.
Help	A standard Windows Help menu.

Default Configuration Window File Menu

Use the **File** menu to save or load configuration files.

Figure 13.7 File Menu



A configuration file contains the following information:

- Application option settings specified in the application dialog boxes
- Message settings that specify which messages to display and treat as errors
- List of last command line executed and current command line
- Window position
- Tip of the Day settings

Configuration files are text files with an extension of `.ini`. The user can define as many configuration files as required for the project, and can switch between the different configuration files using the **File > Load Configuration** and **File > Save Configuration** menu entry, or the corresponding toolbar buttons.

Table 13.2 File Menu Options

Menu Entry	Description
Build Library	Opens a standard Open File dialog box. Processes selected file as soon as Open File box is closed with *OK*.
New/Default Configuration	Resets application option settings to default value. See Startup Command Line Options.
Load Configuration	Opens a standard Open File dialog box. Loads configuration data stored in selected file and uses it in subsequent sessions.
Save Configuration	Saves the current settings.
Save Configuration as	Opens a standard Save As dialog box. Saves current settings in a configuration file with the specified name.
Configuration	Opens **Configuration** dialog box to specify editor used for error feedback and which parts to save with a configuration.
1..... project.ini 2.....	Recent project list. This list can be accessed to open a recently opened project.
Exit	Closes the application.

Default Configuration Libmaker Menu

The Libmaker menu allows you to customize the application. You can set or reset application options or define the optimization level you want to reach.

Figure 13.8 Libmaker Default Configuration Libmaker Menu

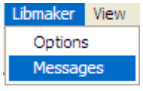


Table 13.3 Libmaker Menu Functions

Menu Entry	Description
Options	Allows you to customize the application. You can set/reset options.

Table 13.3 Libmaker Menu Functions (*continued*)

Menu Entry	Description
Messages	Opens a dialog box in which you can map error, warning or information messages to different message classes (see Libmaker Message Settings Window).
Stop	Stops the current processing session.

Default Configuration Window View Menu

The View menu allows you to customize the application window. You can specify whether to display or hide the status or toolbar. You can also define the font used in the window or clear the window.

Figure 13.9 Libmaker Default Configuration View Menu

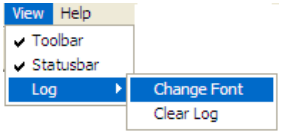


Table 13.4 View Menu Functions

Menu entry	Description
Toolbar	Hide or show toolbar in application window.
Statusbar	Hide or show status bar in application window.
Log	Allows you to customize output in application window content area.
Change Font	Opens a standard font selection box. options selected in font dialog box are applied to application window content area.
Clear Log	Clears application window content area.

Default Configuration Window Help Menu

The **Help** menu allows you to enable or disable the **Tip of the Day** dialog box, display the online help, and an **About Libmaker** dailog box.

Figure 13.10 Libmaker Default Configuration Help Menu

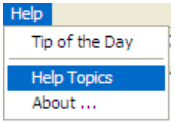


Table 13.5 Help Menu Functions

Menu entry	Description
Tip of the Day	Enable or disable **Tip of the Day** dailog box during startup.
Help Topics	Displays online help.
About	Displays an **About Libmaker** dialog box with version and license information.

Configuration Window

The three tabs of the **Configuration** window let you specify the Editor Settings, Save the Configuration, and specify the Environment.

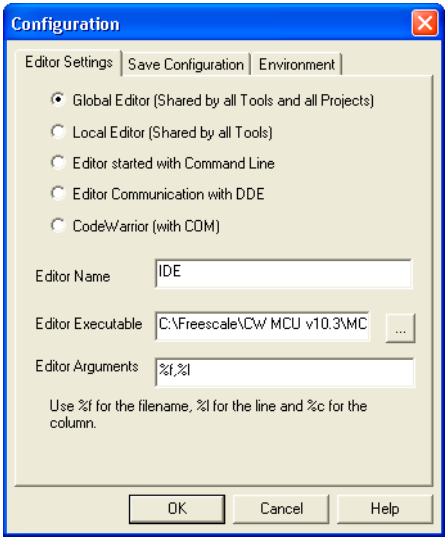
Configuration Window Editor Settings Tab

In the **Editor Settings** tab, select the type of editor to use. Depending on the editor type selected, the tab content changes.

Editor Settings Tab — Global Editor Option

The following figure shows the **Editor Settings** tab contents when you choose the **Global Editor** option.

Figure 13.11 Editor Settings Tab — Global Editor Option

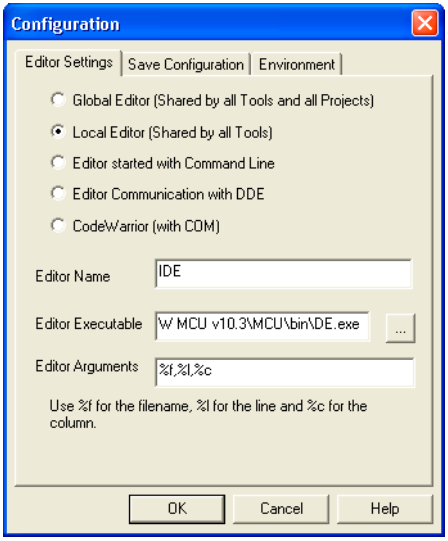


All tools and projects on one computer share the global editor. Editor information is stored in the global initialization file `MCUTOOLS.INI` in the `[Editor]` section. You can specify some Modifiers on the editor command line.

Editor Settings Tab — Local Editor Option

The following figure shows the **Editor Settings** tab contents when the **Local Editor** option is chosen:

Figure 13.12 Editor Settings Tab — Local Editor Option



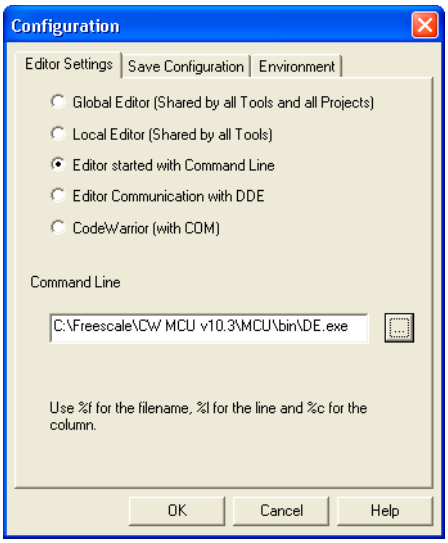
All tools using the same project file share the local editor. You can specify some Modifiers on the editor command line.

You can edit the *Global* and *Local Editor* configuration. However, when these entries are stored, the behavior of other tools using the same entries also changes when you start the tools again.

Editor Settings Tab — Editor Started with Command Line Option

The following figure shows the **Editor Settings** tab contents when the **Editor started with Command Line** option is selected:

Figure 13.13 Editor Settings Tab — Editor started with Command Line



Selecting this editor type associates a separate editor with the application to obtain error feedback.

Enter the command to use to start the editor.

You can start the editor with modifiers. Some Modifiers can be specified on the editor command line that refer to a file name and a line number (see Modifiers).

Examples: (also refer to notes below)

- For IDF use (with path to `idf.exe` file)

  ```
  C:\prog\idf.exe %f -g%l,%c
  ```

- For Premia CodeWright V6.0 (with path to `cw32.exe` file)

  ```
  C:\Premia\cw32.exe %f -g%l
  ```

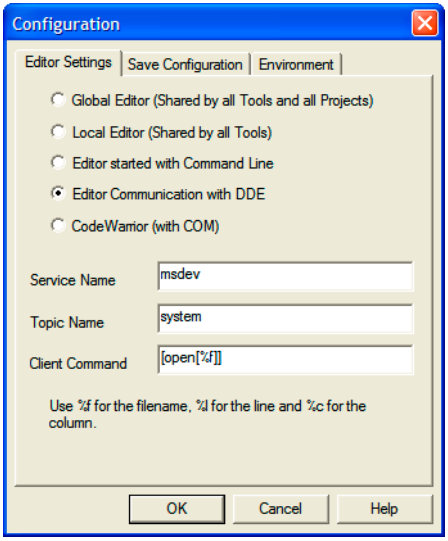
- For Winedit 32-bit version use (with path to `winedit.exe` file)

  ```
  C:\WinEdit32\WinEdit.exe %f /#:%l
  ```

Editor Settings Tab — Editor Communication with DDE Option

The following figure shows the **Editor Settings** tab contents when the **Editor Communication with DDE** option is selected:

Figure 13.14 Editor Settings Tab — Editor Communication with DDE



Enter the service, topic and client name to be used for a DDE connection to the editor. Entries for Topic and Client Command can have modifiers for file name, line number and column number as explained below.

Examples:

- For Microsoft Developer Studio use the following setting:

  ```
  Service Name   : msdev
  Topic Name     : system
  ClientCommand  : [open(%f)]
  ```

- UltraEdit is a powerful shareware editor. It is available from `www.idmcomp.com` or `www.ultraedit.com`, email `idm@idmcomp.com`. The latest version of UltraEdit can also be found on the CD-ROM in the `addons` directory.

  For UltraEdit use the following setting:

  ```
  Service Name   : UEDIT32
  Topic Name     : system
  ClientCommand  : [open("%f/%l/%c")]
  ```

NOTE The DDE application (Microsoft Developer Studio, UltraEdit) must be started or else the DDE communication will fail.

Modifiers

The configurations can contain modifiers that tell the editor which file to open and at which line.

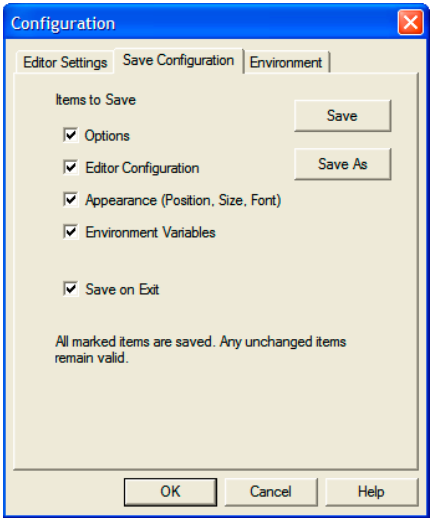
- The `%f` modifier refers to the name of the file (including path) where the message has been detected.
- The `%l` modifier refers to the line number where the message has been detected.
- The `%c` modifier refers to the column number where the message has been detected.

NOTE The `%l` modifier can only be used with an editor that can be started with a line number as a parameter. This is not the case for WinEdit version 3.1 or lower, or Notepad. With these editors, you can start with the file name as a parameter and then select the menu entry *Go to* to jump to the line where the message has been detected. In this case, the editor command looks like: `C:\WINAPPS\WINEDIT\Winedit.EXE %f`. Check your editor manual to define the command line used to start the editor.

Configuration Window — Save Configuration Tab

The **Save Configuration** tab of the **Configuration** dialog box contains options for the save operation.

Figure 13.15 Configuration Window — Save Configuration Tab



Use the **Save Configuration** tab to store selected items in a project file. This tab has the following items:

- **Options**: If checked, saves the current option and message settings. Clearing this option retains the last saved contents.
- **Editor Configuration**: If checked, saves the current editor settings. Clearing this option retains the last saved contents.
- **Appearance**: If checked, saves the window position, size, and font used. Also saves the command line content and history in the project file.

NOTE After you have saved the options you want, disable the options that you do not want saved to the Local Configuration File (Usually project.ini) in subsequent configuration settings. Clear the *Save on Exit* option to retain settings saved during a previous configuration.

- **Environment Variables**: If checked, saves environment variables in the project file.
- **Save on Exit**: If checked, the application writes the configuration settings on exit without confirmation. If not checked, the application does not save configuration changes.

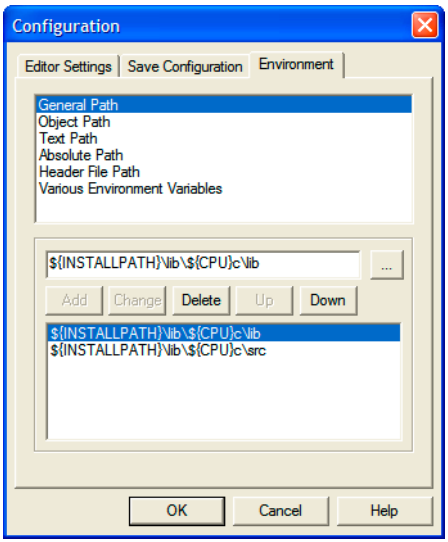
NOTE Almost all settings are stored in the Local Configuration File (Usually project.ini). The only exceptions are: The recently used configuration list and All settings in this tab.

NOTE Application configuration information can coexist in the same file as the project configuration for the IDE. When you configure an editor with the shell, the application can read this information from the project file, if present. The project configuration file is named `project.ini`.

Configuration Window — Environment Tab

Use the **Environment** tab of the **Configuration** window to configure the environment.

Figure 13.16 Configuration Window — Environment Tab



The content of the dialog is read from the project file in the section [Environment Variables]. The following variables are available:

- **General Path**: `GENPATH`
- **Object Path**: `OBJPATH`
- **Text Path**: `TEXTPATH`
- **Absolute Path**: `ABSPATH`
- **Header File Path**: `LIBPATH`
- **Various Environment Variables**: other variables not covered by the above list.

The following command buttons are available:

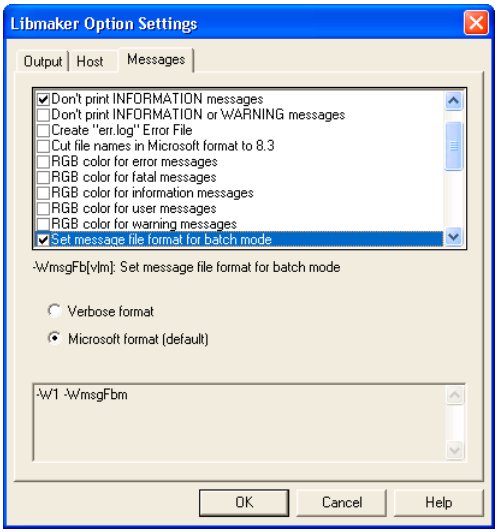
- **Add**: Adds a new line/entry
- **Change**: changes a line/entry
- **Delete**: deletes a line/entry
- **Up**: Moves a line/entry up
- **Down**: Moves a line/entry down

NOTE Variables are written to the project file only if you press the **Save** button, select **File > Save Configuration**, or press *CTRL+S*.

Libmaker Option Settings Window

The **Libmaker Option Settings** window allows you to set/reset application options.

Figure 13.17 Libmaker Options Settings Window — Messages Tab



The lower display area shows available command line options. Available options are arranged in different groups. The content of the list box depends on the selected tab, such as **Messages** (not all groups may be available).

Table 13.6 Option Settings Functions

Group	Description
Output	Lists output file options
Host	Lists host options
Messages	Lists options that control generation of error messages

Checking the checkbox sets an option. To obtain more detailed information for a specific option, select the option and press the *F1* key or help button. To select an option, click the option text. If no option is selected, press *F1* or click help button to display help for the dialog box.

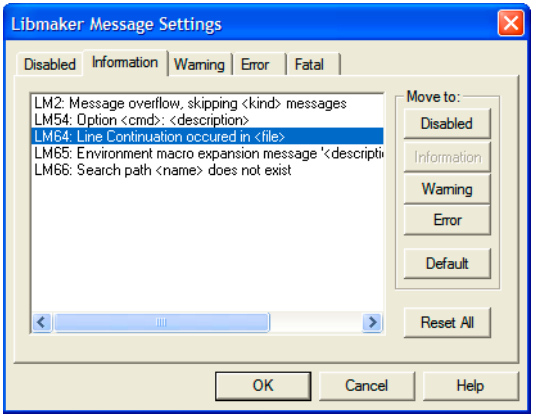
NOTE For options that require additional parameters, an edit box or additional window appears. For example, the option 'Write statistic output to file', in the Output tab.

Libmaker Message Settings Window

This window allows you to map messages to different message classes. A tab is available for each message group: Disabled, Information, Warning, Error and Fatal.

Each message has a one character identifier (e.g. C for Compiler messages, A for Assembler messages, L for Linker messages, M for Maker messages, LM for Libmaker messages) followed by a 4- or 5-digit number. See Libmaker Message List for detailed information about specific messages.

Figure 13.18 Libmaker Message Settings Window



In this window, some command buttons may be disabled. For example, if a message cannot be mapped as an Information message, the **Move to** group **Information** command button is disabled when this message is highlighted.

Table 13.7 Message Classes

Message group	Description
Disabled	Lists all disabled messages that will not be displayed by the application.
Information	Lists all information messages.

Table 13.7 Message Classes

Message group	Description
Warning	Lists all warning messages. Input file processing continues if a warning occurs.
Error	Lists all error messages. Input file processing continues if an error occurs.
Fatal	Lists all fatal error messages. If a fatal message occurs, processing stops immediately. Fatal messages cannot be changed.

Table 13.8 Command Button Functions

Command Button	Description
Move to: Disabled	Disables selected messages
Move to: Information	Selected messages become information messages.
Move to: Warning	Selected messages become warning messages.
Move to: Error	Selected messages become error messages.
Move to: Default	Selected messages revert back to their default mapping.
Reset All	Resets all messages to their default.
Ok	Exits and accepts changes.
Cancel	Exits without accepting changes.
Help	Displays online help.

Changing the Class Associated with a Message

Configure your own message mapping by using the buttons located on the right side of the dialog box. Each button refers to a message class. To change the class associated with a message, select the message in the list box and then click the button associated with another class.

NOTE The **Move to** buttons are only active for messages that can be moved.

For example, to change a warning message to an error message:

1. Select the **Warning** tab to display the list of all warning messages.
2. Select the message you want to change.
3. Click **Error** to define this message as an error message.

NOTE Messages cannot be moved to or from the *fatal error* class.

To validate the new error message mapping, click **OK** to close the **Message Settings** dialog box. If you click **Cancel**, changes are ignored and the previous message mappings remain valid.

Retrieving Information About an Error Message

You can access information about each message displayed in the list box. Select the message in the list box and click the **Help** button or press the *F1* key. An information box appears, which contains a detailed description of the error message and an example of code that produces the message. If several messages are selected, help for the first message is shown. If no message is selected, pressing the *F1* key or help button displays help for this dialog box.

About Libmaker Dialog Box

Select **Help > About** to display the About box. The about box contains the current directory and version information for application modules. The main version is displayed at the top of the dialog.

The **Extended Information** button displays license information about all software components in the same directory as the executable. Click **OK** to close this dialog.

NOTE During processing, you cannot request other versions of the application modules. They are only displayed when the application is not processing information.

IV

Decoder Utility

Introduction

This section describes the CodeWarrior IDE ELF/Freescale Decoder utility, which disassembles object files, absolute files and libraries in the Freescale object file format or ELF/DWARF format and S-Record files. Various output formats are available.

The chapters in this section are:

- Input and Output Files: Describes Decoder input and output files
- Decoder Controls: List menus and the Graphical User Interface (GUI)

Product Highlights

The decoder utility has:

- Graphical User Interface (GUI)
- On-line Help
- Message Management
- 32-bit Functionality
- Decodes Freescale object file format
- Decodes ELF/DWARF 1.1 and 2.0 object file format
- Decodes S-Record files

User Interface

The decoder provides a command line interface and an interactive interface (GUI). If no arguments are given on the command line, a window opens that prompts for arguments.

The Decoder accepts object or absolute files, libraries, and S-Record files as input to generate the listing file. The name of the source files are encoded in the object or absolute file or library. For S-Record files, the processor must be specified with the `-Env` option (see -Env: Set Environment Variable).

The generated listing file has the same name as the input file but with extension `.LST`. It contains source and assembly statements. The corresponding C/C++ source statements can be displayed within the generated assembly instructions.

14

Input and Output Files

This chapter describes Decoder input and output files, and covers the following topics:

Input Files

Input files include the following file types:

Absolute Files

The decoder takes any file as input, and does not require the file name to have a special extension. However, we suggest that all your absolute file names have extension `.ABS`. The decoder searches for absolute files first in the project directory and then in the directories listed in `GENPATH`. The absolute file must be a valid ELF/DWARF V1.1, ELF/DWARF V2.0 or Freescale absolute file.

NOTE Freescale absolute files do not contain source information, so no source information is decoded.

Object File

The decoder takes any file as input, and does not require the file name to have a special extension. However, we suggest that all your relocatable file names have extension `.o`. The decoder searches for object files first in the project directory and then in the directories listed in `GENPATH`. The object file must be a valid ELF/DWARF V1.1, ELF/DWARF V2.0, or Freescale relocatable file.

S-Record Files

For S-Record files, you must specify the processor with the `-Proc` option (see -Proc: Set Processor (Decoder)). Otherwise the structure of the S-Record file prints, but the code is not disassembled.

Intel Hex Files

For Intel Hex files you must specify the processor with the `-Proc` option (see -Proc: Set Processor (Decoder)). Otherwise the structure of the Hex file prints, but the code is not disassembled.

Output Files

After a successful decoding session, the Decoder generates a listing file containing the disassembled instructions generated by each source statement. The Decoder writes this file to the directory given in the environment variable `TEXTPATH`. If that variable contains more than one path, the Decoder writes the listing file in the first directory given. If this variable is not set, the Decoder writes the listing file in the directory containing the binary input file. Listing files always get the extension `.LST`.

In a standard listing file, the code depends on the target. A sample listing is as follows:

Listing 14.1 Listing File Example

```
DISASSEMBLY OF: '.text' FROM 364 TO 448 SIZE 84 (0X54)
Opening source file Y:\Sources\fibo.c'
    4: unsigned int Fibonacci(unsigned int n)
Fibonacci:
00000000 89       PSHX
00000001 8B       PSHH
00000002 A7F8     AIS    #-8
    6:                                              unsigned int
fib1                                                = 0;
00000004 95       TSX
00000005 6F01     CLR    1,X
00000007 7F       CLR    ,X
    7:                                              unsigned intfib2
= 1;
00000008 AE01     LDX    #0x01
0000000A 8C       CLRH
0000000B 9EFF03   STHX   3,SP
    8:                                              unsigned intfibo
= n;
0000000E 9EFE09   LDHX   9,SP
```

```
00000011 9EFF07   STHX   7,SP
    9:                                                  unsigned int i =
2;
00000014 AE02     LDX    #0x02
00000016 8C       CLRH
00000017 9EFF05   STHX   5,SP
   11:                                                  while (i <= n) {
0000001A 2024     BRA    *+38       ;abs = 0x0040
   12:                                                  fibo = fib1 +
fib2;
0000001C 95       TSX
0000001D E603     LDA    3,X
0000001F EB01     ADD    1,X
00000021 87       PSHA
00000022 F6       LDA    ,X
00000023 E902     ADC    2,X
00000025 87       PSHA
00000026 95       TSX
00000027 EE01     LDX    1,X
00000029 8A       PULH
0000002A 9EFF08   STHX   8,SP
   13:                                                  fib1 = fib2;
0000002D 9EFE04   LDHX   4,SP
00000030 9EFF02   STHX   2,SP
   14:                                                  fib2 = fibo;
00000033 87       PSHA
00000034 8A       PULH
00000035 88       PULX
00000036 9EFF03   STHX   3,SP
   15:                                                  i++;
00000039 95       TSX
0000003A 6C05     INC    5,X
0000003C 2602     BNE    *+4        ;abs = 0x0040
0000003E 6C04     INC    4,X
   11:                                                  while (i <= n) {
00000040 9EFE09   LDHX   9,SP
00000043 9EF305   CPHX   5,SP
00000046 24D4     BCC    *-42       ;abs = 0x001C
   18:                                                  return(fibo);
00000048 9EFE07   LDHX   7,SP
   19: }
0000004B A70A     AIS    #10
0000004D 81       RTS
```

15

Decoder Controls

This chapter describes Decoder controls; list menus and the Graphical User Interface (GUI).

This chapter is comprised of the following sections:

List Menus

The Decoder list menus are on the menu bar of the Decoder main window. The following table lists and describes the main window's top-level list menus.

Table 15.1 Decoder Main Window List Menus

Menu Name	Contains
File	Options for managing configuration files
Decoder	Commands for setting options
View	Options for customizing window output
Help	Standard Windows Help menu

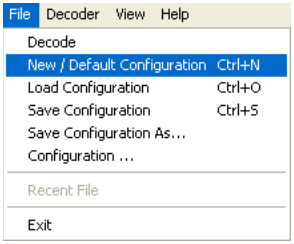
File Menu

With the File menu as shown in the following figure, you can save or load configuration files. The File menu contains:

- Configuration dialog box on settings.
- Message settings that specify which messages to display and which to treat as errors.
- List of last commands executed and current command line
- Window position

- Tip of the Day settings, including whether the Tip of the Day is enabled at startup and current entry

Figure 15.1 File Menu



The following table lists and describes the **File** menu selections:

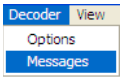
Table 15.2 File Menu Selections

Menu Selection	Description
Decode	Opens the **Select File to Decode** dialog box. Processes selected file as soon as the **Select File to Decode** dialog box is closed using **OK**.
New/Default Configuration	Resets option settings to default value. Default options are specified in Tool Options.
Load Configuration	Opens the **Loading configuration** dialog box. Loads configuration data stored in selected file and uses it in session.
Save Configuration	Saves the current settings.
Save Configuration as	Opens the **Save Configuration as** dialog box. Saves current settings in a configuration file with the specified name.
Configuration	Opens the **Configuration** dialog box to specify the editor to use for error feedback and which parts to save with a configuration.
1..... project.ini 2.....	Recent project list. Access to reopen a recently opened project.
Exit	Closes the Decoder.

Decoder Menu

With the Decoder list menu, as shown in the following figure, you can customize the Decoder, graphically set or reset options, and access message settings.

Figure 15.2 Decoder Menu



The following table lists and describes the Decoder menu selections.

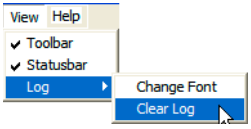
Table 15.3 Decoder Menu Selections

Menu entry	Description
Options	Displays the **Decoder Option Settings** dialog box, where you can define options for processing an input file.
Messages	Opens the **Decoder Message Settings** dialog box, where you can map error, warning or information messages to another message class.

View Menu

With the **View** Menu (as shown in the following figure), you can customize the main window. You can choose whether to display or hide the status bar and the toolbar, choose the font used in the window, and clear the window.

Figure 15.3 View Menu



The following table lists and describes the **View** menu selections.

Table 15.4 View Menu Selections

Menu Entry	Description
Tool Bar	Displays toolbar in the main window.
Status Bar	Displays status bar in the main window.
Log	Lets you customize the output in the main window content area.

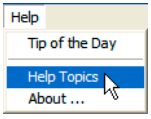
Table 15.4 View Menu Selections (*continued*)

Menu Entry	Description
Change Font	Opens a standard font-selection dialog box. Your selections appear in the main window content area.
Clear Log	Lets you clear the main window content area.

Help Menu

From the **Help** menu (as shown in the following figure), you can customize the **Tip of the Day** dialog box and display help, Decoder version information, and license information.

Figure 15.4 Help Menu



The following table lists and describes the **Help** menu selections.

Table 15.5 Help Menu Selections

Menu entry	Description
Tip of the Day	Switches on or off the **Tip of the Day** dialog box display during startup.
Help Topics	Displays standard Help.
About	Displays an **About Decoder** dialog box with version and license information.

Graphical User Interface

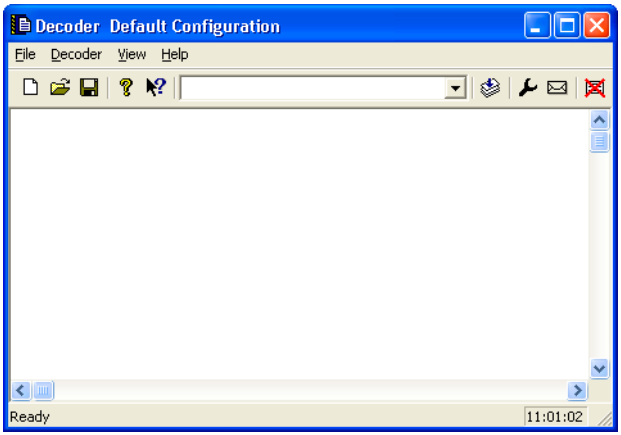
This section describes important aspects of the Decoder graphical user interface (GUI). Windows and dialogs covered here are:

- Decoder Main Window
- Configuration Dialog Box

Decoder Main Window

The Decoder main window appears if you do not specify a file name on the command line. If you start a tool using the Decoder, the Decoder main window does not appear.

Figure 15.5 Decoder Main Window



Main Window Components

The following sections describe the Decoder main window components.

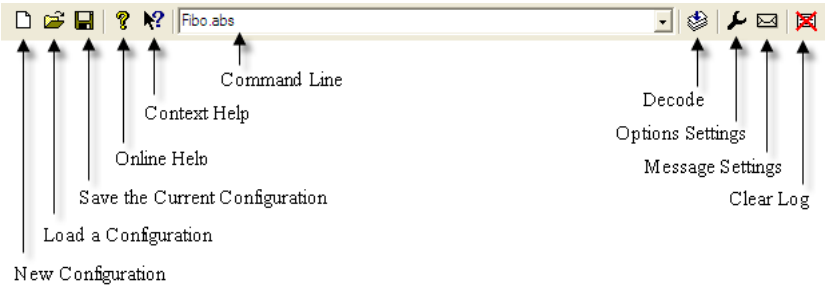
Window Title

The window title displays the tool name and project name. If no project is loaded, **Decoder Default Configuration** displays in the title area. An asterisk (*) after the configuration name indicates you have an unsaved change.

Toolbar

The following figure shows main window toolbar buttons.

Figure 15.6 Decoder Main Window Toolbar Buttons



The following table lists the Decoder main window toolbar buttons and describes their functions.

Table 15.6 Main Window Toolbar Buttons

Button Name	Function
New	Same as the **File > New / Default Configuration** menu selection.
Load	Same as the **File > Load Configuration** menu selection.
Save	Same as the **File > Save Configuration** menu selection.
Help	Displays Decoder online help.
Context Help	Changes cursor to question mark. When you have the cursor over a Decoder screen area, right-click, the context-sensitive help appears for the area you selected.
Command Line	Displays a context menu associated with the command line.
Decode	Starts execution of a desired command.
Options	Displays the **Decoder Option Settings** dialog box.
Messages	Displays the **Decoder Message Settings** dialog box.
Clear	Clears the main window content.

Status Bar

The status bar (Figure 15.7) has two dynamic areas:

- Messages
- Time

When you point to a button in the toolbar or a menu entry, the message area displays the function of the button or menu entry.

The time field shows the start time of the current session (if one is active) or current system time.

Figure 15.7 Main Window Status Bar

Decoder Configuration Dialog Box

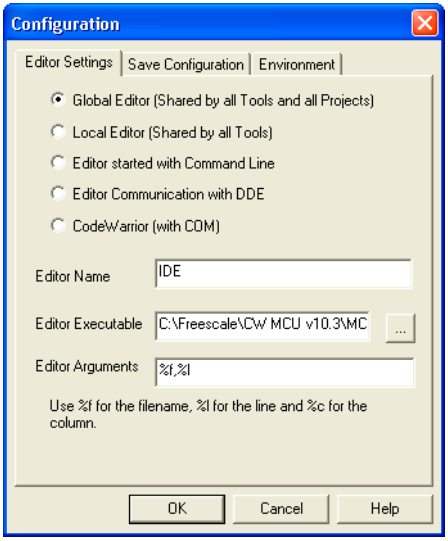
Select **File > Configuration** from the Decoder menu bar, to display the **Configuration** dialog box. The **Configuration** dialog cox has three tabs:

- Editor Settings
- Save Configuration
- Environment

Editor Settings Tab

The following figure shows the **Configuration** dialog box with the **Editor Settings** tab selected.

Figure 15.8 Decoder Configuration Window - Editor Settings Tab



The following table lists and describes the **Editor Settings** tab controls.

Table 15.7 Editor Settings Tab Controls

Control	Function
Global Editor	Shared among all tools and projects on one computer and stored in the `MCUTOOLS.INI` global initialization file.
Local Editor	Shared among all tools using the same project file.
Editor started with Command Line	Enable command-line editor. For Winedit 32-bit version use the `winedit.exe` file `C:\WinEdit32\WinEdit.exe%f /#:%l`
Editor started with DDE	Enter service, topic and client name to be used for a DDE connection to editor. All entries can have modifiers for file name and line number.
CodeWarrior (with COM)	If selected, the CodeWarrior software registered in the Windows Registry launches.
Editor Name	Enter a name for the desired editor in the text box.

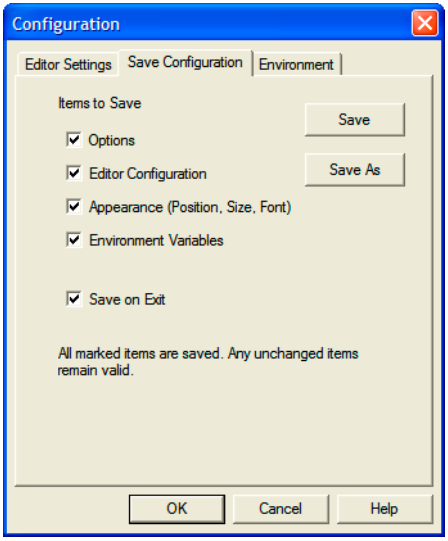
Table 15.7 Editor Settings Tab Controls (*continued*)

Control	Function
Editor Executable	Specify editor's path and executable name. Use the browse button to locate the executable.
Editor Arguments	Enter the command-line arguments for the editor in the text box. Use `%f` for filename, `%l` for line number, and `%c` for column number.

Save Configuration Tab

The following figure shows the **Configuration** dialog box with the **Save Configuration** tab selected.

Figure 15.9 Decoder Configuration Dialog Box - Save Configuration Tab



The following table lists and describes the **Save Configuration** tab controls.

Table 15.8 Save Configuration Tab Controls

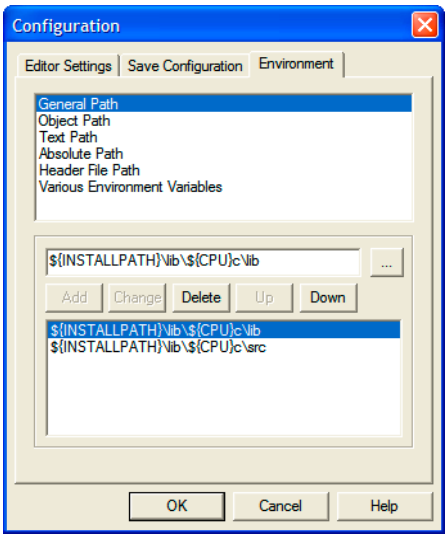
Control	Function
Options	When checked, saves current option and message settings when a configuration is written. When cleared, last saved content remains valid.
Editor Configuration	When checked, saves current editor settings when a configuration is written. When cleared, the last saved content remains valid.
Appearance	When checked, window position, command line content, and history settings are retained when a configuration is written.
Environment Variables	When checked, writes the environment variable settings in the Environment Tab to the configuration.
Save on Exit	When checked, Decoder writes configuration on exit. No confirmation message appears. When cleared, Decoder does not save configuration on exit, even if options or another part of configuration has changed. No confirmation message appears when closing Decoder.

NOTE Settings are stored in the configuration file. Exceptions are recently used configuration list and settings in this dialog. Configurations can coexist in the same file as the shell project configuration. When the shell configures an editor, the Decoder can read the content from the project file. The shell project configuration filename is `project.ini`.

Environment Tab

The following figure shows the **Configuration** dialog box with the **Environment** tab selected.

Figure 15.10 Decoder Configuration Window - Environment Tab



Use the **Environment** tab to configure the environment. The content of the tab is read from the project file in the `[Environment Variables]` section. You can choose from the following environment variables:

- General Path: `GENPATH`
- Object Path: `OBJPATH`
- Text Path: `TEXTPATH`
- Absolute Path: `ABSPATH`
- Header File Path: `LIBPATH`
- Various Environment Variables: other variables not covered in this list

The following table lists and describes the **Environment** tab controls.

Table 15.9 Environment Tab Buttons

Button	Function
Add	Adds a new line/entry
Change	Changes a new line/entry
Delete	Deletes a new line/entry

Table 15.9 Environment Tab Buttons (*continued*)

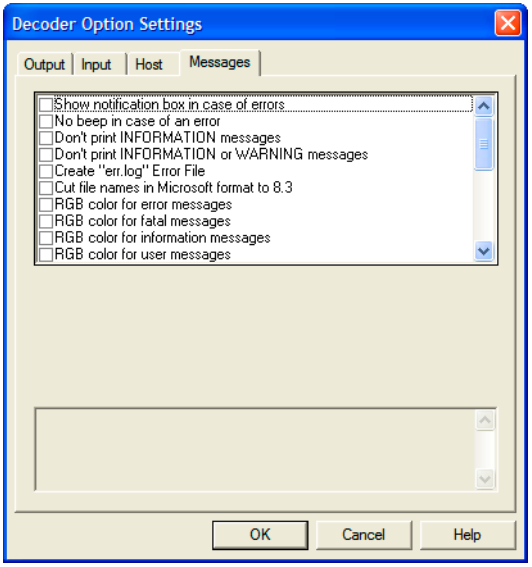
Button	Function
Up	Moves a line/entry up
Down	Moves a line/entry down

Decoder Option Settings

The **Decoder Option Settings** dialog box appears when you select **Decoder > Options** from the Decoder menu bar. Click on the text in the list box to select an option. For help, select an option and press *F1*. The command-line option in the lower part of the dialog box corresponds with your selection in the list box.

NOTE When options requiring additional parameters are selected, a dialog box or window may appear.

Figure 15.11 Decoder Options Settings Window



The following table describes the tabs in the **Decoder Option Settings** dialog box.

Table 15.10 Option Settings Window Tabs

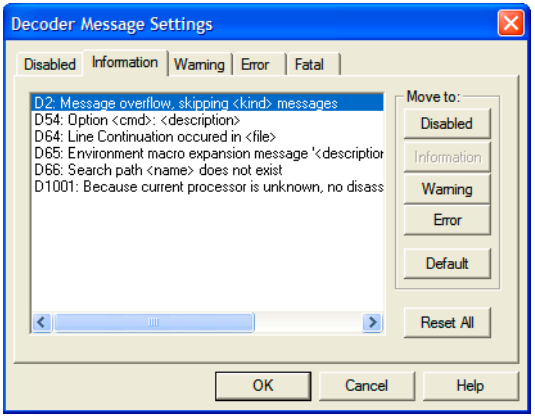
Tab	Description
Output	Command-line execution and print output settings
Input	Macro settings
Host	Lists options related to the host operating system
Messages	Message-handler settings - format, kind, and number of printed messages

Message Settings Window

The **Decoder Message Settings** dialog box (Figure 15.12) appears when you select **Decoder > Messages** from the menu bar. Using this dialog box you can map messages to different message classes.

Each message has its own ID (a character followed by a 4- or 5-digit number). This number allows you to search for the message in the manual and online help. For more information about specific messages, see Decoder Message List.

Figure 15.12 Message Settings Window



The following table describes the tabs in the **Decoder Message Settings** dialog box.

Table 15.11 Message Settings Window Tabs

Message Group	Description
Disabled	Lists disabled messages. Messages displayed in the list box are not written to the output stream.
Information	Lists information messages. Information messages inform you of actions taken.
Warning	Lists warning messages. When a warning message is generated, processing of the input file continues.
Error	Lists error messages. When an error message is generated, processing of the input file stops.
Fatal	Lists fatal error messages. These messages report system consistency errors. Fatal error messages cannot be ignored or moved.

Changing a Message Class

You can map messages to different classes using one of the buttons on the right side of the dialog box. Each button refers to a message class. To change the class associated with a message, select the message in the list box and then click the button corresponding with the desired message class.

Example

To define message `D51 could not open statistic log file` (warning message) as an error message:

1. Select the **Warning** tab.

   A list of warning messages appears in the list box.

2. Select the message `D51 could not open statistic log file` in the list box.
3. Click the **Error** button to define the message as an error message.

NOTE You cannot move the messages to or from the **Fatal** error class.

NOTE The **Move to** buttons are active only when you select messages that can be moved. When you select a message, only the valid **Move to** buttons becomes active.

To validate the changes made in the error message mapping, click **OK** to close the **Decoder Message Settings** dialog box. If you click the **Cancel** button, the previous message mapping remains valid.

Retrieving Information about an Error Message

You can access information about each message in the list box. Select the message in the list box, then click **Help**. An information box opens which contains a more detailed description of the error message as well as a small example of code that could produce the error. If you select several messages, help for the first message displays. If you select no message, pressing *F1* shows help for the dialog box.

About Decoder Dialog Box

The **About Decoder** dialog box appears when you select **Help > About** from the menu bar. This dialog box shows the current directory and the versions of Decoder components, with the version displayed at the top of the dialog box. Click **OK** to close the dialog box.

Specifying the Input File

The following list explains the different ways to specify the decode file to be processed. During processing, the software sets options according to the configurations specified in Decoder windows.

NOTE Before starting the decoding process of a file, use your editor to specify a working directory.

- Use the command line in the toolbar to Decode

  You can use the command line to process files. The command line lets you enter a new file name and additional Decoder options.

- Processing a File Already Run

  You can display the previously executed command using the arrow at the right of the command line. Select a command by clicking it, which puts it on the command line. The software processes the file you choose after you click the **Decode** button in the toolbar or press the **Enter** key.

- **File > Decode**

  When you select **File > Decode**, a standard open file dialog box displays. Browse to the file you want to process. The software processes the file you choose after you click the **Decode** button in the toolbar or press the **Enter** key.

- Drag and Drop

You can drag a file from other programs (such as the File Manager or Explorer) and drop it into the Decoder main window. The software processes the dropped file after you release the mouse button.

If the dragged file has a `.ini` extension, it is loaded and treated as a configuration file, not as a file to be decoded.

Message and Error Feedback

After making, there are several ways to check for different errors or warnings. The format of an error message is:

```
<msgType> <msgCode>: <Message>
```

The following listing shows the examples of error message format.

Listing 15.1 Error Message Format Examples

```
Example1
Could not open the file 'Fibo.abs'
FATAL D50: Input file 'Fibo.abs' not found

Example2
*** command line: 'Fibo.abs' ***
Decoder: *** Error occurred while processing! ***
```

The second example shows that messages from called applications are also displayed, but only if an error occurs. They are extracted from the error file if the called application reports an error.

Using Information from the Main Window

Once a file has been processed, the Decoder window content area displays the list of detected errors or warnings. Use the editor of your choice to open the source file and correct the errors.

Using a User-Defined Editor

You must first configure the editor you want to use for the message or error feedback in the **Configuration** dialog box. Once a file has been processed, you can double-click on an error message. Your selected editor opens automatically and points to the line containing the error.

V

Maker Utility

This section describes the IDE Maker Utility. Maker implements the UNIX make command with a Graphical User Interface (GUI). In addition, you can use Maker to build Modula-2 applications as well as maintain C/C++ projects. Maker has:

- Online Help
- Flexible Message Management
- 32-bit functionality

This section consists of the following chapters:

- Maker Controls: Describes Maker controls, menus and the Graphical User Interface.
- Using Maker: Describes using Maker to build Modula-2 applications and to maintain C/C++ projects.
- Building Libraries: Describes how to use the Maker utility to adapt or build your own libraries.

Starting the Maker Utility

All of the utilities described in this book may be started from executable files located in the Prog folder of your IDE installation. The executable files are:

- `maker.exe`: Maker, The Make Tool
- `burner.exe`: The Burner Utility
- `decoder.exe`: The Decoder
- `libmaker.exe`: Libmaker
- `linker.exe`: The SmartLinker Utility

With a standard full installation of the HC08/RS08 CodeWarrior IDE, the executable files are located here:

<*CWInstallDir*>`\MCU\prog`

For S12Z derivatives, the executable files are located at:

<*CWInstallDir*>`\MCU\S12lisa_Tools`

where <*CWInstallDir*> is the directory where the CodeWarrior software is installed.

To start the Maker Utility, double-click on `maker.exe`.

16

Maker Controls

This chapter describes Maker controls, such as menus and the Graphical User Interface (GUI), and contains the following sections:

- Graphical User Interface
- Specifying the Input File
- Message and Error Feedback

Graphical User Interface

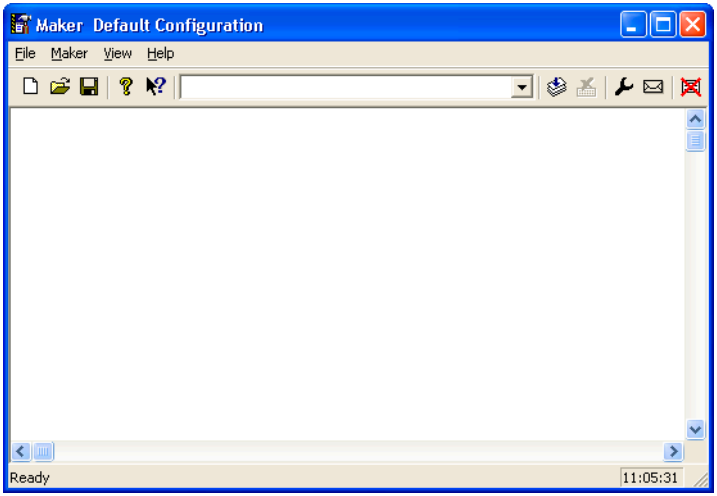
This section describes important aspects of Maker's Graphical User Interface (GUI). This section covers these windows and dialogs:

- Maker Main Window
- Maker Configuration Window

Maker Main Window

The Maker main window appears if you do not specify a file name on the command line. If you start a tool using Maker, the Maker main window does not appear.

Figure 16.1 Maker Main Window



Main Window Components

The Maker main window has these components:

- Window title
- Menu bar
- Toolbar
- Content area
- Status bar

Window Title

The window title displays the tool name and the project name. If Maker has no loaded project, *Maker Default Configuration* appears in the title area. An asterisk (*) after the configuration name indicates that you have unsaved changes.

Maker Main Window Menu Bar

Maker menus are on the menu bar of the main window. The following table describes Maker's top-level menus.

Table 16.1 Maker List Menus

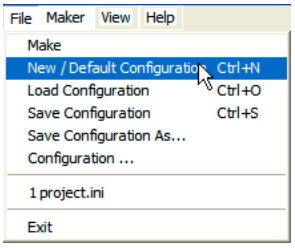
Menu Name	Contains
File	Selections for managing configuration files
Maker	Selections for setting options
View	Selections for customizing window output
Help	Standard Windows Help menu

File Menu

Use the **File** Menu to save or load configuration files. Configuration files contain:

- Configuration dialog option settings.
- Message settings that specify which messages to display and which to treat as errors.
- A list of the last command line executed and the current command line.
- The window position.
- Tips of the Day settings, including the startup settings and the current entry.

Figure 16.2 File Menu



The following table describes **File** menu selections.

Table 16.2 File Menu Selections

Menu Selection	Description
Make	Opens the **Select file to make** dialog box. Maker processes the selected file after you click **OK** to close the **Select file to make** dialog box.
New/Default Configuration	Resets the option settings to default values. Tool Options specifies the default activated options.

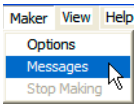
Table 16.2 File Menu Selections (*continued*)

Menu Selection	Description
Load Configuration	Opens the **Loading configuration** dialog box. Future sessions load and use the configuration data stored in the selected file.
Save Configuration	Saves the current settings.
Save Configuration as	Opens the **Saving Configuration as** dialog box. Maker saves the current settings in a configuration file with the specified name.
Configuration	Opens the **Configuration** dialog box to specify the editor to use for error feedback and the parts to save with a configuration.
1..... project.ini 2.....	Recent project list. Access this list to open a recently used project again.
Exit	Closes the Maker.

Maker Menu

With the **Maker** menu you can customize Maker, graphically set or reset options, and access message settings.

Figure 16.3 Maker Menu



The following table describes **Maker** menu selections.

Table 16.3 Maker Menu Selections

Menu entry	Description
Options	Displays the **Maker Options Settings** dialog box in which you can define options for processing an input file.

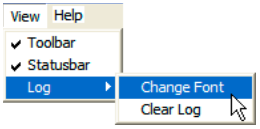
Table 16.3 Maker Menu Selections (*continued*)

Menu entry	Description
Messages	Opens the **Maker Message Settings** dialog box in which you can map error, warning, or information messages to different message classes.
Stop Making	Stops the current Make process. Maker grays out this selection when no active Make process exists.

View Menu

With the **View** menu you can customize the main window. You can choose the font used in the window, specify whether Maker displays or hides the status bar and the toolbar, and clear the window.

Figure 16.4 View Menu



The following table describes **View** menu selections.

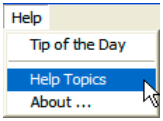
Table 16.4 View Menu Selections

Menu entry	Description
Toolbar	Toggles display of the toolbar in the main window.
Statusbar	Toggles display of the status bar in the main window.
Log	Lets you customize the output in the main window content area.
Change Font	Opens a standard font-selection dialog. Your selections appear in the main window content area.
Clear Log	Clears the main window content area.

Help Menu

From the **Help** menu you can customize the **Tip of the Day** dialog box. Use this menu to display Windows help as well as Maker version and license information.

Figure 16.5 Help Menu



The following table describes **Help** menu selections.

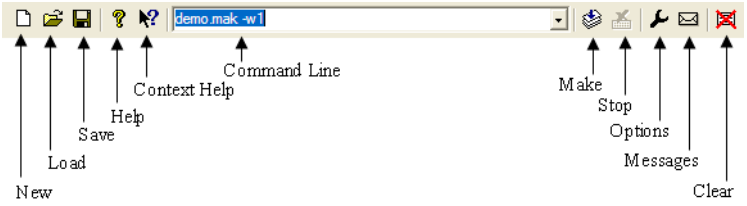
Table 16.5 Help Menu Selections

Menu entry	Description
Tip of the Day	Toggles display of a Tip of the Day dialog box during startup.
Help Topics	Displays standard Help.
About	Displays **About Maker** dialog box with version and license information.

Maker Main Window Toolbar

The Maker Main window toolbar icons are shown in the following figure.

Figure 16.6 Maker Main Window Toolbar Icons



The following table lists the **Maker** main window toolbar buttons and describes their functions.

Table 16.6 Main Window Toolbar Icon

Icon Name	Function
New	Same as **File > New Configuration** menu selection.
Load	Same as **File > Load Configuration** menu selection.
Save	Same as **File > Save Configuration** menu selection.

Table 16.6 Main Window Toolbar Icon (*continued*)

Icon Name	Function
Help	Displays Maker online help.
Context Help	Changes the cursor to a question mark. When you hover your cursor over a Maker screen area and left-click, the context-sensitive help appears for the area you selected.
Command Line	Displays Make files and options associated with the command line.
Make	Starts the execution of a desired command.
Stop	Stops the current make process.
Options	Displays the **Maker Option Settings** dialog box.
Messages	Displays the **Maker Message Settings** dialog box.
Clear	Clears the main window content.

Maker Main Window Status Bar

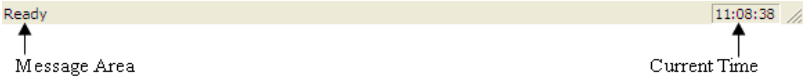
The Maker Main window status bar has two dynamic areas:

- Messages
- Time

When you point to an icon on the toolbar or to a menu entry, the message area displays the function of the button or menu entry.

The time field shows the start time of the current session (if an active session exists) or the current system time.

Figure 16.7 Main Window Status Bar



Maker Configuration Window

When you select **File > Configuration** from the Maker Main window list menus, the **Configuration** dialog box appears. The **Configuration** dialog box has three tabs:

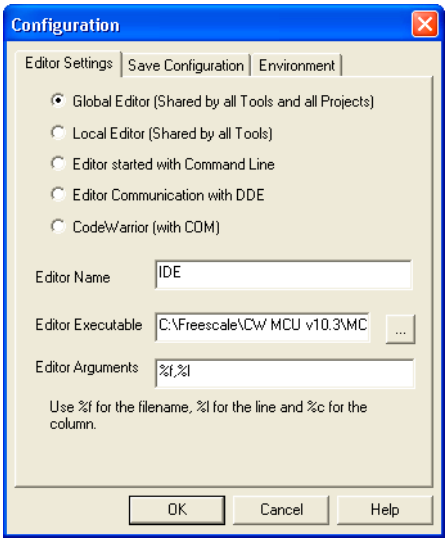
- Editor Settings Tab
- Save Configuration Tab

- Environment Tab

Editor Settings Tab

The following figure shows the **Configuration** dialog box with the **Editor Settings** tab selected.

Figure 16.8 Configuration Dialog Box — Editor Settings Tab



The following table describes **Editor Settings** tab controls.

Table 16.7 Editor Settings Tab Controls

Control	Function
Global Editor	Shared among all tools and projects on one computer. The `MCUTOOLS.INI` global initialization file stores the global editor.
Local Editor	Shared among all tools using the same project file.
Editor started with Command Line	Enable command-line editor starting. For Winedit 32-bit version use the `winedit.exe` file `C:\WinEdit32\WinEdit.exe%f /#:%l`
Editor started with DDE	Enter service, topic, and client name to use for DDE connection to editor. All entries can have modifiers for file name and line number.
CodeWarrior (with COM)	If selected, the CodeWarrior IDE version registered in the Windows Registry launches.

Table 16.7 Editor Settings Tab Controls (*continued*)

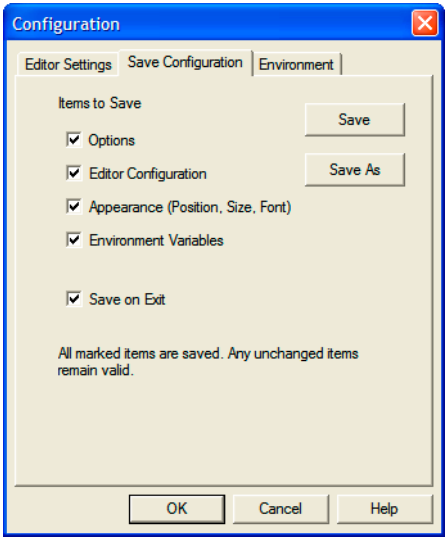
Control	Function
Editor Name	Enter name of desired editor in this text box.
Editor Executable	Specify editor's path and executable name. Use browse button to locate executable file.
Editor Arguments	Enter command-line arguments for editor in this text box. Use `%f` for filename, `%l` for line number, and `%c` for column number.

NOTE Changing the Editor Selection option button settings in this window changes the entries in the text entry fields at the bottom of the dialog box.

Save Configuration Tab

The following figure shows the **Configuration** dialog box with the **Save Configuration** tab selected.

Figure 16.9 Configuration Dialog Box — Save Configuration Tab



The following table describes the **Save Configuration** tab controls.

Table 16.8 Save Configuration Tab Controls

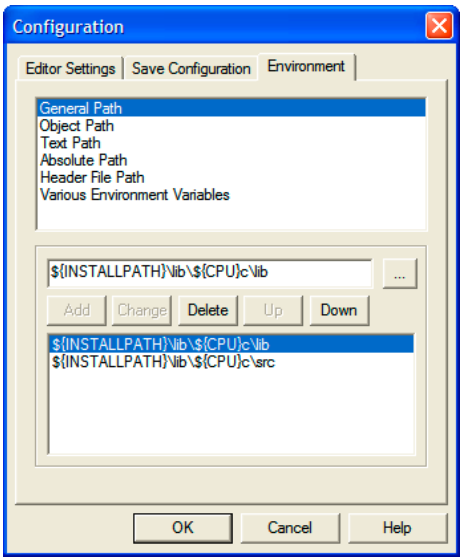
Control	Function
Options	When checked, Maker saves current option and message settings to configuration file. When cleared, last saved content remains valid.
Editor Configuration	When checked, Maker saves current editor setting to configuration file. When cleared, last saved content remains valid.
Appearance	When checked, Maker saves window position, command-line content, and history settings to configuration file. When cleared, last saved content remains valid.
Environment Variables	When checked, Maker saves environment variable settings in **Environment** Tab to the configuration file. When cleared, last saved content remains valid.
Save on Exit	When checked, Maker saves the configuration file on exit. No confirmation message appears. When cleared, Maker does not save configuration file on exit, even if you change options or another part of the configuration file. No confirmation message appears when closing Maker.

NOTE Maker stores settings in the configuration file, with the exception of the recently used configuration list and the settings in this dialog box. Configurations can coexist in the same file as the shell project configuration. When the shell configures an editor, Maker can read the content from the project file. The shell project configuration filename is `project.ini`.

Environment Tab

Use the **Configuration** dialog box with the **Environment** tab selected to configure the environment.

Figure 16.10 Configuration Dialog Box — Environment Tab



Maker reads the content of the dialog from the `[Environment Variables]` section of the actual project file. You can choose from these environment variables:

- General Path: `GENPATH`
- Object Path: `OBJPATH`
- Text Path: `TEXTPATH`
- Absolute Path: `ABSPATH`
- Header File Path: `LIBPATH`
- Various Environment Variables: other variables not covered in this list

The following table lists and describes the **Environment** tab controls.

Table 16.9 Environment Tab Buttons

Button	Function
Add	Adds a new line/entry
Change	Changes a new line/entry
Delete	Deletes a new line/entry

Table 16.9 Environment Tab Buttons (*continued*)

Button	Function
Up	Moves a line/entry up
Down	Moves a line/entry down

Tip of the Day Dialog Box

When you start the tool, a **Tip of the Day** dialog box displays a randomly selected user tip.

The **Next Tip** button lets you read the next hint. If you don't want the **Tip of the Day** dialog box to open when the program starts, clear the **Show Tips on StartUp** checkbox. Click **Close** to close the **Tip of the Day** dialog box.

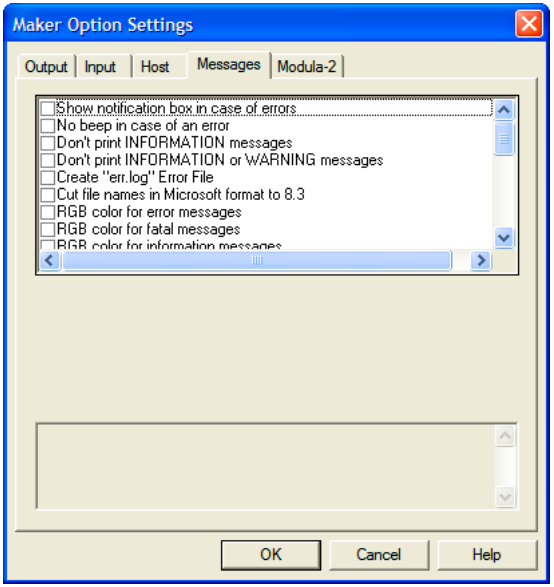
NOTE The local project file stores user configurations.

Maker Option Settings Dialog Box

The Option Settings dialog box appears when you select **Maker > Options** from the menu bar. Click once on the text in the list box to select an option. For help, select an option and press *F1*. The command-line option in the lower part of the dialog box corresponds to your selection in the list box. For more information on Maker options, see Tool Options.

NOTE When you select options requiring additional parameters, a dialog box or subwindow may appear.

Figure 16.11 Maker Option Settings



The following table describes the tabs in the **Maker Option Settings** dialog box.

Table 16.10 Option Settings Dialog Box Tabs

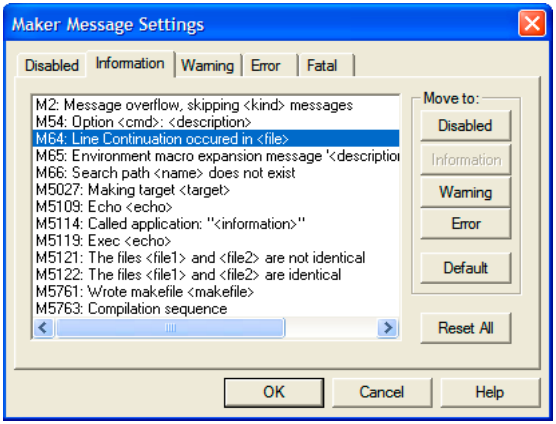
Tab	Description
Output	Command-line execution and print-output settings.
Input	Macro settings.
Host	Lists options related to the host operating system.
Messages	Message-handler settings, such as format, kind, and number of printed messages.
Modula-2	Modula-2 make-specific options (not relevant for C users).

Maker Message Settings Dialog Box

The **Message Settings** dialog box appears when you select **Maker > Messages** from the list menus. This dialog box lets you map messages to different message classes.

Each message has its own ID (a character followed by a 4- or 5-digit number). This number allows for message look-up both in the manual and in the online help. For information about specific messages, see Makefile Messages.

Figure 16.12 Message Settings Window



The following table describes the tabs in the **Message Settings** dialog box.

Table 16.11 Message Settings Dialog Box Tabs

Message Group	Description
Disabled	Lists disabled messages. Maker does not write the messages displayed in the list box to the output stream.
Information	Lists information messages. Information messages inform you of actions taken.
Warning	Lists warning messages. When Maker generates a warning message, it continues processing the input file.
Error	Lists error messages. When Maker generates an error message, it stops processing the input file.
Fatal	Lists fatal error messages. These messages report system consistency errors. You cannot ignore or move fatal error messages.

Changing a Message Class

You can map messages to different classes using one of the buttons at the right of the dialog box. Each button refers to a message class. To change the class associated with a message, select the message in the list box and then click the button corresponding with the desired message class.

Example

To define message `M5116 could not delete file` (a warning message) as an error message, follow these steps:

1. Select the **Warning** tab

   A list of warning messages appears in the list box.

2. Select the message `M5116 could not delete file` in the list box.
3. Click the **Error** button to define the message as an error message.

NOTE You cannot move messages from or to the **Fatal** error class. Maker only enables the **Move to** buttons when you select movable messages. If you try to move a message to an impermissible group, Maker grays out the impermissible move to button.

To save the modification you performed in the error message mapping, click **OK** to close the **Maker Message Settings** dialog box. If you click **Cancel** to close the dialog box, the previous message mapping remains valid.

Retrieving Information about an Error Message

You can access information about each message in the list box. Select the message in the list box, then click **Help**. An information box opens, which contains a detailed description of the error message as well as a small example of code producing it. If you select several messages, help for the first message appears. If you select no message, pressing *F1* shows the help for the dialog box.

About Maker Dialog Box

The **About Maker** dialog box appears when you select **Help > About** from the menu bar. This dialog box shows the current directory and the Maker component versions. The Maker version appears separately at the top of the dialog box. Click **OK** to close the dialog box.

NOTE During a Make process, Maker component versions do not appear. Maker must be idle in order for versions to appear.

Specifying the Input File

You can use several different ways to tell the make file to process. During processing, the software sets options according to the configurations that you specified in Maker dialogs.

Before starting to process a make file, specify a working directory using your editor.

- Use the Toolbar Command Line to Make

  Use the command line to process files. The command line lets you enter a new file name and additional Maker options.

- Processing a File Already Run

  You can display the previously executed command using the arrow at the right of the command line. Select a command by clicking it, which puts it on the command line. The software processes the file you choose after you click the **Make** button in the toolbar or after you press the **Enter** key.

- File > Make

  When you select **File > Make** from the menu bar, the **Select file to make** dialog box appears. Navigate and select the file you want to process. The software processes the file you choose after you click the **Make** button in the toolbar or press the *Enter* key.

- Drag and Drop

  You can drag a file from other software (such as the File Manager or Explorer) and drop it into the Maker main window. The software processes the dropped file after you release the mouse button.

  If the dragged file has the `.ini` extension, Maker loads and treats it as a configuration file, not as a makefile. To process a makefile with an `.ini` extension, use another method to run it.

Message and Error Feedback

After making, there are several ways to check where Maker detected different errors or warnings. The format of an error message looks like this:

```
<msgType> <msgCode>: <Message>
```

Examples

```
ERROR M5102: input file not found
```

```
ERROR M5112: called application: "ERROR C1011: Undeclared
enumeration tag"
```

The second example shows that Maker also displays messages from called applications, but only if an error occurs. Maker extracts the messages from the error file if the called application reports an error.

Using Information from the Main Window

After Maker processes a file, the Maker window content area displays a list of detected errors or warnings. Use the editor of your choice to open the source file and correct the errors.

Using a User-Defined Editor

You must first configure the editor you want to use for message or error feedback in the **Configuration** dialog box. After Maker processes a file, you need only double-click an error message to open your selected editor automatically and point to the line containing the error.

17

Using Maker

With Maker you can build Modula-2 applications as well as maintain C/C++ projects. Maker syntax is a subset of the UNIX **Make** command.

This chapter covers the following topics:

Making Modula–2 Applications

To make a Modula-2 application, enter the name of the main module at the input prompt (or the command line). First, Maker collects dependencies given by the IMPORT clauses in the source files of both implementation and definition modules. Second, Maker recompiles files modified since the last compilation. Third, Maker tries to link the application.

The **Make** utility needs three environment variables:

LINK: Linker for Modula-2 — Defines the linker program

COMP: Modula-2 Compiler — Defines the compiler

FLAGS: Options for Modula-2 Compiler — Defines the compiler options for the compiler given in COMP

These variables are necessary only when you use the Maker to build a Modula-2 application, not for makefile processing (although you can use them as macros, as described later in this chapter).

Making C Applications

Since in C you cannot always deduce dependencies between files by looking at the source files, automatic make (as with Modula-2 applications) is not possible. However, if you describe these dependencies in a file, Make can process this makefile and build, or rebuild, a C application.

Using Makefiles

This section gives a short introduction to writing and using makefiles. If you already know UNIX–style make utilities, you probably already know most of what follows. If you have been working until now with Microsoft Make, we strongly recommend that you read this section.

Syntax of Makefiles

Makefile syntax is as follows:

```
MakeFile   =  {Entry | Directive}.
Entry      =  {Macro | Update | Rule}.
Macro      =  Name {"="|"+="|"=+"} Line NL.
Update     =  Name ":" [Name {[","] Name}] NL {Command}.
Command    =  WhiteSpace {WhiteSpace} Line NL.
Rule       =  "." Suffix ["." Suffix] ":" NL {Command}.
Directive  =  INCLUDE Name NL.
WhiteSpace =  " "|"\t".
NL         =  "\n".
Line       =  {<any char except un-escaped linebreaks>}.
Name       =  <any valid file name>.
Suffix     =  Letter [Letter] [Letter].
Letter     =  any letter from "A" to "Z" or from "a" to "z">.
```

Case Sensitivity

By default, Maker is case-sensitive. However, if you set the `-C` option, Maker treats uppercase and lowercase letters the same.

Line Breaks

Processing a makefile is a line-oriented job because you use a linebreak to terminate most constructs, such as macro definitions or dependency lists. If you want Make to ignore a linebreak, place a backslash (“\”) immediately before the linebreak. Make then reads the combination of backslash and linebreak as one single blank. You cannot use a line continuation to enlarge comment lines.

Comments

Comments in a makefile start with the number sign (#) and end with the next linebreak.

Dependencies

Makefile update entries determine dependencies between files. Such an update entry has the form:

```
target file: {dependency file} {command line}
```

This entry tells HI-CROSS Make that the target file depends on all the dependency files. If any of the dependency files changed since the last target-file make, or if the target file does not exist, Make executes the command lines in order of appearance. If dependencies do not exist, Make always executes the command lines. If command lines do not exist, the target needs re-making, and rules are inapplicable, Make issues an error message. See the following sections for more information on rules.

Commands

You must begin each command on a new line and prefix that command by at least one blank or tab. Maker does not claim the tab as in UNIX make. The following list describes additional characteristics:

- Maker strips leading and trailing blanks and tabs from the command line.
- If the command line terminates with an exit code not equal to zero, Maker displays an error message and stops makefile processing, unless the line starts with a dash (-). Maker removes the `dash` before executing the command.
- An asterisk (*) at the start of the command line prevents Maker from capturing the output of the called tool. Sixteen-bit applications such as `command.com` need the asterisk to function properly.

Processing

Make processes updated entries recursively, which means that if a dependency file appears as a target in some other update entry, Make processes that other update entry first. If a dependency file does not exist and rules are inapplicable, Make issues an error message. See the following sections for more information on rules.

Normally, makefile processing starts with the update entry for the target given on the command line or at the input prompt. If you do not specify a target, processing starts at the first update entry in the makefile.

If there are two update entries for the same target file, Make appends the dependencies and commands of the second update entry to those of the first update entry.

Make issues an error message if it finds circular dependencies.

Macros

Macros associate a name with some arbitrary text. You can substitute this name for each occurrence of the arbitrary text in the makefile. There are two different forms of macros: user-defined static macros and predefined dynamic macros.

User-Defined Macros (Static Macros)

This section describes the macro definition form.

Definition

A macro definition has the form:

```
macro_name = text up to the next un-escaped linebreak
```

After you define a macro, you can use a macro reference to include the text at any place in a makefile.

Reference

A macro reference has the form:

```
$(macro_name)
```

Make replaces the reference with the text, including the "`$(`" and the "`)`". If the text itself contains more macro references, Make expands those, as well.

Redefinition

You can redefine macros, in which case the text in the new definition overwrites the text in the old definition. Maker issues an error message if it detects a circular macro definition like this:

```
ThisMacro = $(ThatMacro)
ThatMacro = Not $(ThisMacro)
```

Macro Substitution

During macro expansion, use the following syntax to have Maker replace strings:

```
$(macroname:find=replace)
```

In this example, Maker replaces every occurrence of `find` with `replace`.

Use this kind of macro expansion to derive filenames, as in the following example:

```
SRCNAMES= a.c b.c
OBJNAMES = $(SRCNAMES:.c=.o)
```

As a result of this example, `OBJNAMES` contains `a.o b.o`.

NOTE Maker does not allow spaces in the search string, the replace string, the whole macro definition, or before or after the ":" or the "="

Macros and Comments

If a comment follows a macro on the same line, as in the following example, the text that replaces any reference of these macros ends just before the # character:

```
MyMacro   = another #And that's a comment
OurMacro  = This is \
$(MyMacro)  example #That's a comment, too!
MyMacro   = a third #Redefinition of a macro
HisMacro  = This is \
          $(MyMacro) example
```

Maker replaces the macro references as follows (without double quotes):

```
$(MyMacro)  = "a third"
$(OurMacro) = "This is a third example"
$(HisMacro) = "This is a third example"
```

You can use macro references in update entries, inference rules, macro definitions, and macro references. See the following sections for more information on rules. The macro-reference possibility allows constructs such as:

```
This = Macro
MyMacro = This is a circular macro reference!
$(My$(This))
```

This example first evaluates to "`$(MyMacro)`" and then to "This is a circular macro reference!".

Concatenation

Besides the macro definition operator "`=`", **Make** knows two additional operators: "`+=`" and "`=+`". The first operator appends the text on the right to the macro on the left. The second operator assigns to the macro the value given by appending the macro's previous value to the text given on the right:

```
MyMacro = File
MyMacro += .TXT
     #Now the macro has the value "File.TXT"
MyMacro =+ D:\
     #Now it has the value "D:\File.TXT"
```

The following macro is a case handled differently by different make utilities:

```
MyMacro = D:\SomeDir\
```

In HI-CROSS **Make** it has the value `D:\SomeDir\`. Other make implementations expand it as `D:\SomeDir` and take the last backslash as part of an escaped linebreak.

Command-Line Macros

There are two kinds of user-defined macros: Command-line macros and makefile macros. Makefile macros are the macro definitions that appear in the make file. Command-line macros are macros on the command line with option `-d`. Command-line macros have a higher priority than macros defined in the makefile or in an included file. Therefore, if you define a macro on command line, Maker ignores further definition of a macro with the same name in the makefile.

A special command-line macro is `TARGET`, which defines the name of the top target to make. The `TARGET` macro provides compatibility with previous Maker versions. Specify a top target by adding its name after the makefile name. Defining an explicit top target with the `TARGET` macro works only on the command line. The `TARGET` macro in the makefile does not define a new top target. Do this explicitly by specifying a new target at the top, which has the top target to make as dependency.

Dynamic Macros

In addition to user-defined macros, which are always static, HI-CROSS **Make** recognizes the following dynamic macros, which evaluate differently in different contexts:

```
$*  base name (without suffix and period) of the target file.
$@  complete target file name.
$<  complete list of dependency files.
$?  list of dependency files that are younger than the target
$$  evaluates to a single dollar sign.
```

Except for the first and last macro, these dynamic macros may only appear within command lines. Maker replaces them at the very end of macro substitution, just as it executes the command:

```
MyMacro = $<
OurMacro = file.c $(MyMacro)
THAT.EXE : $*.C $(OurMacro)
  $(COMP) $(MyMacro)
  $(LINK) $*.PRM
```

The first line evaluates to:

```
THAT.EXE : THAT.C file.c $<
```

This line is circular, since Maker now replaces `$<` with `THAT.C file.c $<` and so on. For this reason, the dynamic macros `$<` and `$?` may only appear on a command line (after Maker completes all macro substitution). If we define `OurMacro` as:

```
OurMacro = file.c io.c
```

Once Maker completes all macro substitution, we get:

```
THAT.EXE : THAT.C file.c io.c
```

Example of `$<`:

```
target.o: target.c a.c b.c
  $(COMP) $<
```

replaced with:

```
target.o: target.c a.c b.c
  $(COMP) target.c a.c b.c
```

Example of `$?`:

```
target.o: target.c a.c b.c
  $(COMP) $?
```

If `a.c` and `b.c` are newer than `target.o`, then the result is:

```
target.o: target.c a.c b.c
  $(COMP) a.c b.c
```

NOTE `HI-CROSS Make` also defines macros for all currently set environment variables. You can redefine these macros like any other macro.

Inference Rules

Inference rules specify default rules for certain common cases. Inference rules have the form:

```
.depSuffix.targetSuffix:
```

```
  {Commands}
```

or:

```
.depSuffix:
  {Commands}
```

These rules tell `HI-CROSS Make` how to make a file with suffix `targetSuffix` if it cannot find an update entry for the file: look for a file with the same name as the target but with suffix `depSuffix`. Assume the target depends on that file, make the usual checks, and if Maker must remake the target, execute the commands. If commands do not exist and the target needs remaking, Maker issues an error.

The second form of an inference rule with only one suffix works exactly as the first one. Maker assumes an empty target suffix.

For example, object files usually depend on a source file of the same name, but with a different suffix, and Make calls a compiler to create those object files. Assume that object files have the extension `.o` and source files have the extension `.c`. For example:

```
.c.o:
  $(COMP) $*.c
```

If Make now finds a dependency file with extension `.o` (for example, `THIS.o`) but no update entry having this file as target, it applies the above rule. The result is exactly the same as if your makefile contained the dependency:

```
THIS.o: THIS.c
  $(COMP) $*.c
```

Rules also play a different role: if there is an update entry without command lines, `HI-CROSS Make` searches for a rule that might apply and executes the commands specified in that rule. For example, with your makefile containing the above rule, the update entry:

```
THAT.o: FILE.h DATA.h
```

This is equivalent to:

```
THAT.o: FILE.h DATA.h THAT.c
  $(COMP) $*.c
```

If you define two different inference rules for the same target suffix, only the last one is active.

If `HI-CROSS Make` finds a dependency file that does not appear as a target in some other update entry, it tries to find an inference rule to apply. If Make cannot find an inference rule, and the file exists, Make assumes that the file is up to date. If the file does not exist, Maker needs to remake it. Since Maker lacks a rule or an update entry for the file, it issues an error message.

Here is a more complex example:

Listing 17.1 Example

```
# demo make file for assembly project

OBJECTS = a_1.o a_2.o a_3.o
ASM = c:\freescale\prog\assembler.exe
LINK = c:\freescale\prog\linker.exe
all: myasm.abs
  echo "all done"
myasm.abs: $(OBJECTS) myasm.prm
a_1.o: a_1.inc
a_2.o: a_1.inc a_2.inc
  .prm.abs:
  $(LINK) $*.prm
  .asm.o :
  $(ASM) $*.asm
```

Multiple Inference Rules

You can specify more than one inference rule for each dependency suffix. Use this technique when you have source files written in different programming languages with different file suffixes. For example, assume you have sources written in assembly language, in ANSI-C and C++. The object files produced by the assembler and compiler have all the same suffixes. They are linked together to one program or library. You can represent this relationship by one target having all the object files as a dependency list:

```
makeAll: asm_obj1.o asm_obj2.o asm_obj3.o c_obj1.o cobj2.o
cpp_obj1.o
```

These rules build the object files:

```
.asm.o:
    $(ASSEMBLE) $*.asm $(ASMOPTIONS)
.c.o:
    $(COMPILE) $*.c $(COPTIONS)
.cpp.o:
    $(COMPILE) $*.cpp $(CPPOPTIONS)
```

Maker selects the first applicable rule.

NOTE The Maker resolution algorithm is logically incomplete. You can chain rules together in some cases, but doing so may lead to conflicts with the handling of multiple inference rules. For example, if you use template frames with the suffix `.tpl` compiled by a program that produces C files from TPL files, Maker may have problems resolving multiple rules in the further compilation

steps. To work around these problems, construct and use a test makefile that contains the main resolution features in order to investigate Maker's build behavior. If the test makefile works, the full makefile also works.

Directives and Special Targets

HI-CROSS **Make** lets you include one makefile into another by using an include directive of the form:

```
INCLUDE filename
```

This directive textually replaces the include directive with the given file's contents (from another makefile). If Make cannot locate, open, or read the file, it issues an error message.

Make always includes the default makefile DEFAULT.MAK at the very beginning. The environment variable GENPATH specifies the directory that contains the makefile.

NOTE Because the DEFAULT.MAK is included automatically, you have to be careful when using this name. An incorrectly used DEFAULT.MAK causes failures in all other makefiles for which it is in the search path. We recommend sharing common definitions by explicit makefile includes instead of using the implicitly included DEFAULT.MAK.

Make issues an error message for circular includes.

HI-CROSS **Make** also allows definition of two special targets without dependencies:

```
BEFORE:
  {Commands}
```

and

```
AFTER:
  {Commands}
```

Make executes these commands just before and just after processing the top target given on the command line.

Built-In Commands

You can start DOS programs from the HI-CROSS **Make** Utility on the command line. You can directly execute external DOS commands; to execute built-in commands call COMMAND.COM with option /c, like this:

```
*COMMAND.COM /c dir C:\freescale > C:\DIR.TXT
```

NOTE The asterisk (*) prevents Maker from capturing the output of command.com. The output capture facility is inconsistent when handling 16-bit executables like command.com. In WinNT environments, use the native 32-bit shell cmd.exe instead of command.com.

The HI-CROSS **Make** Utility also has a few simple built-in commands. These commands include:

```
copy file1 file2
```

This command creates a copy of file1 with the name file2. No wildcards are allowed. If you need wildcards, use the DOS built-in copy command.

```
del file1 file2... fileN
```

This command deletes the files passed as arguments. Again, no wildcards are allowed. Maker follows the file path from the current directory, if you do not specify an absolute path. Maker does not consult the environment settings to find the files to delete.

```
cd directory
```

This command changes the current directory. The scope of the cd command is the command list of a target from which Maker called it.

NOTE Avoid using this command unless absolutely necessary. The command may lead to inconsistency with relative-path definitions in the environment.

```
echo text
```

This command is actually a no-op. If Maker displays the commands, it displays the text, too. You can view the echo text command as a way of defining a comment that Maker shows, while hiding normal comments starting with #.

```
puts outputfile text
```

This command writes text, the rest of the command line, to the file specified with outputfile (the first identifier of the command line). The write mode is appending. If the file does not exist, Maker creates it (mode a+).

Example

```
puts myOutput.txt This is a text\n
```

This example writes the text This is a text with a line break at the end to the file myOutput.txt.

Listing 17.2 Example

```
GENMAKE= bb.mak
TARGET = b
```

```
MAKE= c:\freescale\prog\maker.exe
COMP= c:\freescale\prog\compiler.exe
STAR=*
DEPENDENDS = $(TARGET).c $(TARGET).h
 create$(GENMAKE):
   -del $(GENMAKE)
  puts $(GENMAKE) \nCOMP=$(COMP)
  puts $(GENMAKE) \nMAKE=$(MAKE)
  puts $(GENMAKE) \n$(TARGET).o :  $(DEPENDENDS)
  puts $(GENMAKE) \n $$(COMP) $(TARGET).c
  $(MAKE) $(GENMAKE) $(TARGET).o
```

This example generates and runs `bb.mak`.

Listing 17.3 Example

```
COMP=c:\freescale\prog\compiler.exe
MAKE=c:\freescale\prog\maker.exe
b.o : b.c b.h
 c:\freescale\prog\compiler.exe b.c

fc file1 file2
```

This example compares two files, specified by name as `file1` and `file2`, byte by byte and remembers the result for the next `?` command. The result is TRUE if the files are identical and FALSE if they are not identical.

```
fctext file1 file2
```

This example compares two text files byte by byte, ignoring blanks for compare, and remembers the result for the next `?` command. The result is TRUE if the files are identical and FALSE if they are not identical.

```
?
```

```
Syntax:   ? <commandIfYes> ':' <commandIfNo>
```

The result of the last compare operation executes either <`commandIfYes`>, if the compared files were identical, or <`commandIfNo`> if the compared files were not identical.

```
fctext  upxcall.c upxcall.old
```

```
? puts log.txt files are equal : puts log.txt files are not
equal
```

or:

```
fctext upxcall.c upxcall.old
```

```
? puts log.txt files are equal \
```

```
: puts log.txt files are not equal
rehash
```

This example reloads the HI-CROSS environment from the `default.env` file. Thereafter all commands, all macro expansions, and all file searches execute in the new environment.

```
ren file1 file2
```

This example renames `file1` to `file2`. No wildcards are allowed.

Command Line

The Maker command line consists of three parts:

- Maker Options

  Maker treats all entries starting with a dash (-) as options. To specify the top target, use the target name on the command line after the makefile name.

- Makefile name

  Maker treats the first command line argument, which does not start with a dash, as a makefile name.

- Targets

  Maker treats all remaining arguments without a leading dash as targets to build. If you do not specify targets, the first rule is build.

When you start Maker without command-line arguments, a window opens in which you can manually enter commands.

Implementation Restrictions

Make has only one implementation restriction: the string resulting from a macro substitution cannot contain more than 4095 characters.

18

Building Libraries

This chapter explains using the Maker utility to adapt or build your own libraries. Listings in this chapter have the <target> identifier instead of a specific CPU name. <target> stands for your own target name.

The following topics are covered in this chapter:

Maker Directory Structure

The make files distributed for building the libraries expect the directory structure recommended in the Tools installation. The following items are installed in the C:\Program Files\Freescale\CW MCU v10.x directory.

- FREESCALE program folder. Normal installation places the .EXE files for each tool in this folder:

  <*CWInstallDir*>\MCU\prog

  For S12Z derivatives: <*CWInstallDir*>\MCU\S12lisa_Tools

- Your working directory for building libraries, makefiles, project files, and configuration files installed here:

  <*CWInstallDir*>\lib\<target>

- Binary tool path, defined as a relative path from your working directory in the environment variable OBJPATH. Object files and libraries build here:

  <*CWInstallDir*>\lib\<target>\lib

- The lib directory contains the library in the preferred object-file format. For targets supporting different object-file formats, other formats reside in these directories (which exist only if the format supports libraries and is not the default):

  FREESCALE: <*CWInstallDir*>\lib\<target>\lib.hix

ELF/DWARF 1.1: <*CWInstallDir*>\lib\<target>\lib.e11

ELF/DWARF 2.0: <*CWInstallDir*>\lib\<target>\lib.e20

- Source paths of the Compiler or Assembler used, defined as a relative path from your working directory in the environment variable GENPATH:

  <*CWInstallDir*>\lib\<target>\src

- Include path of the Compiler or Assembler used, defined as a relative path from your working directory in the environment variable LIBPATH:

  <*CWInstallDir*>\lib\<target>\include

NOTE The <*CWInstallDir*> is the installation directory for the CodeWarrior for Microcontrollers v10.x.

Configuring WinEdit for the Maker

Configure WinEdit as follows:

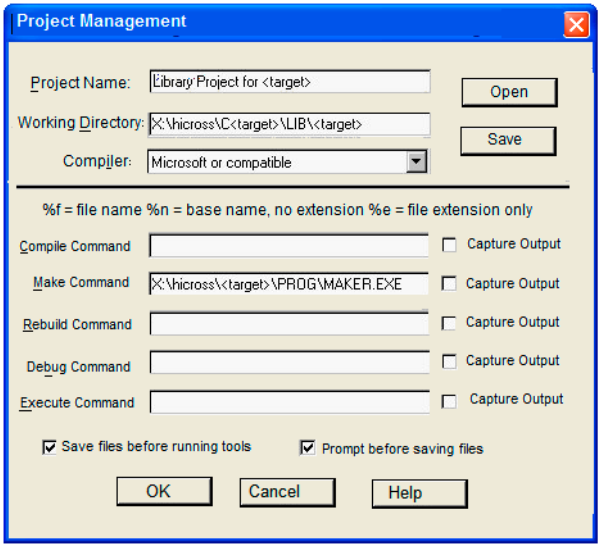
1. Open the Dialog **Project > Configure** in WinEdit.

   This dialog appears only when you open a source file.

2. Load a prepared configuration file with **Open** or edit the tool definition and save the configuration file.
3. For the Maker configuration (and also the other tools used directly from WinEdit) you must enter the full path to the application in the corresponding text box.
4. Enter the path to your make files in the working directory field.

The following figure shows a sample configuration in the Project Management dialog box.

Figure 18.1 Project Management Dialog Box



Configuring default.env for the Maker

This section contains a sample `default.env` (see ENVIRONMENT: Environment File Specification) with Maker settings. For building libraries, you need `COMP` for the compiler, `MAKE` for the make tool, and `LIBM` for the library. Additionally, you must specify path environment variables such as `OBJPATH` and `GENPATH`. The makefiles introduced in this section also reference these paths.

```
OBJPATH=.\lib
GENPATH=.\src
LIBPATH=.\include
MAKE=..\..\prog\maker.exe
COMP=..\..\prog\c<target>.exe
LIBM=..\..\prog\libmaker.exe
```

Building Libraries with Defined Memory Model Options

Modify memory-model options of a library to build or to extend the built libraries with a new one as follows:

1. Open the file `mkall.mak`.

   This file is the main makefile for building libraries. For every library, you specify a command line under the top target `makeall`. An example is:

   ```
   $(MAKE) mklib.mak -D(MM=$(FLAGS) -Ms) \
                          -D(LIBDIR=$(LIBDIR))\
                          -D(LIBNAME=testlib)\
                          -D(INCLIBS=ansilib.lib cpplib.lib)
   ```

2. With the command line macro `MM`, specify the options for your library (memory model option and others).

   To change the memory model from small to banked, replace `-Ms` in the macro definition with `-Mb`.

NOTE The macro definition introduced here is in -D: Define a Macro (Maker). You can specify more than one option switch inside the braces, as in this example:

```
-D(MM=$(FLAGS) -Ms -Cf)
```

3. Specify the library directory in `LIBDIR`.

   This step is necessary only when you use the default directory `\lib`, as with processors supporting ELF and Freescale object-file format.

4. In `LIBNAME`, name the library to build without an extension. For example, use `testlib` if the name of the library to build is `testlib.lib`.

5. Call Maker with `mkall.mak`.

The library built with this example includes the ANSI library and the C++ library.

Building Libraries with Objects Added

Add your own objects to a library or build a new one as follows:

1. Copy the `ansilib.mak` makefile to a makefile with the name of the library you want to build. For example, use `mylib.mak` if the name of the library you want to build is `mylib.lib`.

2. Put this makefile in the same directory as the other makefiles.

NOTE The name of the sublibrary of a built library must be the same as the underlying makefile, with the `.lib` extension instead of `.mak`.

3. Remove all object files listed in the macro `OBJECTS` in `mylib.mak`.

   If you now list the new makefile `mylib.mak`, you get:

```
OBJECTS =
makeLib: createLib $(OBJECTS)
  echo --- Sublibrary ansilib created
createLib:
  $(CC) string.c assert.c
  $(LIBM) string.o + assert.o = $(OBJPATH)\$(LIBNAME).lib
  del $(OBJPATH)\string.o
  del $(OBJPATH)\assert.o
.c.o:
  $(CC) $*.c
  $(LIBM) $(OBJPATH)\$(LIBNAME).lib+$*.o =
$(OBJPATH)\$(LIBNAME).lib
  del $(OBJPATH)\$*.o
```

4. List your object files with the `.o` extension in the `OBJECTS` macro.

   Place your library source files in the folder specified in GENPATH (see GENPATH: Define Paths to Search for Input Files).

5. Open the `mkall.mak` file.

   `mkall.mak` is the main makefile for building libraries. For every library, you specify a command line under the top target `makeall:`.

   An example is:

```
$(MAKE) mklib.mak -D(MM=$(FLAGS) -Ms) \
                  -D(LIBNAME=testlib)\
                  -D(STARTANSIOBJ=start<target>s)\
                  -D(STARTCPPOBJ=strt<target>sp)\
                  -D(INCLIBS=mylib.lib)
```

6. In the passed `INCLIBS` command-line macro, specify the sublibrary names.

   In the example above, Maker builds only the sublibrary `mylib.lib` with `mylib.mak`. In this example, we list only one sublibrary. You can add additional sublibraries to the list, separated by spaces.

7. In `LIBNAME`, specify the name of the built library without the extension.

   The other macros passed specify the startup files to build. Maker does not insert the startup files into the library but instead builds them separately.

NOTE The name of the library to build, specified in `LIBNAME`, must be different from the name of the sublibrary included, such as `mylib` in the example. If not, Maker deletes the built library just after building it. (Maker deletes the sublibrary after adding it to the built library.)

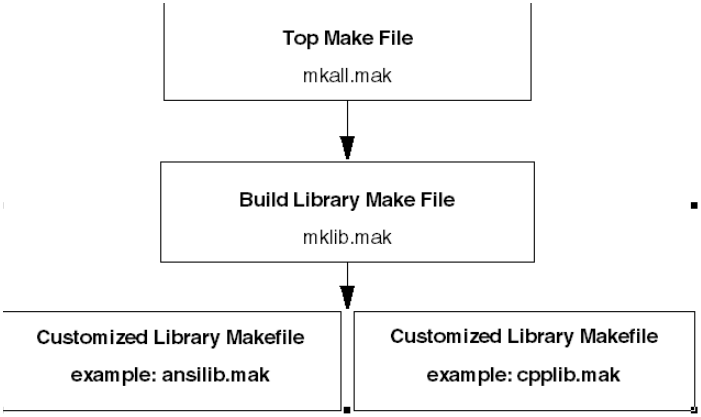
8. Call Maker with `mkall.mak`

Your library builds among the others.

Structured Makefiles for Libraries

Building a library works on three makefile levels, as shown in the following figure.

Figure 18.2 Building a Library



This layering compares to the modular concept of procedural programming languages. An upper makefile calls Maker with the makefile and the arguments passed over command-line macros. The top layer makefile `mkall.mak`, for example, calls the makefile `mklib.mak` to build one library and passes the memory model, the name of the library to build, the name of the participant sublibraries, and the startup files build.

A sample makefile, `mkall.mak`, looks like this:

Listing 18.1 Sample makefile

```
FLAGS   =  ## insert here the global options for all libraries
makeall:
  -dosprmpt.pif /c del lib\*.*
  echo --- Making all libraries:
  $(MAKE) mklib.mak -D(MM=$(FLAGS) -Ms) -D(LIBNAME=ansis) \
                    -D(STARTANSIOBJ=start<target>s) \
                    -D(STARTCPPOBJ=strt<target>sp) \
                    -D(INCLIBS=ansilib.lib cpplib.lib)
  $(MAKE) mklib.mak -D(MM=$(FLAGS) -Ms -Cf) \
                    -D(LIBNAME=ansisf) \
                    -D(STARTANSIOBJ=start<target>s) \
                    -D(STARTCPPOBJ=strt<target>sp) \
                    -D(INCLIBS=ansilib.lib cpplib.lib)
  $(MAKE) mklib.mak -D(MM=$(FLAGS) -Mb) -D(LIBNAME=ansib)  \
                    -D(STARTANSIOBJ=start<target>b) \
                    -D(STARTCPPOBJ=strt<target>bp)  \
                    -D(INCLIBS=ansilib.lib cpplib.lib)
  $(MAKE) mklib.mak -D(MM=$(FLAGS) -Mb -Cf)
                    -D(LIBNAME=ansibf) \
                    -D(STARTANSIOBJ=start<target>b) \
                    -D(STARTCPPOBJ=strt<target>bp) \
                    -D(INCLIBS=ansilib.lib cpplib.lib)
  echo "--- libraries done
```

The first command for the top target `makeall` deletes all libraries and object files previously built.

One Maker call with `$(MAKE)` evaluates Maker over the environment variable `MAKE` in `default.env`, which corresponds to building one library.

- The first Maker call of `mklib.mak`, for example, builds an ANSI library for the small memory model (with option `-Ms` passed over the command-line macro `MM`).
- `mklib.mak` expects these command-line macros:
  - `MM` = options for the memory model,
  - `LIBNAME` = name of the produced library
  - `STARTUP` = name of the ANSI-C Startup file
  - `STARTCPP` = name of the C++ Startup file
  - `INCLIBS` = in library of included sub libraries

In the example, we pass the library names `cpplib.lib` and `ansilib.lib` in the `INCLIBS` command-line macro. The `mklib.mak` makefile appears below:

NOTE Do not modify `mklib.mak`. Instead, use `mkall.mak` to specify the compiler options, the sublibrary list, and your own sublibraries, such as `ansilib.mak`, `cpplib.mak`, and the example, `mylib.mak`.

Listing 18.2 mklib.mak makefile

```
CC =  $(COMP) $(MM)
makeall: startup createLib $(INCLIBS)
  echo "--- all done! ---"
startup: start<target>.c
  echo "--- making startup
  $(CC) $(GENPATH)\start<target>.c
  copy $(OBJPATH)\start<target>.o
$(OBJPATH)\$(STARTANSIOBJ).o
  $(CC) -C++ $(GENPATH)\start<target>.c
  copy $(OBJPATH)\start<target>.o
$(OBJPATH)\$(STARTCPPOBJ).o
  del  $(OBJPATH)\start<target>.o
  echo "--- startup done
createLib:
  echo "--- creating library
  $(LIBM) $(OBJPATH)\$(STARTANSIOBJ).o =
$(OBJPATH)\$(LIBNAME).lib
  $(LIBM) $(OBJPATH)\$(LIBNAME).lib -
$(OBJPATH)\$(STARTANSIOBJ).o =\
    $(OBJPATH)\$(LIBNAME).lib
  $(LIBM) $(OBJPATH)\$(LIBNAME).lib ?
$(OBJPATH)\$(LIBNAME).lst
  echo "--- library done
  .mak.lib:
  echo "--- making and add $* library
  $(MAKE) $*.mak -D(CC=$(CC)) -D(LIBNAME=$*)
  $(LIBM) $(OBJPATH)\$(LIBNAME).lib + $(OBJPATH)\$*.lib =\
    $(OBJPATH)\$(LIBNAME).lib
  del $(OBJPATH)\$*.lib
  del $(OBJPATH)\$*.lst
```

The makefile uses build rules. For each library built, the makefile `mylib.mak` must reside in the working directory. The makefile collects a group of object files. Maker calls the makefile, passing these command-line arguments as parameters:

- `CC` = compiler with option list
- `LIBNAME` = name of the produced library

These settings depend on settings already passed from `mkall.mak`. The sublibraries built with the delivered makefiles are `ansilib.mak` and `cpplib.mak`.

VI

Appendices

This section contains topics common to all of the build tools, and contains the following chapters:

- Environment Variables
- Tool Options
- Messages
- Tool Commands
- EBNF Notation

Items and topics specific to individual tools are marked within the text.

A

Environment Variables

This chapter describes the environment variables used by the tools described in this manual. Differences between tools are noted in the text. Other tools, such as the Assembler and the Compiler, use some of the same environment variables. Refer to the respective tool manuals for more information.

You can set parameters in the environment using environment variables. The syntax is always the same:

```
VARIABLENAME=Definition
```

NOTE **No** blanks are allowed in the definition of an environment variable.

Example:

```
GENPATH=C:\INSTALL\LIB;D:\PROJECTS\TESTS;/usr/local/lib;/
home/me/my_project
```

These parameters may be defined in several ways:

- Using system environment variables supported by your operating system.
- Putting the definitions in a file called `DEFAULT.ENV` (`.hidefaults` for UNIX) in the project directory.

NOTE The maximum length of environment variable entries in the `DEFAULT.ENV` or `.hidefaults` is 65535 characters (1024 characters for the Decoder and Maker).

- Putting the definitions in a file given by the value of the system environment variable ENVIRONMENT: Environment File Specification.

NOTE The project directory shown above can be set using the `DEFAULT` system environment variable DEFAULTDIR: Default Current Directory.

When looking for an environment variable, all programs first search the system environment, then the `DEFAULT.ENV` (`.hidefaults` for UNIX) file, and finally the global environment file given by ENVIRONMENT: Environment File Specification. If no definition can be found, the tool assumes a default value.

NOTE You can also change the environment using the `-Env` option. Do not leave spaces at the end of environment variables.

Current Directory

The most important environment variable for all tools is the current directory. The current directory is the base search directory where the tool starts to search for files (for example, for the `DEFAULT.ENV /.hidefaults`).

Normally, the operating system or a program that launches another program (for example, WinEdit) determines the current directory of a tool. For the UNIX operating system, the directory in which an executable is started is also the current directory from which the binary file starts. For Microsoft® Windows®-based operating systems, the current directory definition is more complicated:

- If you launch the tool using a File Manager/Explorer, the current directory is the location of the executable launched.
- If you launch the tool using a desktop icon, the current directory is the working directory specified and associated with the icon.
- If you launch the tool by dragging a file onto the desktop icon, the desktop is the current directory.
- If you launch the tool from another tool with its own working directory specification (e.g., an editor as WinEdit), the current directory is the one specified by the launching tool (e.g., working directory definition in WinEdit).
- Changing the current project file also changes the current directory if the new project file is in a different directory. Browsing for a prm file does not change the current directory.

To overwrite this behavior, you can use the environment variable DEFAULTDIR: Default Current Directory.

To view the current directory, as well as other information, use the `-v` option or the **About** box.

Tool-Specific Search Information

This section details environment information unique to each tool. For further information about the Compiler, Assembler, and Debugger refer to the appropriate manual.

Compiler

- Symbol Files
  - The compiler looks for symbol files in the current directory, then in the directories given by the environment variable SYMPATH and finally in directories given in GENPATH.
  - New symbol files are written in the directory containing the source, unless the environment variable SYMPATH is set. If set, the compiler puts the symbol file in the first directory in the path list.
- Object Files
  - The compiler normally puts object files in the first directory specified in the environment variable OBJPATH. If that variable is not set, the compiler writes the object file into the directory containing the source file.
- Compiler Variables: COMPOPTIONS
  - If you set this variable, the compiler appends its contents to the command line each time a file is compiled. You can use this variable to globally specify certain options, so you don't have to specify them at each compilation.

Debugger

- Object Files
  - The debugger looks for object files in the current directory, then in directories specified in the environment variable OBJPATH and finally in GENPATH.
- Absolute Files
  - The debugger looks for absolute files in the current directory, then in directories specified in ABSPATH and finally in GENPATH.

Libmaker

- Source Files, Linker Parameter File
  - The Libmaker searches for Source Files and the Linker Parameter File first in the current directory, then in the other directories defined by the environment variable GENPATH.
- Header Files
  - If you include a header file in double quotes, the Libmaker searches the current directory first, then the directories given in GENPATH and finally those given in LIBPATH.

- If you include a header file using angle brackets, Libmaker does not search the directories in GENPATH, but searches only the current directory and those specified in LIBPATH.

Maker

- Maker Utility Variables
  - The maker utility can access any environment variable with the following syntax: $(Name) (e.g. $(COMP)). For makefiles given in your installation, the following environment variables are used.

    COMP: contains name of Compiler

    LINK: contains name of Linker

    FLAGS: contains command line options for the compiler specified by COMP.
- Makefiles and Include files
  - Maker searches for makefiles and include files first in the current directory and then in the GENPATH: Define Paths to Search for Input Files directory.
  - Maker calls the tools that produce the output files of a make run (except error reports). Refer to the corresponding manuals for the tools you use.

SmartLinker

- Object Files
  - The linker looks for object files in the current directory, then in directories specified in the environment variable OBJPATH and finally in GENPATH.
- Map Files
  - If linking succeeds, the linker writes a protocol of the link process to a list file called map file. The name of the map file is the same as that of the ABS file, but with extension MAP. The linker writes the map file to the directory specified by the environment variable TEXTPATH.
- Absolute Files
  - The linker creates absolute files in the first directory specified in ABSPATH. If that variable is not set, the linker generates the absolute file in the directory containing the parameter file.

Global Initialization File (MCUTOOLS.INI) (PC only)

All tools may store some global data into the `MCUTOOLS.INI` file. The tool first searches for this file in the directory of the tool itself (path of the executable). If there is no `MCUTOOLS.INI` file in this directory, the tool looks for an `MCUTOOLS.INI` file located in the Microsoft Windows installation directory (for example, `C:\WINDOWS`).

Example:

```
C:\WINDOWS\MCUTOOLS.INI
```

```
D:\INSTALL\PROG\MCUTOOLS.INI
```

If you start the tool in the `D:\INSTALL\PROG` directory, the tool uses the current file located in the same directory as the tool (`D:\INSTALL\PROG\MCUTOOLS.INI`).

However, if you start the tool outside the `D:\INSTALL\PROG` directory, the tool uses the current file in the Windows directory `(C:\WINDOWS\MCUTOOLS.INI)`.

[Installation] Section

This section lists the following variables.

- Path
- Group

Path

Arguments

Last installation path

Description

When you install a tool, the installation script stores the installation destination directory in this variable.

Example

```
Path=c:\install
```

Group

Arguments

Last installation program group.

Description

When you install a tool, the installation script stores the created program group in this variable.

Example

```
Group=ANSI-C Compiler
```

[Options] Section

This section lists the DefaultDir variable.

DefaultDir

Arguments

Default Directory to use.

Description

Specifies the current directory for all tools on a global level (see also environment variable DEFAULTDIR: Default Current Directory).

Example

```
DefaultDir=c:\install\project
```

[Tool] Section

Variables listed in this section in the global configuration file appear in separate sections by tool name, i.e., `[LINKER] Section`, `[BURNER] Section`.

This section lists the following variables:

- SaveOnExit
- SaveAppearance

SaveOnExit

Arguments

```
1/0
```

Description

1: Stores the configuration when the tool closes

0: Discards the configuration

The tool does not ask to store a configuration in either case.

SaveAppearance

Arguments

```
1/0
```

Description

1: Stores the visible topics when writing a project file

0: Discards visible topics

The command line, its history, the windows position and other topics belong to this entry.

SaveEditor

Arguments

```
1/0
```

Description

1: Stores the visible topics when writing a project file

0: Discards the visible topics

The editor settings contain all information of the editor configuration dialog.

SaveOptions

Arguments

```
1/0
```

Description

1: Saves the options when writing a project file

0: Discards the options

The options also contain the message settings.

RecentProject0, RecentProject1, etc.

Arguments:

Names of the last and prior project files

Description

Loading or saving a project updates this list. The file menu shows its current content.

Example

```
SaveOnExit=1
SaveAppearance=1
SaveEditor=1
SaveOptions=1
RecentProject0=C:\myprj\project.ini
RecentProject1=C:\otherprj\project.ini
```

TipFilePos

Arguments

Any integer

Description

Index number of the tip of the day shown; used to display different tip every time.

ShowTipOfDay

Arguments

`0/1`

Description

Specifies whether to show the Tip of the Day dialog at startup.

1: Shows Tip of the Day at startup

0: Shows Tip of the Day only when opened from the help menu.

TipTimeStamp

Arguments

`Date`

Description

Used to record the time that new tips became available. When the date specified here does not match the date of the tips, the first tip is displayed.

Example

```
[LINKER]
TipFilePos=357
TipTimeStamp=Jan 25 2000 12:37:41
ShowTipOfDay=0
SaveOnExit=1
SaveAppearance=1
SaveEditor=1
SaveOptions=0
RecentProject0=C:\myprj\project.ini
RecentProject1=C:\otherprj\project.ini
```

[Editor] Section

This section lists the following variables:

- Editor_Name
- Editor_Exe
- Editor_Opts

Editor_Name

Arguments

The name of the global editor

Description

Specifies the name displayed in the global editor. This entry has a descriptive effect only. Its content does not apply to starting the editor.

NOTE Maker cannot modify this entry.

Editor_Exe

Arguments

The name of the executable file of the global editor

Description

Specifies the file name (including its path) which is called for showing a text file when the global editor setting is active. In the editor configuration dialog, the global editor selection is active only when this entry is present and not empty.

Saved

Only with Editor Configuration set in the **File > Configuration > Save Configuration** tab.

NOTE Maker cannot modify this entry.

Editor_Opts

Arguments

The options to use the global editor

Description

Specifies options for the global editor. If this entry is missing or empty, `%f` is used. The command line to launch the editor is built by taking the `Editor_Exe` content, appending a space, then appending this entry.

Saved

Only with Editor Configuration set in the **File > Configuration > Save Configuration** tab.

Example

```
[Editor]
editor_name=WinEdit
editor_exe=C:\Winedit\WinEdit.exe
editor_opts=%f
```

NOTE Maker cannot modify this entry.

MCUTOOLS.INI Example

The following listing shows a typical layout of the `MCUTOOLS.INI` file.

Listing A.1 Sample MCUTOOLS.INI file

```
[Installation]
Path=c:\Freescale
Group=ANSI-C Compiler

[Editor]
editor_name=WinEdit
editor_exe=C:\Winedit\WinEdit.exe
editor_opts=%f

[Options]
DefaultDir=c:\myprj

[Linker]
SaveOnExit=1
SaveAppearance=1
SaveEditor=1
SaveOptions=1
RecentProject0=c:\myprj\project.ini
RecentProject1=c:\otherprj\project.ini
```

Local Configuration File (Usually project.ini)

The tools read `DEFAULT.ENV` and do not change its content in any way. The configuration file stores all the configuration properties. Different applications use the same configuration file. The configuration file format is the same format as Windows® `*.ini` files.

The tools can use any file name for the project configuration file, and store their own entries with the same section name as in the global `mcutools.ini` file. The application

backend is encoded into the section name so that different application backends can use the same file without overlapping. Different versions of the same tools use the same entries. This is important mainly when options available in only one version are stored in the configuration file. In such situations, you must maintain two files for the different tool versions. If no incompatible options are enabled when the file is last saved, you can use the same file for both versions.

The current directory is always the directory where the configuration file is located. If you load a configuration file in a different directory, then the current directory also changes. Changing the current directory reloads the `DEFAULT.ENV` file.

The shell uses the configuration file with the name `project.ini` in the current directory only, therefore it is recommended that you use this name with the tools as well. The tools can use the editor configuration written and maintained by the shell only when the shell uses the same file. Apart from this distinction, the tools can use any file name for the project file.

Loading or storing a configuration file reloads the options in the environment variables LINKOPTIONS (see LINKOPTIONS: Default SmartLinker Options) and COMPOPTIONS, and adds the options to the project options. This behavior is important to note when different `DEFAULT.ENV` files exist in different directories and contain incompatible LINKOPTIONS options. When you load a project using the first `DEFAULT.ENV`, you add its LINKOPTIONS and COMPOPTIONS to the configuration file. If you store this configuration in a different directory which contains a `DEFAULT.ENV` file with incompatible options, the tools add the options and reports the inconsistency. A message appears to report that the `DEFAULT.ENV` options were not added. If this occurs, you can either remove the option from the configuration file using the advanced option dialog, or you can remove the option from the `DEFAULT.ENV` with the shell or a text editor, depending upon which options you want to use in the future.

At startup there are two ways to load a configuration:

- Use the `-Prod` command line option
- Use the `project.ini` file in the current directory

If you use the `-Prod` option, then the directory containing the project file is the current directory. If you specify a directory using the `-Prod` option, you load the `project.ini` file from the specified directory.

[Editor] Section

This section lists the following variables:

- Editor_Name
- Editor_Exe
- Editor_Opts

Editor_Name

Arguments

The name of the local editor

Description

Specifies the name displayed in the local editor. This entry has a descriptive effect only. Its content does not apply to starting the editor.

Saved

Only with Editor Configuration set in the **File > Configuration > Save Configuration** Tab. This entry has the same format as the global editor configuration in the `mcutools.ini` file.

NOTE Maker cannot modify this entry.

Editor_Exe

Arguments

The name of the executable file of the local editor

Description

Specifies the file name which is called for showing a text file when the local editor setting is active. In the editor configuration dialog, the local editor selection is active only when this entry is present and not empty.

Saved

Only with Editor Configuration set in the **File > Configuration > Save Configuration** Tab. This entry has the same format as the global editor configuration in the `mcutools.ini` file.

NOTE Maker cannot modify this entry.

Editor_Opts

Arguments

The options to use the local editor

Description

Specifies the options to use for the local editor. If this entry is absent or empty, the tools use `%f`. The tools construct the command line to launch the editor by taking the `Editor_Exe` content, appending a space, then adding the `Editor_Opts` entry.

Saved

Only with Editor Configuration set in the **File > Configuration > Save Configuration** Tab. This entry has the same format as the global editor configuration in the `mcutools.ini` file.

NOTE Maker cannot modify this entry.

Example

```
[Editor]
editor_name=WinEdit
editor_exe=C:\Winedit\WinEdit.exe
editor_opts=%f
```

[Tool] Section

The local configuration file stores the following variables in separate sections for each tool and labeled accordingly, i.e., `[LINKER]`, `[BURNER]`.

This section lists the following variables:

- RecentCommandLineX, X=Integer
- CurrentCommandLine
- StatusbarEnabled
- ToolbarEnabled
- WindowPos
- WindowFont
- TipFilePos

- ShowTipOfDay
- Options
- EditorType
- EditorCommandLine
- EditorDDEClientName
- EditorDDETopicName
- EditorDDEServiceName
- BurnerUndefByte
- BurnerSwapByte
- BurnerOrigin
- BurnerDestination
- BurnerLength
- BurnerFormat
- BurnerDataBus
- BurnerOutputType
- BurnerDataBits
- BurnerParity
- BurnerByteCommands
- BurnerBaudRate
- BurnerOutputFile
- BurnerHeaderFile
- BurnerInputFile

RecentCommandLineX, X=Integer

Arguments

String with a command line history entry. For example: `fibo.prm`, `fibo.bbl`

Description

This list of entries contains the content of command line history.

Saved

Only with Appearance set in the **File > Configuration > Save Configuration** Tab.

CurrentCommandLine

Arguments

String with the command line. For example: `fibo.prm -w1`, `fibo.bbl -w1`

Description

The currently visible command line content.

Saved

Only with Appearance set in the **File > Configuration > Save Configuration** Tab.

StatusbarEnabled

Arguments

`1/0`

Description

This entry is considered only at startup. Later load operations do not use it.

1: Enables the status bar

0: Hides the status bar

Saved

Only with Appearance set in the **File > Configuration > Save Configuration** Tab.

ToolbarEnabled

Arguments

`1/0`

Description

The tool considers this entry only at startup. Later load operations do not use it.

1: Enables the toolbar

0: Hides the toolbar

Saved

Only with Appearance set in the **File > Configuration > Save Configuration** Tab.

WindowPos

Arguments

10 integers, e.g., `0,1,-1,-1,-1,-1,390,107,1103,643`

Description

The tool considers this entry only at startup. Later load operations do not use it.

NOTE Changes of this entry do not show the * in the title.

These numbers contain the position and the state of the window (maximized, minimized) and other flags.

Saved

Only with Appearance set in the **File > Configuration > Save Configuration** Tab.

WindowFont

Arguments

`Size:` == 0 -> generic size, < 0 -> font character height, > 0 font cell height,

`Weight:` 400 = normal, 700 = bold (valid values are 0–1000),

`Italic:` 0 == no, 1 == yes,

`Font name:` max 32 characters.

Description

Font attributes.

Saved

Only with Appearance set in the **File > Configuration > Save Configuration** Tab.

Example

```
WindowFont=-16,500,0,Courier
```

TipFilePos

Arguments

Any integer, e.g. 236

Description

Actual position of tip of the day file.

Saved

Always when saving a configuration file.

ShowTipOfDay

Arguments

0/1

Description

Display Tip of the Day dialog at startup.

1: Shows the Tip of the Day dialog

0: Hides the Tip of the Day dialog (can be displayed from the help menu)

Saved

Always when saving a configuration file.

Options

Arguments

W2

Description

The currently active option string. Because this entry contains the messages, the entry can be very long.

Saved

Only with Options set in the **File > Configuration > Save Configuration** Tab.

EditorType

Arguments

`0/1/2/3`

Description

This entry specifies the active editor configuration.

0: Global editor configuration (in the file `mcutools.ini`)

1: Local editor configuration (the one in this file)

2: Command line editor configuration: entry `EditorCommandLine`

3: DDE editor configuration: entries beginning with `EditorDDE`.

Saved

Only with Editor Configuration set in the **File > Configuration > Save Configuration** Tab.

EditorCommandLine

Arguments

Command line. For WinEdit: `C:\Winapps\WinEdit.exe %f /#:%l`

Description

Command line content to open a file.

Saved

Only with Editor Configuration set in the **File > Configuration > Save Configuration** Tab.

EditorDDEClientName

Arguments

Client command. For example, `[open(%f)]`

Description

Name of the client for DDE editor configuration.

Saved

Only with Editor Configuration set in the **File > Configuration > Save Configuration** Tab.

EditorDDETopicName

Arguments

Topic name. For example, `system`

Description

Name of the topic for DDE editor configuration.

Saved

Only with Editor Configuration set in the **File > Configuration > Save Configuration** Tab.

EditorDDEServiceName

Arguments

Service name. For example, `system`

Description

Name of the service for DDE editor configuration.

Saved

Only with Editor Configuration set in the **File > Configuration > Save Configuration** Tab.

Burner Dialog Entries in [BURNER]

The following entries are specific to the Burner, and appear only in the [BURNER] section of the `project.ini` file.

BurnerUndefByte

Arguments

Integral value of undefined bytes. Default is 0xff.

Description

Value of the Undef Byte entry on the Content page in the Burner dialog.

Saved

Only with Appearance set in the **File > Configuration > Save Configuration** dialog.

BurnerSwapByte

Arguments

0: Do not swap

1: Swap

Description

Value of the Swap Bytes check box on the Content page in the **Burner** dialog.

Saved

Only with Appearance set in the **File > Configuration > Save Configuration** dialog.

BurnerOrigin

Arguments

Integral value (0,1,2)

Description

Value of the Origin field on the Content page in the **Burner** dialog.

Saved

Only with Appearance set in the **File > Configuration > Save Configuration** dialog.

BurnerDestination

Arguments

Integral value (0,1,2)

Description

Value of the Destination Offset field on the Content page in the **Burner** dialog.

Saved

Only with Appearance set in the **File > Configuration > Save Configuration** dialog.

BurnerLength

Arguments

Integral value (0,1,2)

Description

Value of the Length field on the Content page in the **Burner** dialog.

Saved

Only with Appearance set in the **File > Configuration > Save Configuration** dialog.

BurnerFormat

Arguments

0: Freescale S record format

1: Intel Hex file format

2: Binary file format

Description

Format type specified on the Content page in the **Burner** dialog.

Saved

Only with Appearance set in the **File > Configuration > Save Configuration** dialog.

BurnerDataBus

Arguments

0: “1 Byte”

1: “2 Bytes”

2: “4 Bytes”

Not the size in bytes.

Description

Setting in the Data Bus field on the Content page in the **Burner** dialog.

Saved

Only with Appearance set in the **File > Configuration > Save Configuration** dialog.

BurnerOutputType

Arguments

0: Com1

1: Com2

2: Com3

3: Com4

4: File

Description

Setting in the Output field on the Input/Output page in the **Burner** dialog.

Saved

Only with Appearance set in the **File > Configuration > Save Configuration** dialog.

BurnerDataBits

Arguments

0: 7 Bits

1: 8 Bits

Description

Setting in the Data Bits field on the Input/Output page in the **Burner** dialog.

Saved

Only with Appearance set in the **File > Configuration > Save Configuration** dialog.

BurnerParity

Arguments

0: None

1: Odd

2: Even

Description

Setting in the Parity field on the Input/Output page in the **Burner** dialog.

Saved

Only with Appearance set in the **File > Configuration > Save Configuration** dialog.

BurnerByteCommands

Arguments

0: 1st Byte (msb)

1: 2nd Byte

2: 3rd Byte

3: 4th Byte

4: 1st Word

5: 2nd Word

Description

Setting in the command box on the Input/Output page in the **Burner** dialog.

Saved

Only with Appearance set in the **File > Configuration > Save Configuration** dialog.

BurnerBaudRate

Arguments

300, 600, 1200, 2400, 4800, 9600, 19200, 38400

Description

Setting in the Baud Rate box on the Input/Output page in the **Burner** dialog.

Saved

Only with Appearance set in the **File > Configuration > Save Configuration** dialog.

BurnerOutputFile

Arguments

File Name, e.g., `file.s19`

Description

Content of the Name box on the Input/Output page in the **Burner** dialog.

Saved

Only with Appearance set in the **File > Configuration > Save Configuration** dialog.

BurnerHeaderFile

Arguments

File Name, e.g., `headerfile`

Description

Content of the Header File box on the Input/Output page in the **Burner** dialog.

Saved

Only with Appearance set in the **File > Configuration > Save Configuration** dialog.

BurnerInputFile

Arguments

File Name, e.g., `file.abs`

Description

Content of the Input File box on the Input/Output page in the **Burner** dialog.

Saved

Only with Appearance set in the **File > Configuration > Save Configuration** dialog.

Configuration File Example

The following listing shows a typical layout of the configuration file (usually `project.ini`).

Listing A.2 Example Configuration File

```
[Editor]
Editor_Name=WinEdit
Editor_Exe=C:\WinEdit\WinEdit.exe %f /#:%l
Editor_Opts=%f

[Linker]
StatusbarEnabled=1
ToolbarEnabled=1
WindowPos=0,1,-1,-1,-1,-1,390,107,1103,643
WindowFont=-16,500,0,Courier
Options=-w1
EditorType=3
RecentCommandLine0=fibo.prm -w2
RecentCommandLine1=fibo.prm
CurrentCommandLine=calc.prm -w2
EditorDDEClientName=[open(%f)]
EditorDDETopicName=system
EditorDDEServiceName=msdev
```

```
EditorCommandLine=C:\WinEdit\WinEdit.exe %f /#:%l

[Burner]
StatusbarEnabled=1
ToolbarEnabled=1
WindowPos=0,1,-1,-1,-1,-1,390,107,1103,643
WindowFont=-16,500,0,Courier
TipFilePos=0
ShowTipOfDay=1
Options=-w1
EditorType=3
RecentCommandLine0=-ffibo.bbl -w1
CurrentCommandLine=-ffibo.bbl -w2
EditorDDEClientName=[open(%f)]
EditorDDETopicName=system
EditorDDEServiceName=msdev
EditorCommandLine=C:\WinEdit\WinEdit.exe %f /#:%l
BurnerUndefByte=255
BurnerSwapByte=0
BurnerOrigin=0
BurnerDestination=0
BurnerLength=65536
BurnerFormat=0
BurnerDataBus=0
BurnerOutputType=4
BurnerDataBits=1
BurnerParity=0
BurnerByteCommands=0
BurnerBaudRate=9600
BurnerOutputFile=outputfile.s19
BurnerHeaderFile=headerfile
BurnerInputFile=InputFile.abs

[Maker]
StatusbarEnabled=1
ToolbarEnabled=1
WindowPos=0,1,-1,-1,-1,-1,390,107,1103,643
WindowFont=-16,500,0,Courier
TipFilePos=0
ShowTipOfDay=1
EditorType=3
RecentCommandLine0=mkall.mak
RecentCommandLine1=cpplib.mak -D(LIBNAME=cpplib)
CurrentCommandLine=mkall.mak
EditorDDEClientName=[open(%f)]
EditorDDETopicName=system
EditorDDEServiceName=msdev
```

```
EditorCommandLine=C:\WinEdit\WinEdit.exe %f /#:%l
```

Paths

Most environment variables contain path lists telling where to look for files. A path list is a list of directory names, separated by semicolons, following the syntax below:

```
PathList = DirSpec {";" DirSpec}.
```

```
DirSpec = ["*"] DirectoryName.
```

Example:

```
GENPATH=C:\INSTALL\LIB;D:\PROJECT\TESTS;\usr\local\freescale
\lib;/home/me/my_project
```

If a directory name is preceded by an asterisk (*), the programs recursively search that whole directory tree for a file, not just the given directory itself. The directories are searched in the order they appear in the path list.

Example:

```
LIBPATH=*C:\INSTALL\LIB
```

NOTE Some DOS/UNIX environment variables (like `GENPATH`, `LIBPATH`, etc.) are used. For further details refer to Environment Variable Details.

We recommend working with WinEdit and setting the environment by means of a `DEFAULT.ENV` (`.hidefaults` for UNIX) file in your project directory. You can set this project directory in WinEdit's **Project Configure** menu command. This way, you can have different projects in different directories, each with its own environment.

NOTE When using WinEdit, do *not* set the system environment variable DEFAULTDIR: Default Current Directory. If you use this variable and it does not contain the project directory given in WinEdit's project configuration, files might not be put where you expect them.

Line Continuation

It is possible to specify an environment variable in an environment file (`default.env`/ `.hidefaults`) over different lines, using the line continuation character '\':

Example:

```
COMPOPTIONS=\
```

```
-W2 \
-Wpd
```

This is the same as:

```
COMPOPTIONS=-W2 -Wpd
```

Use caution when pairing this continuation character with paths. The following code:

```
GENPATH=.\
TEXTFILE=.\txt
```

Results in:

```
GENPATH=.TEXTFILE=.\txt
```

To avoid such problems, use a semicolon (;) at the end of a path if the path contains a '\' at the end:

```
GENPATH=.\;
TEXTFILE=.\txt
```

Environment Variable Details

The remainder of this section describes each of the environment variables available for the tools. The following table shows the types of information provided in the variable descriptions.

Table A.1 Environment Variable Description

Topic	Description
Tools	Lists tools which use this variable.
Synonym	Synonyms exist for some environment variables. Those synonyms may be used for older releases of the SmartLinker and will be removed in the future. A synonym has lower precedence than the environment variable.
Syntax	Specifies the syntax of the option in EBNF format.
Arguments	Describes and lists optional and required arguments for the variable.
Default	Shows the default setting for the variable, or none.
Description	Provides a detailed description of the option and how to use it.

Table A.1 Environment Variable Description (*continued*)

Topic	Description
Example	Gives a usage example, and illustrates the effects of the variable when possible. Shows an entry in the `default.env` for PC or in the `.hidefaults` for UNIX.
See also	Names related sections.

ABSPATH: Absolute Path

Tools

SmartLinker, Debugger

Synonym

None

Syntax

```
ABSPATH= {<path>}
```

Arguments

`<path>`: Paths separated by semicolons, without spaces.

Description

When you define this environment variable, the SmartLinker stores the absolute files it produces in the first directory specified there. If `ABSPATH` is not set, the SmartLinker stores the generated absolute files in the directory in which the parameter file was found.

Example

```
ABSPATH=\sources\bin;..\..\headers;\usr\local\bin
```

See also

None

COMP: Modula-2 Compiler

Tools

Maker

Synonym

None

Syntax

```
COMP = <compiler>.
```

Arguments

```
<compiler>: Used Modula-2 compiler.
```

Default

None.

Description

Use this environment variable to specify the Modula-2 compiler.

Example

```
COMP=C:\INSTALL\PROG\TPM.EXE
```

COPYRIGHT: Copyright Entry in Absolute File

Tools

Compiler, Assembler, SmartLinker, Libmaker

Synonym

None

Syntax

```
COPYRIGHT= <copyright>
```

Arguments

`<copyright>`: copyright entry.

Default

None

Description

Each absolute file contains an entry for a copyright string. Use the decoder to retrieve this information from the absolute files.

Example

```
COPYRIGHT=Copyright by PowerUser
```

See also

Environment variables USERNAME: User Name in Object File and INCLUDETIME: Creation Time in Object File.

DEFAULTDIR: Default Current Directory

Tools

Compiler, Assembler, SmartLinker, Decoder, Debugger, Libmaker, Maker, Burner

Synonym

None

Syntax

```
DEFAULTDIR= <directory>.
```

Arguments

`<directory>`: Directory to be the default current directory.

Default

None

Description

Use this environment variable to specify the default directory for all tools. When you use this environment variable, all the tools indicated above take the specified directory as their current directory instead of the one defined by the operating system or launching tool.

Example

```
DEFAULTDIR=C:\INSTALL\PROJECT
```

See also

Current Directory and Global Initialization File (MCUTOOLS.INI) (PC only).

NOTE This is a the system level (global) environment variable. It cannot be specified in a default environment file (`DEFAULT.ENV/.hidefaults`).

ENVIRONMENT: Environment File Specification

Tools

Compiler, SmartLinker, Decoder, Debugger, Libmaker, Maker, Burner

Synonym

`HIENVIRONMENT`

Syntax

`ENVIRONMENT= <file>`

Arguments

`<file>`: file name with path specification, without spaces

Default

None

Description

You must specify this variable at the system level. Normally the application looks in the current directory for the `default.env/.hidefaults` environment file. Using ENVIRONMENT (e.g. set in the `autoexec.bat` (DOS) or `.cshrc` (UNIX) file), a different file name may be specified.

Example

```
ENVIRONMENT=\Freescale\prog\global.env
```

See also

None

NOTE This is a system level (global) environment variable. It cannot be specified in a default environment file (`DEFAULT.ENV/.hidefaults`).

ERRORFILE: Error File Name Specification

Tools

Compiler, SmartLinker, Assembler, Burner, Libmaker, Maker (restricted)

Synonym

None

Syntax

```
ERRORFILE= <filename>
```

Arguments

`<filename>`: File name with possible format specifiers.

Description

The environment variable ERRORFILE specifies the name for the error file. Possible format specifiers are:

`%n`: Substitute with the file name, without the path.

`%p`: Substitute with the path of the source file.

`%f`: Substitute with full file name, i.e. with path and name (the same as `%p%n`).

Using an invalid error file name causes a notification box to appear.

NOTE Maker does not recognize error files of other tools containing `%` substitutions. Maker reads the string assigned to the environment variable `ERRORFILE` as filename string without substitutions, so tools that use `%` substitutions for their error output report their error to Maker as the unspecified error message `M5108 called application detected an error`.

NOTE Maker cannot report error-position information with the same precision as a compiler because most of the errors have a long history. Maker can only report the general position, not the position where the error occurred. Most of Maker's messages lack position information (pos = 0).

Example

`ERRORFILE=MyErrors.err` lists all errors into the file `MyErrors.err` in the project directory.

`ERRORFILE=\tmp\errors` lists all errors into the file called `errors` in the `\tmp` directory.

`ERRORFILE=%f.err` lists all errors into a file with the same name as the source file, but with extension `.err`, into the same directory as the source file. For example, linking a file called `\sources\test.prm` generates an error list file called `\sources\test.err`.

Specifying `ERRORFILE=\dir1\%n.err` and linking a source file called `test.prm` generates an error list file called `\dir1\test.err`.

Specifying `ERRORFILE=%p\errors.txt` and linking a source file called `\dir1\dir2\test.prm` generates an error list file called `\dir1\dir2\errors.txt`.

If the environment variable `ERRORFILE` is not set, the errors are written to the file `EDOUT` in the project directory, or to the default error file. The default error file name depends on the way the application is started:

- If a file name is provided on the application command line, the errors are written to the file `EDOUT` in the project directory.
- If no file name is provided on the application command line, the errors are written to the file `ERR.TXT` in the project directory.

Example

This example shows usage of this variable to support correct error feedback with the WinEdit Editor, which looks for an error file called EDOUT:

```
Installation directory: E:\INSTALL\PROG
Project sources: D:\MEPHISTO
Common Sources for projects: E:\CLIB

Entry in default.env (D:\MEPHISTO\DEFAULT.ENV):
ERRORFILE=E:\INSTALL\PROG\EDOUT

Entry in WINEDIT.INI (in Windows directory):
OUTPUT=E:\INSTALL\PROG\EDOUT
```

NOTE Be sure to set this variable if the WinEdit Editor is use, otherwise the editor cannot find the EDOUT file.

Maker-Specific Error Listing Information

If Maker detects any errors, it creates an error listing file ERR.TXT. Maker generates this file in the working directory.

If you start Maker from WinEdit (with %f on the command line) or Codewright (with %b%e on the command line), it does not produce this error file. Instead, Maker writes the error messages in a special format in a file called EDOUT using the default Microsoft format. Use WinEdit's Next Error or Codewright's Find Next Error command to see both the error positions and the error messages.

Interactive Mode (Main Window Opened)

If you set ERRORFILE: Error File Name Specification, Maker creates a message file with the name specified in this environment variable.

If you do not set ERRORFILE, Maker generates a default file named ERR.TXT in the current directory.

Batch Mode (Main Window Closed)

If you set ERRORFILE: Error File Name Specification, Maker creates a message file with the name specified in this environment variable.

If you do not set ERRORFILE, Maker generates a default file named EDOUT in the current directory.

FLAGS: Options for Modula-2 Compiler

Tools

Maker for Modula-2

Syntax

FLAGS = {<*optionlist*>}.

Arguments

<*optionlist*>: List of options.

Default

None

Description

Maker, fed with a Modula-2 main module, starts the compiler with the options specified with FLAGS. The environment variable COMP specifies the Modula-2 compiler.

GENPATH: Define Paths to Search for Input Files

Tools

Compiler, Assembler, SmartLinker, Decoder, Debugger, Libmaker, Burner, Maker

Synonym

HIPATH

Syntax

GENPATH= {<path>}

Arguments

<path>: Paths separated by semicolons, without spaces.

Description

The application looks for the prm first in the project directory, then in the directories listed in the environment variable GENPATH. The object and library files specified in the

linker `prm` file are searched in the project directory, then in the directories listed in the environment variable `OBJPATH` and finally in those specified in `GENPATH`.

Example

```
GENPATH=\obj;..\..\lib;
GENPATH=\sources\include;..\..\headers;\usr\local\lib
```

NOTE If a directory specification in this environment variables starts with an asterisk (*), the application searches the whole directory tree recursively, depth first, i.e., all subdirectories and *their* subdirectories and so on are searched, too. Within one level in the tree, search order of the subdirectories is indeterminate.

INCLUDETIME: Creation Time in Object File

Tools

Compiler, Assembler, SmartLinker, Libmaker

Synonym

None

Syntax

```
INCLUDETIME= ( ON | OFF )
```

Arguments

`ON` : Include time information into object file.

`OFF` : Do not include time information into object file.

Default

`ON`

Description

Normally each absolute file created contains a time stamp indicating the creation time and data as strings. When one of the tools creates a new file, the new file gets a new time stamp entry.

This behavior may be undesirable if a binary file compare must be performed. Even if the information in two absolute files is the same, the files do not match exactly because the

time stamps are different. To avoid such problems this variable may be set to OFF. In this case the time stamp strings in the absolute file for date and time are **none** in the object file.

Use the decoder to retrieve the time stamp from the object files.

Example

```
INCLUDETIME=OFF
```

LINK: Linker for Modula-2

Tools

Maker for Modula-2

Syntax

```
LINK = {<linker>}.
```

Arguments

<linker>: Linker for Modula-2.

Default

none

Description

Maker, fed with a Modula-2 main module, starts the linker specified in this environment variable.

LINKOPTIONS: Default SmartLinker Options

Tools

SmartLinker

Synonym

None

Syntax

```
LINKOPTIONS= {<option>}
```

Arguments

<option>: SmartLinker command line option.

Description

Setting this environment variable appends the option contents to the SmartLinker command line each time a file is linked. Use this option to specify certain required options, so that you do not have to specify them each time a file is linked.

Example

```
LINKOPTIONS=-W2
```

See also

Option Details

OBJPATH: Object File Path

Tools

Compiler, Assembler, SmartLinker, Decoder, Debugger

Synonym

None

Syntax

```
OBJPATH= {<path>}
```

Arguments

<path>: Paths separated by semicolons, without spaces.

Description

Defining this environment variable causes the linker to search for the object and library files specified in the linker prm file in the project directory, then in the directories listed in the environment variable OBJPATH, and finally in those specified in GENPATH.

Example

```
OBJPATH=\sources\bin;..\..\headers;\usr\local\bin
```

RESETVECTOR: Reset Vector Location

Tools

Compiler, Assembler, SmartLinker

Synonym

None

Syntax

```
RESETVECTOR= <Address>
```

Arguments

`<Address>`: Address of reset vector

Default

```
0xFFFE
```

Description

For the VECTOR directive, the linker must know where to place VECTOR 0.

Example

```
RESETVECTOR=0xFFFE
```

SRECORD: S Record File Format

Tools

Assembler, SmartLinker, Burner

Synonym

None

Syntax

```
SRECORD= <RecordType>
```

Arguments

`<Record Type>`: Force the type for the S Record which must be generated. This parameter may take the value `S1`, `S2` or `S3`.

Description

This environment variable is relevant only when absolute files, rather than object files, are directly generated by the macro assembler. When you define this environment variable, the Assembler generates a Freescale S-record file containing records of the specified type (`S1` records when `S1` is specified, `S2` records when `S2` is specified and `S3` records when `S3` is specified).

If you do not set this variable, the assembler generates S records based on the address size. If the address can be coded on two bytes, the assembler generates an `S1` record. If the address is coded on three bytes, the assembler generates an `S2` record. Otherwise the assembler generates an `S3` record.

Example

```
SRECORD=S2
```

NOTE If you set the `SRECORD` environment variable, it is your responsibility to specify the appropriate S-record type. Specifying S1 when your code is loaded at an address greater than `0xFFFF` results in an incorrect S file, in which all addresses are truncated to 2-byte values.

TEXTFAMILY: Text Font Family

Tools

Compiler, Assembler, Linker, Decoder, Libmaker, Maker

Synonym

`HITEXTFAMILY`

Syntax

```
TEXTFAMILY = <FontName>.
```

Arguments

`<FontName>`: Font family name to use.

Default

Terminal

Description

Defines the font family to use. The default font family is “Terminal.”

Example

```
TEXTFAMILY=Times
```

TEXTKIND: Text Font Character Set

Tools

Compiler, Assembler, Linker, Decoder, Libmaker, Maker

Synonym

```
HITEXTKIND
```

Syntax

```
TEXTKIND = ( OEM | ANSI ).
```

Arguments

`OEM`: Use OEM font character set.

`ANSI`: Use ANSI font character set.

Default

```
OEM
```

Description

Gives the character set, `OEM` or `ANSI`. `OEM` is the default value.

Example

```
TEXTKIND=ANSI
```

TEXTPATH: Text Path

Tools

Compiler, Assembler, SmartLinker, Decoder, Libmaker

Synonym

None

Syntax

```
TEXTPATH= {<path>}
```

Arguments

`<path>`: Paths separated by semicolons, without spaces.

Description

When you set this environment variable, the application stores the map file it produces in the first directory specified in the path. If `TEXTPATH` is not set, the application stores generated map file in the directory where the `prm` file was found.

Example

```
TEXTPATH=\sources..\..\headers;\usr\local\txt
```

TEXTSIZE: Text Font Size

Tools

Compiler, Assembler, Linker, Decoder, Libmaker, Decoder, Maker

Synonym

```
HITEXTSIZE
```

Syntax

```
TEXTSIZE = <number>
```

Arguments

`<number>`: Font size to use.

Default

14

Description

Defines the size of the font. The default size is 14 point.

Example

```
TEXTSIZE=12
```

TEXTSTYLE: Text Font Style

Tools

Compiler, Assembler, Linker, Decoder, Libmaker, Maker

Synonym

```
HITEXTSTYLE
```

Syntax

```
TEXTSTYLE = ( NORMAL  |  BOLD )
```

Arguments

`NORMAL`: Use normal font style (not bold or italic).

`BOLD`: Use bold font style.

Default

NORMAL

Description

Defines the font style to use, NORMAL or BOLD. The default value is NORMAL.

Example

```
TEXTSTYLE=BOLD
```

TMP: Temporary Directory

Tools

Compiler, Assembler, SmartLinker, Debugger, Libmaker, Burner

Synonym

None

Syntax

```
TMP= <directory>
```

Arguments

`<directory>`: Directory to be used for temporary files.

Description

This environment variable works in conjunction with the ANSI function `tmpnam()` when the tools must create a temporary file. The `tmpnam()` library function stores the temporary files in the directory specified by the `TMP` environment variable. If the variable is empty or does not exist, the tool stores the temporary files in the current directory. Check this variable if you get an error message `Cannot create temporary file`.

Example

```
TMP=C:\TEMP
```

See also

Current Directory

NOTE This is a system level (global) environment variable. It cannot be specified in a default environment file (`DEFAULT.ENV/.hidefaults`).

USERNAME: User Name in Object File

Tools

Compiler, Assembler, SmartLinker, Libmaker

Synonym

None

Syntax

```
USERNAME= <user>
```

Arguments

`<user>`: Name of user.

Description

Each absolute file contains an entry identifying the user who created the file. Use the decoder to retrieve this information from the absolute files.

Example

```
USERNAME=PowerUser
```

See also

COPYRIGHT: Copyright Entry in Absolute File and INCLUDETIME: Creation Time in Object File

B

Tool Options

Each tool offers a number of options that you can use to control operation. Options are composed of a dash (-) followed by one or more letters or numerals. Options not starting with a dash are interpreted as the name of a parameter file to be linked.

Command line options are not case-sensitive. For example, `-W1` is the same as `-w1`.

- SmartLinker Specific: Anything not starting with a dash is the name of a parameter file to be linked. Specify SmartLinker options on the command line or in the `LINKOPTIONS` variable (see LINKOPTIONS: Default SmartLinker Options). Typically, each linker option is specified only once per linking session.

  Setting the `LINKOPTIONS` environment variable appends the option contents to the SmartLinker command line each time a file is linked. Use this option to specify certain required options, so that you do not have to specify them each time a file is linked.

- Burner specific: The burner command line can contain the name of a file to be built with the -F: Execute Command File, or a list of commands.

  Options before the first command on the command line are recognized. Then, all remaining text is taken as arguments to the command, including options. For example:

  ```
  OPENFILE "fibo.out" format=freescale len=0x1000 SENDBYTE
  1 "fibo.abs.abs" CLOSE
  ```

  Command is executed.

  `-f=fibo.bbl` executes the `fibo.bbl` command file.

  `-f fibo.bbl` is an alternate form of the recommended `-f=fibo.bbl`. This form is allowed for compatibility only.

  `fibo.bbl -f` is not allowed, because the burner interprets `fibo.bbl` as a command with argument `-f`. This generates an error, since no such command exists.

- Options for the Freescale object file format may differ from the options for decoding ELF/DWARF binaries.
- You can specify maker options on the command line or interactively in the Advanced Option Settings dialog box.

NOTE Not all tools options have been defined for this release. All descriptions will be available in an upcoming release.

Option Details

The remainder of this section describes each of the options available for the tools. The following table lists the details available for each of the options.

Table B.1 Option Details

Topic	Description
Group	Specifies the groups influenced by the option.
Syntax	Specifies the option syntax.
Arguments	Describes and lists optional and required arguments for the option.
Default	(Where used): Shows the default setting for the option. (Where not used): No default setting for the option.
Description	Provides a detailed description of the option and how to use it.
Example	Gives an example of usage, and effects of the option where possible. Shows settings, source code and/or `prm` files where applicable.
See also	(Where used): Names related topics.

Table B.2 Option Groupings

Group	Tools	Description
HOST	All	Host-related options
INPUT	All	Specification of command-line handling, such as macro definitions and unknown-macro expansions.
MESSAGES	All	Message handling, such as specification of format, kind, and number of Maker printed messages
MODULA-2	M	Modula-2 make-specific options. (No effect for C users.)
NONE	SL	These options cannot be specified interactively.
OPTIMIZATIONS	SL	
OUTPUT	SL, LM, D, M	Specification of command execution and output print

Table B.2 Option Groupings (*continued*)

Group	Tools	Description
STARTUP	SL	These options cannot be specified interactively.
VARIOUS	SL, B, M	Does not appear in the dialog box

Special Modifiers

You can use special modifiers with some options, although some modifiers may not make sense for all options. The following table lists and describes these modifiers.

Table B.3 Supported Modifiers

Modifier	Description
%p	Path including file separator
%N	File name in strict 8.3 format
%n	File name without extension
%E	Extension in strict 8.3 format
%e	Extension
%f	Path + file name without extension
%”	A double quote (“) if the file name, path or extension contains a space
%’	A single quote (‘) if the file name, path or extension contains a space
%(ENV)	Replaces it with contents of an environment variable
%%	Generates a single ‘%’

Examples

For these examples we assume that our actual file name (base file name for the modifiers) is:

```
c:\Freescale\my demo\TheWholeThing.myExt
```

`%p` gives the path only with a file separator:

```
c:\Freescale\my demo\
```

`%N` results in the file name in 8.3 format, that is the name with only eight characters:

`TheWhole`

`%n` returns just the file name without extension:

`TheWholeThing`

`%E` gives the extension in 8.3 format, that is, the extension with only three characters:

`myE`

`%e` is used for the whole extension:

`myExt`

`%f` gives the path plus the file name:

`c:\Freescale\my demo\TheWholeThing`

Because the path contains a space, using `%"` or `%'` is recommended: Thus `%"%f%"` gives:

`c:\Freescale\my demo\TheWholeThing`

where `%'%f%'` gives:

`'c:\Freescale\my demo\TheWholeThing'`

When using `%(envVariable)` an environment variable may be used too. A file separator after `%(envVariable)` is ignored if the environment variable is empty or does not exist. For example, `$(TEXTPATH)\myfile.txt` is replaced with:

`c:\Freescale\txt\myfile.txt`

if `TEXTPATH` is set to:

`TEXTPATH=c:\Freescale\txt`

But is set to:

`myfile.txt`

if TEXTPATH does not exist or is empty.

`%%` may be used to print a percent sign. `%e%%` gives:

`myExt%`

-A: Print Full Listing (Decoder)

Group

OUTPUT

Syntax

`-A`

Arguments

None

File Format

Only Freescale. ELF Object files are not affected by this option.

Description

Prints a listing with the header information of the object file.

Example

```
Listing with command line fibo.o -A:

*** Header information ***
Program Version            2700
Format Version             2
File Id                    129
flags                      0
processor family           11
processor type             1
Unitname                   fibo.abs
Username                   PFR
Program time string        Feb 25 1998
Creation time string       Wed Feb 25 11:43:22 1998
CopyRight

*** Directory information for Absfile***
Is romlib?   0

Init start:end   32774:32774
Code beg:end     32768:32939
Data beg:end     384:4096
Total number of objects   7

At address: 8000 code size: 40
00008000 1410         ORCC  #16
.........
```

-A: Warning for Missing .DEF File (Maker)

Group

MODULA-2

Syntax

```
-A
```

Arguments

None

Description

Invokes a warning for a missing `.DEF` file and affects only the processing of Modula-2 makefiles.

Example

```
maker test.mod -M -A
```

-Add: Additional Object/Library File

Group

INPUT

Syntax

```
-Add <FileList>
```

Arguments

`<FileList>`: Names of an additional object files or libraries.

Description

Use this option to add additional files to a project without modifying the link parameter file.

If you intend to specify all binary files using the `-Add` command line option, then you must include an empty NAMES block (just NAMES END) in the link parameter file.

SmartLinker links object files added with this option before linking the object files specified in the NAMES block.

Example

To specify more than one file either use several `-Add` options:

```
linker.exe demo.prm -addFileA.o -addFileB.o
```

Or use braces to bind the list to the `-Add` option:

```
linker.exe demo.prm -add(FileA.o FileB.o)
```

Use braces together with double quotes to add a file in which the name contains spaces:

```
linker.exe demo.prm -add("File A.o" "File B.o")
```

```
linker.exe fibo.prm -addfibo1.o -addfibo2.o
```

This example links the additional object files `fibo1.o` and `fibo2.o` with the `fibo` application.

See also

NAMES: List Files Building the Application.

NOTE To turn off smart linking for the additional object file, use a + sign immediately behind the filename.

-Alloc: Allocation Over Segment Boundaries (ELF)

Group

OPTIMIZATION

Syntax

```
-Alloc ( First | Next | Change )
```

Arguments

`First` : Use first free location

`Next` : Always use next segment

`Change` : Check when segment changes only

Default

```
-AllocNext
```

Description

The linker supports allocating objects from one ELF section into different segments. This option controls where space for the next object is allocated as soon as the first segment is full.

When you use `-AllocNext`, the linker always takes the next segment as soon as the current segment is full. Gaps resulting from this process are not used later. With the `Next` argument, the allocation order corresponds to the definition order in the object files. Objects defined first in a source file are allocated before objects defined later.

When you use `-AllocFirst`, the linker checks space requirements for every object. If the object fits into a previously used, partially filled segment, the linker uses that space.

`-AllocFirst` does not maintain the definition order.

When you use `-AllocChange`, the linker checks space requirements only when the object does not fit into the current segment. If the object fits into a previously used, partially filled segment, the linker uses that space. `-AllocChange` does not maintain the definition order, but uses fewer different ranges than `-AllocFirst`.

NOTE This option has no effect in the Freescale format. In the Freescale format, the linker always uses the `-AllocNext` strategy. The linker does not maintain allocation order for small variables.

NOTE This option has no effect if sections are not split into segments. Then all strategies behave identically.

NOTE Some compilers perform code optimization in the assumption that the definition order is maintained in the memory. Such code is not split into multiple segments so no problems result from using this option.

Example

```
Objects:     AAAA BB CCC D EEE FFFFF
Segments:    "---" "-------" "------------"
AllocNext:   "---" "AAAABB-" "CCCDEEEFFFFF"
AllocChange:"CCC" "AAAABBD" "EEEFFFFF----"
AllocFirst: "BBD" "AAAACCC" "EEEFFFFF----"
```

In this example, objects A (size 4 bytes), B (size 2 bytes), and F (size 5 bytes) must be allocated into three segments of size 3, 7 and 12 bytes. Because object A does not fit into the first segment, `-AllocNext` does not use this space at all. The two other strategies fill this space later. Only `-AllocNext` maintains object order.

-ArgFile: Specify a file from which additional command line options will be read

Group

HOST

Syntax

```
-ArgFile<filename>
```

Arguments

`<filename>:` Specify filename that has options to be passed to command line.

Description

The options present in file are appended to existing command line options.

Example

```
option.txt
-M
Linker.exe -ArgFileoption.txt test.prm
```

This is equivalent to linker.exe -M test.prm and linker generates output file test.map

-AsROMLib: Link as ROM Library

Group

OUTPUT

Syntax

```
-AsROMLib
```

Arguments

<FileList>: Names of an additional object files or libraries.

Description

Set -AsROMLib to link the application as a ROM library. This option has the same effect as specifying AS ROM_LIB in the linker parameter file.

Example

```
linker.exe myROMlib.prm -AsROMLib
```

-B: Generate S-Record file (SmartLinker)

Group

OUTPUT

Syntax

-B

Arguments

None

Default

Disabled

Description

Setting this option tells the linker to generate an S-record file in addition to an absolute file. The name of the S-record file is the same as the name of the .abs file, except that the extension .SX is used. The default.env variable SRECORD may specify an alternative extension.

Example

```
LINKOPTIONS=-B
```

-C: Write Disassembly Listing with Source Code (Decoder)

Group

OUTPUT

Syntax

`-C`

Arguments

None

Default

None

File Format

Only Freescale. (ELF Object files are not affected by this option.)

Description

This option setting is default for the Freescale object files as input. When this option is specified, the Decoder decoding Freescale object files writes the source code within the disassembly listing.

Example

```
unsigned int Fibonacci(unsigned int n)
Fibonacci:
00000000 89       PSHX
00000001 8B       PSHH
00000002 A7F8     AIS    #-8
    6: unsigned int  fib1 = 0;
00000004 95       TSX
00000005 6F01     CLR    1,X
00000007 7F       CLR    ,X
    7: unsigned intfib2 = 1;
00000008 AE01     LDX    #0x01
0000000A 8C       CLRH
0000000B 9EFF03   STHX   3,SP
    8: unsigned intfibo = n;
0000000E 9EFE09   LDHX   9,SP
00000011 9EFF07   STHX   7,SP
    9: unsigned int i = 2;
```

-C: Ignore Case (Maker)

Group

INPUT

Syntax

-C

Arguments

None

Description

The make utility has default case sensitivity. Use this option to disable case sensitivity and treat lowercase characters the same as uppercase characters.

Example

```
maker test.mak -o
```

In the file `test.mak`:

```
OBJECTFILES = startup.o fibo.o
makeAll:  $(ObjectFiles)
```

This line with -c is equivalent to:

```
makeAll:  $(OBJECTFILES)
```

CAllocUnusedOverlap: Allocate Not Referenced Overlap Variables (Freescale)

Group

OPTIMIZATION

Syntax

```
-CAllocUnusedOverlap
```

Arguments

None

Description

When Smart Linking is switched off, defined but unreferenced overlapped variables are not allocated by default. Such variables do not belong to a specific function, therefore they cannot be allocated overlapped with other variables.

This option only changes the behavior of variables in the special `_OVERLAP` segment. This segment is used only to allocate parameters and local variables for processors which do not have a stack. Not allocating an unreferenced overlap variable is similar to not allocating a variable on the stack for other processors. If you use this stack analogy, then allocating such variables this way corresponds to allocating unreferenced stack variables in global memory.

This option allows allocation of all defined objects. Using this option is not recommended.

Example

```
LINKOPTIONS=-CAllocUnusedOverlap
```

-Ci: Link Case Insensitive

Group

INPUT

Syntax

```
-Ci
```

Arguments

None

Description

With this option, the linker ignores object name capitalization.

This option supports case-insensitive linking of assembly modules. Since all identifiers are linked case insensitive, this also affects C or C++ modules.

NOTE This option can cause severe problems when combined with the name mangling of C++. Do not use this option with C++.

This option only affects the comparison of names of linked objects. Section names or the parsing of the link parameter file are unaffected. They remain case sensitive.

Example

```
void Tim(void);
void main(void) {
   tim(); /* with -ci this call is resolved to Tim */
}
```

The linker matches the `tim` and `Tim` identifiers at link time. However, for the compiler these are still two separate objects and therefore the code above issues an “implicit parameter declaration” warning.

-CheckAcrossAddrSp… ELF/DWARF: Check if objects overlap in

the absolute file (even if different address spaces)

Group

OUTPUT

Syntax

```
-CheckAcrossAddrSp
```

Arguments

```
None
```

Description

This option when enabled throws error for objects allocated to multiple segments and all these segments span the same physical memory.

For example:

```
PRM of mc9s08qe128:
PPAGE_5                  =  READ_ONLY   0x058000 TO 0x05BFFF;
MY_PPAGE_5               = READ_ONLY 0x014000'F TO
     0x014FFF'F; /* This page is already in segment PPAGE_5 */
PLACEMENT
..
    C1 INTO PPAGE_5;
    C2 INTO MY_PPAGE_5;
END
```

Assume C1 and C2 sections have `cnst1` and `cnst2` constants defined in 'C' source. For this test case, when option enabled, linker throws error:

```
   Link Error   : L1924: Objects cnst1 and cnst2 overlap
```

-Cmd: Libmaker Commands

Group

OUTPUT

Syntax

```
"-Cmd" "" <commands> "").
```

Arguments

<commands>: libmaker commands, separated by semicolon.

Default

None.

Description

You can either run a libmaker command file (preceded by '@'), or use the -Cmd command on the command line to run libmaker commands. Alternatively, you can use the command without the '+' operator as well:

```
-Cmd"a.o b.o c.o = d.lib"
```

Instead of ".." to wrap around the command string, you can use as well:

```
-Cmd(a.o b.o c.o = d.lib)
-Cmd[a.o b.o c.o = d.lib]
-Cmd{a.o b.o c.o = d.lib}
-Cmd'a.o b.o c.o = d.lib'
```

If your file names have spaces or operator characters in the file name, you need to use double quotes for the file name:

```
-Cmd(a.o "my b.o" "c-c.o" = d.lib)
```

You still can use double quotes for the -Cmd option, but in such a case you need to double-double quote files names in double quotes:

```
-Cmd"a.o ""my b.o"" ""c-c.o"" = d.lib"
```

Example

```
-Cmd"a.o + b.o = c.lib"
```

See also

-Mar: Freescale Archive Commands (Libmaker)

-Cocc: Optimize Common Code (ELF)

Group

OPTIMIZATION

Syntax

```
-Cocc [ = [ D ] [ C ]]
```

Arguments

```
D : optimize Data (constants and strings).
C : optimize Code
```

Description

This option defines the default when optimizing constants and cod. The commands `DO_OVERLAP_CONSTS` and `DO_NOT_OVERLAP_CONSTS` take precedence over the option.

Example

```
printf("Hello World\n"); printf("\n");
```

`-Cocc` allocates the string `"\n"` inside of the string `"Hello World\n"`.

-ConstDist: ELF/DWARF: Enable automatic content placement

Group

OPTIMIZATION

Syntax

```
-ConstDist
```

Arguments

None

Description

With this option the linker constant optimizer is enabled. Instead of performing usual linking actions, the linker generates a data distribution file which contains optimized distribution for constant objects.

-ConstDistSeg: ELF/DWARF: Specify constant distribution segment name

Group

OPTIMIZATION

Syntax

```
-ConstDistSeg <segment name>
```

Arguments

`<segment name>`: Name of the constant distribution segment.

Default

```
CONST_ DISTRIBUTE
```

Description

When this option is enabled, it's possible to specify the name of the constant distribution segment.

Example

```
LINKOPTIONS=-ConstDistSegMyDistributionSegment
```

NOTE If the project has to distribute only constant objects then `-ConstDist,-ConstDistSeg, -DataDistInfo` and `-DataDistFile` options are to be used. `-DataDistInfo` and `-DataDistFile` options are used in common for optimization of data and constant objects.

-CRam: Allocate Non-specified Constant Segments in RAM (ELF)

Group

OPTIMIZATION

Syntax

`-CRam`

Arguments

None

Description

This option allocates constant data segments not explicitly allocated in a `READ_ONLY` segment in the default `READ_WRITE` segment.

This was the default for old versions of the linker, so this option provides a compatible behavior with old linker versions.

Example

When C source files are compiled with `-CC`, the constants are put into the `ROM_VAR` segment. If the `ROM_VAR` segment is not mentioned in the `prm` file, then without this option, these constants are allocated in `DEFAULT_ROM`. With this option they are allocated in `DEFAULT_RAM`.

-D: Display Dialog Box (Burner)

Group

VARIOUS

Syntax

`"-D".`

Arguments

None

Default

None

Description

This option displays the Burner dialog box. This interface, with its three tabs, allows you to launch the burner from a make file and await user input.

Figure B.1 Burner Dialog Window Input/Output Tab

Example

```
burner.exe -D
```

-D: Decode DWARF Sections (Decoder)

Group

OUTPUT

Syntax

```
-D
```

Arguments

None

Default

Disabled

File Format

Only ELF. Freescale object files are not affected by this option.

Description

When you specify this option, DWARF section information is also written to the listing file. Decoding from the DWARF section inserts this information in the listing file. See the following listings for more information.

Listing B.1 Source/code reference information

```
.debug_line
  0x4 Version 2
```

```
  0x6 PrologLen 122l
  0xa MinInstrLen 1c
  0xb DefIsStmt 0c
  0xc LineBase 0c
  0xd LineRange 4c
  0xe DW2L_OpcodeBase 9c
  0xf Opcodelengths : 0c 1c 1c 1c 1c 0c 0c 0c 1c

Includedir :
 0x19 File  1: Y:\DEMO\WAVE12C\fibo.c, 0, 0, 0
 0x33 File  2: y:\LIB\ELF12C\hidef.h, 0, 0, 0
 0x4c File  3: y:\LIB\ELF12C\default.sgm, 0, 0, 0
 0x69 File  4: y:\LIB\ELF12C\stddef.h, 0, 0, 0
 0x84 Set Addr  867(2151):   ADDR  FILE LINE COL STMT BASIC
 0x8b set column         :   867    1     1   14   0     0
 0x8d advance line       :   867    1     8   14   0     0
 0x8f negate stmt        :   867    1     8   14   1     0
 0x90 negate stmt        :   867    1     8 14   0     0
...
```

Listing B.2 Argument location for local variables information

```
.debug_loc
    0 Start 867, End 869  (2)DW_OP_breg15 0(0)
  0xc Start 869, End 86a  (2)DW_OP_breg15 8(8)
 0x18 Start 86a, End 895  (2)DW_OP_breg15 10(a)
 0x24 Start 895, End 896  (2)DW_OP_breg15 0(0)
 0x30 0, 0 : end of location-list
```

Listing B.3 Symbol Debug information

```
DWARF: .debug_info (1053) [0x734]
Compi.Unit Header: size 304, version 2, abbrev 0, addrsize 4
  0xb Abbrevation 128 ,compile_unit
  0xd name         string       fibo.c
 0x14 producer     string       FREESCALE
 0x1b comp_dir     string       Y:\DEMO\WAVE12C
 0x2b language     udata        DW_LANG_C89
 0x2c stmt_list    data4        0(0)
```

Listing B.4 Frame Debug Information

```
.debug_frame
    0 CIE Information  0x8 Version 1
  0x9 Augmentor Freescale CFA 1.0
```

```
 0x18 CodeAlign: 1, DataAlign: 1, ReturnAddr-Column: 18
 0x1b instruction      PC   FP(Reg) R[ 0] R[ 1] R[ 2] R[ 3] R[ 4] R[ 5]
R[ 6] R[ 7] R[ 8] R[ 9] R[10] R[11] R[12] R[13] R[14] R[15] R[16] R[17]
R[18] R[19] R[20] R[21] R[22] R[23] R[24] R[25] R[26] R[27] R[28] R[29]
R[30] R[31]
0x1bstart-values    84d: 0(15)
 0x1b Def CFA Register reg: 15,
 0x1d Def CFA Offset ofs: 0
 0x1f Offset: reg 18, Ofs: 0
 0x21 Undefined reg: 0
 0x23 Undefined reg: 1
```

NOTE Specify the `-E` option when the `-D` option is activated.

-D: Define a Macro (Maker)

Group

INPUT

Syntax

`-D <macroname> = <value>`

Arguments

The macro definition string "*<macroname> = <value>*".

Description

This option defines command-line macros. Command-line macros define macros and arguments for the make file. A macro defined this way has a higher priority than a macro defined in the makefile. Because you separate the arguments in the command line with spaces, you cannot place spaces in a command-line macro.

Examples

```
-dCOMP=chc08.exe
-dCOMP=chc08.exe -Li -Wi
-d[MAKE=Maker.exe -s -d(COMP=$(COMP))]
```

-DataDist: ELF/DWARF: Enable automatic data placement

Group

OPTIMIZATION

Syntax

```
-DataDist
```

Arguments

None

Description

With this option the linker data optimizer is enabled. Instead of performing usual linking actions, the linker generates a data distribution file which contains optimized distribution.

-DataDistFile: ELF/DWARF: Specify data distibution file name

Group

OPTIMIZATION

Syntax

```
-DataDistFile <file name>
```

Arguments

`<file name>:` Name of the data distribution file.

Default

```
data.inc
```

Description

When this option is enabled, it's possible to specify the name of the data distribution file. There, all distributed data and how the compiler has to reallocate them are listed.

Example

```
LINKOPTIONS=-DataDistFileMyFile
```

-DataDistInfo: ELF/DWARF: Generate data optimizer information file

Group

OPTIMIZATION

Syntax

```
-DataDistInfo <file name>
```

Arguments

`<file name>`: Name of the data information file.

Default

```
data.txt
```

Description

When this option is enabled, the data optimizer generates a data distribution information file giving information on object to segment mapping.

Example

```
LINKOPTIONS=-DataDistInfoMyFile
```

-DataDistSeg: ELF/DWARF: Specify data distribution segment name

Group

OPTIMIZATION

Syntax

```
-DataDistSeg <segment name>
```

Arguments

`<segment name>`: Name of the data distribution segment.

Default

DATA_DISTRIBUTE

Description

When this option is enabled, it's possible to specify the name of the data distribution segment.

Example

```
LINKOPTIONS=-DataDistSegMyDistributionSegment
```

-Dconf[={a}]" Configure which parts of DWARF information to decode

Group

OUTPUT

Syntax

```
-Dconf=<argument>
```

Arguments

```
[={a}]
```

Description

It decodes DWARF2 abbreviation tables in the output list file.

-DefaultEpage: ELF/DWARF: Define the default value of the PPAGE register

Group

OUTPUT

Syntax

```
-DefaultEpage<hexValue>
```

Arguments

`<hexValue>`: the reset value for the EPAGE register, in hex format (e.g. 0xFE)

Default

`0 for <hexValue>`

Description

This option defines the reset value for the EEPROM Page Index Register (EPAGE). The value is specific to the actual S12(X) derivative.

-DefaultPpage: ELF/DWARF: Define the default value of the PPAGE register

Group

OUTPUT

Syntax

`-DefaultPpage <hexValue>`

Arguments

`<hexValue>`: the reset value for the PPAGE register, in hex format (e.g. 0xFE)

Default

`0 for <hexValue>`

Description

This option defines the reset value for the Program Page Index Register (PPAGE). The value is specific to the actual S12(X) derivative.

-DefaultRpage: ELF/DWARF: Define the default value of the RPAGE register

Group

OUTPUT

Syntax

```
-DefaultRpage <hexValue>
```

Arguments

`<hexValue>`: the reset value for the RPAGE register, in hex format (e.g. 0xFD)

Default

`0 for <hexValue>`

Description

This option defines the reset value for the RAM Page Index Register (RPAGE). The value is specific to the actual S12(X) derivative.

-Disp: Display Mode (Maker)

Group

OUTPUT

Syntax

```
-Disp
```

Arguments

None

Description

Maker echoes executing commands without calling them. Use this mode to check the dependency graph without affecting any files.

Example

```
maker test.mak -disp
```

-Dist: Enable Distribution Optimization (ELF) (SmartLinker)

Group

OPTIMIZATIONS

Syntax

```
-Dist
```

Arguments

None

Description

This option enables the linker optimizer. Instead of a link, the linker generates a distribution file which contains an optimized distribution.

-DistFile: Specify Distribution File Name (ELF) (SmartLinker)

Group

OPTIMIZATIONS

Syntax

```
-DistFile <file name>
```

Arguments

```
<file name>: Name of the distribution file.
```

Default

```
distr.inc
```

Description

Enable this option to specify the name of the distribution file. The distribution file lists all distributed functions and specifies how the compiler reallocates them.

Example

```
LINKOPTIONS=-DistFileMyFile
```

-DistInfo: Generate Distribution Information File (ELF) (SmartLink-

er)

Group

OPTIMIZATIONS

Syntax

```
-DistInfo <file name>
```

Arguments

```
<file name>: Name of the information file.
```

Default

```
distr.txt
```

Description

Using this option, the optimizer generates a distribution information file containing a list of all sections and their functions. Available function information includes the old size, optimized size, and new calling convention.

Example

```
LINKOPTIONS=-DistInfoMyInfoFile
```

-DistOpti: Choose Optimizing Method (ELF) (SmartLinker)

Group

OPTIMIZATIONS

Syntax

```
-DistOpti ( FillBanks | CodeSize )
```

Arguments

```
FillBanks : Priority is to fill the banks.
CodeSize : Priority is to minimize the code size.
```

Default

```
-DistOptiFillBanks
```

Description

Enable this option to choose the optimizing method. With the `FillBanks` argument the linker minimizes the free space in every bank. `FillBanks` is most effective for functions using the `near` calling convention. Use the `CodeSize` argument to minimize code when free space within the banks is no concern.

Example

```
LINKOPTIONS=-DistOptiFillBanks
```

-DistSeg: Specify Distribution Segment Name (ELF) (SmartLinker)

OPTIMIZATIONS

Syntax

```
-DistSeg <segment name>
```

Arguments

```
<segment name>: Name of the distribution segment.
```

Default

```
DISTRIBUTE
```

Description

Use this option to specify the name of the distribution segment.

Example

```
LINKOPTIONS=-DistSegMyDistributionSegment
```

-E: Specify the Name of the Startup Function

Group

INPUT

Syntax

```
-E= <FunctionName>
```

Arguments

<FunctionName> : Name of the function considered to be the entry point in the application.

Description

This option specifies the name of the application entry point.

The symbol specified must be externally visible (not defined as static in an ANSI-C source file or XREFed in an assembly source file).

Example

```
LINKOPTIONS=-E=entry
```

This is the same as using the command:

```
INIT entry
```

in the prm file.

-E: Decode ELF sections (Decoder)

Group

OUTPUT

Syntax

```
-E
```

Arguments

None

File Format

Only ELF. Freescale Object files are not affected by this option.

Description

When you specify this option, ELF section information is also written to the listing file. Decoding from the ELF section inserts the following information in the listing file:

Listing B.5 ELF Header Information

```
File: Y:\DEMO\WAVE12C\fibo.abs
Ident: ELF with 32-bit objects, MSB encoding, Version 1
```

```
Type:  Executable file,   Machine:  Freescale HC08,   Vers:  1
Entry point: 83D
Elf flags: 0
ElfHSiz: 34
ProgHOff:      34,   ProgHSi:     20,   ProgHNu:      6
SectHOff:     E3A,   SectHSi:     28,   SectHNu:      19,
SectHSI:       18
```

Usually the ELF Program header Table is available only for absolute files.

Listing B.6 ELF Program header Table Information

```
PROGRAM HEADER TABLE - 6 Items
Starts at:       34, Size of an entry:     20, Ends at:       F4
  NO   TYPE    OFFSET   SIZE VIRTADDR  PHYADDR  MEMSIZE   FLAGS ALIGNMNT
  0 - PT_PHDR    34       C0
  1 - PT_LOAD    F4        0       0       800        4       6         0
  2 - PT_LOAD    F4       AE       0       810       AE       1         0
```

Listing B.7 ELF Section Header Table Information

```
SECTION HEADER TABLE - 19 Items
Starts at:      E3A, Size of an entry:     28, Ends at:     1132
String table is in section: 12
 NO NAME          TYPE     FLAGS OFFSET   SIZE   ADDR ALI RECS LINK INFO
 0-                NULL        0      0      0      0    0    0    0
 1-.common         NOBITS     WA     F4     4     800    0    0    0    0
 2-.init           PROGBITS   AX     F4     3D    810    0    0    0    0
 3-.startData      PROGBITS   AX    131     1A    84D    0    0    0    0
 4-.text           PROGBITS   AX    14B     55    867    0    0    0    0
 5-.copy           PROGBITS   AX    1A0      2    8BC    0    0    0    0
 6-.stack          NOBITS     WA    1A2    100    B00    0    0    0    0
 7-.vectSeg0_vect PROGBITS    AX    1A2      2   FFFE    0    0    0    0
```

Listing B.8 Symbol Table Information

```
SYMBOL TABLE: .symtab - 13 Items
Starts at:      1A4, Size of an entry:     10, Ends at:      274
String table is in section: 9
First global symbol is in entry no.: 8
 NO NAME                          VALUE  SIZE BIND   TYPE     SECT
  0-                                0     0 LOCAL  NOTYPE
  1-                                0     0 LOCAL  SECTION     1
  2-                                0     0 LOCAL  SECTION     2
  3-Init                          810    2D LOCAL  FUNC        2
```

```
  4-                                    0      0 LOCAL  SECTION      3
  5-                                    0      0 LOCAL  SECTION      4
```

Listing B.9 Relocation Section Information

```
RELOCATION TABLE RELA: .rela.init - 1 Items
Starts at:      2AA, Size of an entry:      C, Ends at:      2B6
Symbol table is in section: 8
Binary code/data is in section: 2
   NO     OFFSET            SYMNDX TYP   ADDEND SYMNAME
   0 -     2163      873         3   3     4107 Init
```

Listing B.10 Hexadecimal dump from all sections defined in the binary file

```
HEXDUMP OF: .init FROM 244 TO 305 SIZE 61 (0X3D)
OFFSET  +0 +1 +2 +3 +4 +5 +6 +7 : +8 +9 +A +B +C +D +E +F  ASCII DATA
000000  FE 08 55 FD 08 53 27 10 : 35 ED 31 EC 31 69 70 83  ...U ...
S'.5.1.1ip.
000010 00 01 26 F9 31 03 26 F0 : FE 08 57 EC 31 27 0D ED .&.1.&...
W.1'..
000020 31 18 0A 30 70 83 00 01 : 26 F7 20 EF 3D FC 08 4D 1..0p. .&.
.=..M
000030  26 03 FF 08 51 07 C9 15 : FB 00 04 20 F0          &...Q.... . .
```

-E: Unknown Macros as Empty Strings (Maker)

Group

INPUT

Syntax

`-E`

Arguments

None

Description

This macro discards errors for unknown macros referenced in the makefile. Maker substitutes an unknown macro with an empty string.

Example

```
maker -m test.mod -e
```

-Ed: Dump ELF Sections in LST File (Decoder)

Group

OUTPUT

Syntax

`-Ed`

Arguments

None

Default

None

File Format

Only ELF. Freescale object files are not affected by this option.

Description

This option generates a HEX dump of all ELF sections.

NOTE The related option `-E` shows the information contained in ELF sections in a more readable form.

-Env: Set Environment Variable

Group

HOST

Syntax

```
-Env <Environment Variable> = <Variable Setting>
```

Arguments

`<Environment Variable>` : Environment variable to be set.

`<Variable Setting>` : Setting of the environment variable.

Description

This option sets an environment variable. The environment variable may be used in the maker or to overwrite system environment variables.

Example

```
-EnvOBJPATH=\sources\obj
```

This is the same as:

```
OBJPATH=\sources\obj
```

in `default.env`

To use an environment variable with file names that contain spaces, use the following syntax:

```
-Env"OBJPATH=program files"
```

-F: Execute Command File

Group

INPUT

Syntax

`"-F=" <fileName>.`

Arguments

<fileName>: Batch Burner command file to be executed.

Default

None

Description

This option causes the Burner to execute a Batch Burner command file (usual extension is `.bbl`).

Example

```
-F=fibo.bbl
```

-F: Object File Format

Group

INPUT

Syntax

```
-F ( A | E | I | H | S )
```

Arguments

None

Default

```
-FA
```

Description

The decoder is able to decode different object file formats. This option defines which object file format should be decoded:

`-FA` : the decoder determines the object file format automatically.

`-FE` : this can be overridden and only ELF files are correctly decoded.

`-FH` : only Freescale files are decoded.

`-FS` : only S-Record files can be decoded.

`-FI` : Intel Hex files can be decoded.

NOTE This option defines the Object File Format, which also defines the format of absolute files and libraries. It does not only affect object files. Many other options only effect a specific object file format. See the corresponding option for details.

NOTE To decode an S-Record or Intel Hex file, use the option -Proc: Set Processor (Decoder) to specify the processor.

-FA, -FE, -FH -F6: Object File Format (SmartLinker)

Group

INPUT

Syntax

```
-F ( A | E | H | 6 )
```

Arguments

none

Default

```
-FA
```

Description

Using this option the linker is able to link different object file formats. This option defines which object file format the linker uses:

- Using -FA, the linker determines the object file format automatically.
- Using -FE, the linker recognizes only ELF files correctly.
- Using -FH, the linker recognizes only Freescale files correctly.
- Using -F6, the linker produces a V2.6 Freescale absolute file.

NOTE It is not possible to build an application consisting of both Freescale and ELF files. Either all files must be in ELF format or all files must be in Freescale format.

The format of the generated absolute file is the same as the format of the object files. ELF object files generate ELF absolute files and Freescale object files generate Freescale absolute files.

-H: Prints the List of All Avaialble Options (Short Help)

Group

OUTPUT, VARIOUS

Syntax

```
-H
```

Arguments

None

Description

This option prints the list of all options, sorted by Group. Options in the same group are sorted alphabetically. No other option or source file should be specified with the `-H` option.

Example

Linker option output of -H:

```
-F      Object File Format
-Fh     Freescale
-FEo    Compatible ELF (DWARF 1.1/DWARF 2.0)
-Fa    Automatic Detection
-F6    Freescale V2.6
```

Burner option output of -H:

```
...
VARIOUS:
-H    Prints this list of options
-V    Prints the Compiler version
...
```

Libmaker option output of -H:

```
HOST:
-Env    Set environment variable
-View   Application Standard Occurrence
           -ViewWindow Window
           -ViewMin Min
           -ViewMax Max
           -ViewHidden Hidden
```

-I: Ignore Exit Codes (Maker)

Group

OUTPUT

Syntax

```
-I
```

Arguments

None

Description

This option lets Maker ignore exit codes of the called programs. Maker continues processing even if the called application reports a fatal error or creation of the corresponding process fails. Use this option for testing purposes, where Maker resolves only the dependencies of a make file.

Example

```
maker -m test.mod -i
```

-L: Add a Path to Search Path

Group

INPUT

Syntax

```
-L <Directory>
```

Arguments

`<Directory>` : Name of an additional search directory for object files.

Description

With this option, the ELF part of this linker searches object files first in all paths given with this option before considering the usual environment variables.

Example

```
LINKOPTIONS=-Lc:\freescale\obj
```

See also

OBJPATH: Object File Path

-L: Produce Inline Assembly File (Decoder)

Group

OUTPUT

Syntax

```
-L
```

Arguments

None

File Format

Only Freescale. ELF Object files are not affected by this option.

Description

The output listing is an inline assembly file without additional information, but in C comments.

Example

Part of Listing with command line `fibo.o -L` (code depends on target):

```
unsigned int Fibonacci(unsigned int n)
{
  unsigned fib1, fib2, fibo;
  int i;
  asm{
                  PSHX
                  PSHH
                  AIS #-8
                  TSX
                  CLR 1,X
                  CLR ,X
                  LDX #0x01
                  CLRH
                  STHX   3,SP
                  LDHX   9,SP
                  STHX   7,SP
....
                  RTS
                }

}
```

-L: List Modules (Maker)

Group

MODULA-2

Syntax

`-L <listfile>`

Arguments

File name of the generated listing file

Description

This option lists compiled files in build order in the file specified in the argument *<listfile>*. This option affects only the processing of Modula-2 makefiles.

Example

```
maker -m test.mod -ltest.lst
```

-LibFile: Specify Library File Name

Specifies the name of the file that contains linker-generated library information.

Syntax

```
-LibFile<filename>
```

Arguments

<filename>: Name of the file that has the information about libraries and startup(optional) to be used in second link step.

Description

When this option is enabled,linker generates file<filename> which has information about the current libraries and also about the files with which they should be replaced with.

-LibOptions: Specify Library Option File Generation

Enables library information generation.

Syntax

```
-LibOptions
```

Arguments

None

Description

When this option is enabled,linker generates file(default libFile.txt) which has information about the current library and the startup file and also about the files with which they should be replaced with.

-Lic: License Information

Group

Various

Syntax

```
-Lic
```

Arguments

None

Description

This options shows the current state of the license information. When no full license is available, the tool runs in demo mode. This information is also displayed in the About box.

Example

```
-Lic
```

-LicA: License Information about Every Feature in Directory

Group

Various

Syntax

```
-LicA
```

Arguments

None

Description

The `-LicA` option prints the license information of every tool or `dll` in the directory where the executable is located. Because the option analyzes every single file in the directory, this may take a long time.

Example

```
-LicA
```

-LicBorrow: Borrow License Feature

Group

HOST

Syntax

```
-LicBorrow <feature>[ ; <version>] : <Date>
```

Arguments

`<feature>`: the feature name to be borrowed (e.g. `HI100100`).

`<version>`: optional version of the feature to be borrowed (e.g. `3.000`).

`<date>`: date with optional time until when the feature shall be borrowed (e.g. `15-Mar-2007:18:35`).

Description

This option allows you to borrow a license feature until a given date/time. Borrowing allows you to use a floating license even if disconnected from the floating license server.

You need to specify the feature name and the date you will return the feature. If the feature you want to borrow is a feature belonging to the tool where you use this option, then you do not need to specify the feature version (because the tool knows the version). To borrow any feature not belonging to the tool, you need to specify the feature version. You can check the status of currently borrowed features in the tool **About** box.

You can borrow features only if you have a floating license and borrowing is enabled on your floating license. See the FLEXlm documentation for details on borrowing.

Example

```
-LicBorrowHI100100;3.000:12-Mar-2004:18:25
```

-LicWait: Wait for Floating License from Floating License Server

Group

HOST

Syntax

```
-LicWait
```

Arguments

None

Description

By default, if a license is not available from the floating license server, then the application returns immediately. When you set `-LicWait`, the application waits until a license is available from the floating license server. This is called blocking.

Example

```
-LicWait
```

-M: Generate Map File (SmartLinker)

Group

OUTPUT

Syntax

```
-M
```

Arguments

None

Description

This option forces map file generation after a successful linking session.

Example

```
LINKOPTIONS=-M
```

This is the same as using the command:

```
MAPFILE ALL
```

in the `prm` file.

See also

MAPFILE: Configure Map File Content

-M: Produce Make File (Maker)

Group

MODULA-2

Syntax

`-M [ <makefile> ]`

Arguments

File name of the generated makefile

Description

This option generates a makefile. If this option immediately follows a file name, Maker writes the makefile to that file; otherwise, the makefile has the same name as the main module, but with suffix `.MAK`. This makefile uses macros by referencing above environment variables.

Example

```
maker test.mod -m test.mak
```

-Mar: Freescale Archive Commands (Libmaker)

Group

OUTPUT

Syntax

```
"-Mar" """ <library> [<member>] """.
```

Arguments

<library>: name of the library.

<member>: list of members for the library to be added.

Default

None

Description

This command provides a more 'ar' (archive) like way to create a library out of object files. Instead of the following:

```
-Cmd"a.o b.o c.o = d.lib"
```

You can use:

```
-Mar"d.lib a.o b.o c.o"
```

Unlike the -Cmd command, this command performs no operator processing ('+'/'-'), which makes it easier to deal with file names containing operator characters.

Example

```
-Mar"c.lib a.o b.o"
```

See also

-Cmd: Libmaker Commands

-Map[RAM|Flash|Ex..]: Define mapping for memory space 0x4000-0x7FFF

Group

OUTPUT

Syntax

-Map(RAM|FLASH|Exernal)

Arguments

RAM: maps accesses to 0x4000-0x7FFF to 0x0F_C000-0x0F_FFFF in the global memory space (RAM area).

FLASH: maps accesses to 0x4000-0x7FFF to 0x7F_4000-0x7F_7FFF in the global memory space (FLASH).

External: maps accesses to 0x4000-0x7FFF to 0x14_4000-0x14_7FFF in the global memory space (external access).

Default

FLASH

Description

This option sets the memory mapping for addresses between 0x4000 and 0x7FFF for HCS12XE. This mapping is determined by the MMC control register (the ROMHM and RAMHM bits) and the linker must be aware of the current setting to correctly perform address translations.

-MkAll: Make Always (Maker)

Group

INPUT

Syntax

```
-MkAll
```

Arguments

None

Description

This option skips Maker time-checking. Maker rebuilds up-to-date files. Use this option for updating the application after a change not covered by makefile dependencies.

Example

```
maker test.mak -mkall
```

-N: Display Notify Box

Group

MESSAGE

Syntax

`-N`

Arguments

None

Description

This option makes the tool display an alert box if an error occurs during linking. This is useful when running a makefile since the linker waits for the user to acknowledge the message, thus suspending makefile processing. (The `N` stands for `Notify`.) This option is

Use this feature for halting and aborting a build using the Make Utility.

Example

SmartLinker: `LINKOPTIONS=-N`

Burner: `-Fnofile -N`

```
If an error occurs during linking, an error dialog box
opens.
```

NOTE This option is only present on the PC version of the tools. The UNIX version does not accept `-n` as an option string.

-NoBeep: No Beep in Case of an Error

Group

MESSAGE

Syntax

`-NoBeep`

Arguments

None

Description

Normally there is a ‘beep’ notification at the end of processing if an error occurs. To silence this error behavior, use this option to switch off the beep.

Example

None

-NoCapture: Do Not Redirect stdout of Called Processes (Maker)

Group

OUTPUT

Syntax

```
-NoCapture
```

Arguments

None

Description

Maker’s default behavior is to redirect from `stdout` the output text of called applications. Use this option to prevent redirection and text output for errors. This option affects only text output, since Maker does not detect the called application issuing the error.

This option accelerates the make process and older applications that do not support output. Using this option is equivalent to placing “*” at the start of every command line.

Example

```
maker test.mak -NoCapture
```

-NoEnv: Do Not Use Environment

Group

Startup. (This option cannot be specified interactively.)

Syntax

```
-NoEnv
```

Arguments

None

Description

This option can be specified only while starting the application at the command line. It cannot be specified in any other circumstance, including the `default.env` file, and the command line.

When this option is given, the application does not use any environment (`default.env`, `project.ini` or tips file).

Example

```
linker.exe -NoEnv
```

See also

Environment Variables

-NoPath: Strip Path Info (Libmaker)

Group

OUTPUT

Syntax

```
"-NoPath".
```

Arguments

None

Default

None

Description

Use this option to ignore path information in object files. This is useful if you want to move object files to another file location or hide your path structure.

Example

```
-NoPath
```

-NoSectCompat: Never Check Section Qualifier Compatibilty

Group

OUTPUT

Syntax

```
-NoSectCompat
```

Arguments

None

Description

For some target CPU's, when placing a section in a segment the linker checks if the qualifiers of the section are compatible with the ones of the segment (for instance when placing .text into RAM may result in a linker error).This option disables the check.

-NoSym: No Symbols in Disassembled Listing (Decoder)

Group

OUTPUT

Syntax

```
-NoSym
```

Arguments

None

Description

Prevents symbols from printing in the disassembled listing.

NOTE In previous versions of the Decoder, this option was called `-N`. It was renamed because of a conflict with the common option `-N`, which was not present in previous versions. The option `-NoSym` has no effect when decoding `.abs` files. As the `.abs` file does not contain any relocation information, it is not possible to display symbol names in the disassembly listing.

Example

Part of Listing with command line `fibo.o -NoSym`.

```
DISASSEMBLY OF: '.text' FROM 364 TO 448 SIZE 84 (0X54)
    4: unsigned int Fibonacci(unsigned int n)
Fibonacci:
00000000 89       PSHX
00000001 8B       PSHH
00000002 A7F8     AIS    #-8
    6: unsigned int  fib1 = 0;
00000004 95       TSX
00000005 6F01     CLR    1,X
00000007 7F       CLR    ,X
    7: unsigned intfib2 = 1;
00000008 AE01     LDX    #0x01
0000000A 8C       CLRH
0000000B 9EFF03   STHX   3,SP
    8: unsigned intfibo = n;
0000000E 9EFE09   LDHX   9,SP
00000011 9EFF07   STHX   7,SP
    9: unsigned int i = 2;
```

-Ns: Configure S-Records (Burner)

Group

OUTPUT

Syntax

```
"-Ns" ["=" {"p" | "0" | "7" | "8" | "9"}].
```

Arguments

"p": no path in S0 record

"0": no S0 record

"7": no S7 record

"8": no S8 record

"9": no S9 record

Default

None

Description

Usually an S-Record file contains a S0-Record at the beginning that contains the name of the file and an S7, S8 or S9 record at the end, depending on the address size. For the S3 format, an S7 record is written at the end. For S2 format, an S8 record is written at the end. For the S1 format, an S9 record is written at the end.

This feature is useful for disabling some S-Record generation in case a non-standard S-Record file reader cannot read S0, S7, S8 or S9 records.

In case the option is specified without suboptions (only `-Ns`), no start (S0) and no end records (S7, S8 or S9) are generated.

The option `-Ns=p` removes the path (if present) from the file name in the S0 record.

Example

```
-Ns=0
```

See also:

SRECORD: S-Record Type

-O: Define Absolute File Name (SmartLinker)

Group

OUTPUT

Syntax

```
-O <FileName>
```

Arguments

`<fileName>`: Name of the absolute file which must be generated by the linking session.

Description

Use this option to define the name of the generated `ABS` file. If you are using the Linker with the CodeWarrior Development Studio, this option is automatically added to the command line passed to the linker. You can see this if you enable *Display generated command lines in message window* in the Linker preference panel in the CodeWarrior IDE.

No extension is added automatically. Specifying the option `-otest` generates a file named `test`. To get the usual `.abs` file extension, use `-otest.abs`.

Example

```
LINKOPTIONS=-Otest.abs
```

This is the same as using the command:

```
LINK test.abs
```

in the `prm` file,

See also

LINK: Specify Name of Output File

-O: Specify the Name of the Output File (Decoder)

Group

OUTPUT

Syntax

```
-O <FileName>
```

Arguments

`<fileName>`: Name of listing file that must be generated by the decoding session.

Default

None

Description

This option defines the name of the output file to be generated.

Example

```
-O=TEST.LST
```

The decoder generates a file named `TEST.LST`.

-O: Compile Only (Maker)

Group

MODULA-2

Syntax

```
-O
```

Arguments

None.

Example

```
maker test.mod -o
```

Description

Use this macro to have Maker perform only compile steps for a Modula-2 build. Maker does not call the linker. This option affects only Modula-2 makefile processing.

-OCopy: Optimize Copy Down (ELF) (SmartLinker)

Group

OPTIMIZATION

Syntax

```
-OCopy ( On | Off )
```

Arguments

`On` : Do the optimization.

`Off`: Optimization disabled.

Default

```
-OCopyOn
```

Description

This optimization changes the copy-down structure to use as little space as possible.

The optimization assumes that the application performs both the zero out and the copy down step of the global initialization. If a value is set to zero by the zero out, then zero values are removed from the copy down information. The resulting initialization is not changed by this optimization if the default startup code is used.

This switch only has an effect in the ELF Format. The optimizations done in the Freescale format cannot be switched off.

Example

```
LINKOPTIONS=-OCopyOn
```

-Options: Enable Option File Generation

Enables compiler option generation. The generated options will be used for second step compilation.

Syntax

```
-Options
```

Arguments

None

Description

Linker generates a text file containing a compiler option for the second step (one of the following: `-ConstQualiNear`, `-NonConstQualiNear`, `-Mb`). The content of the file is appended to the compiler options for the second compilation step.

-OptionFile: Specify Data Optimizer Options File Name

Specifies the name of the file that contains the set of linker-generated compiler options.

Syntax

```
-OptionFile<filename>
```

Arguments

```
<filename> : Name of the option file.
```

Description

When this option is enabled, linker places the second step compiler options in the specified file`<filename>`.

-P2LibFile: Specify Library File Name

Specifies the name of the library information file.

Syntax

```
-P2libFile<filename>
```

Arguments

<filename> Name of the library information file.

Description

When this option is enabled in second link step,linker reads file<filename> which has information about the libraries.

-Proc: Set Processor (Decoder)

Group

INPUT

Syntax

```
-Proc= <ProcessorName>[ : <Derivative>].
```

Arguments

`<ProcessorName>`: Name of a supported processor.

`<DerivativeName>`: Name of supported derivative.

Default

None

Description

This option specifies which processor should be decoded. For object files, libraries and applications, the processor is usually detected automatically. For S-Record and Intel Hex files, however, the decoder cannot determine which CPU the code is for, and therefore the processor must be specified with this option to get a disassembly output. Without this option, only the structure of a S-Record file is decoded.

The following values are supported:

`HC08`, `HC08:HCS08`, `HC11`, `HC12`, `HC12:CPU12`, `HC12:HCS12`, `HC12:HCS12X`, `HC16`, `M68k`, `MCORE`, `PPC`, `RS08`, `8500`, `8300`, `8051` and `XA`

Example

```
decoder.exe fibo.s19 -proc=HC08
```

-Prod: Specify Project File at Startup (PC) (No d, no m)

Group

None. This option cannot be specified interactively.

Syntax

```
-Prod= <file>
```

Arguments

<file>: Name of a project or project directory.

Description

This option can only be specified while starting the linker at the command line. It cannot be specified in any other circumstances, including the `default.env` file, the command line, etc.

When you use this option, the linker opens the file as a configuration file. When <file> contains only a directory name, the linker appends the default name `project.ini`. When the loading fails, a message box appears.

Example

```
linker.exe -prod=project.ini
```

-ReadLibFile: Enable Option to Read libFile.txt i P2

Instructs the linker to read in the library information file that it generated in step one.

Syntax

```
-ReadLibFile
```

Arguments

None

Description

This option is passed in second link step. It tells the linker to read library information file(default libFile.txt).

-S: Do Not Generate DWARF Information (ELF) (SmartLinker)

Group

OUTPUT

Syntax

```
-S
```

Arguments

None

Description

This option disables the generation of DWARF sections in the absolute file to save memory space.

Example

```
LINKOPTIONS=-S
```

NOTE If the absolute file does not contain any DWARF information, you will not be able to debug it symbolically.

-S: ELF/DWARF: Strip symbolic information

Group

OUTPUT

Syntax

```
-S
```

Arguments

None

Description

This option disables the generation of DWARF sections in the absolute file to save memory space.

-S: Silent Mode (Maker)

Group

OUTPUT

Syntax

```
-S
```

Arguments

None

Example

```
maker test.mod -s
```

Description

Maker does not echo executed commands. Use this option to examine only Maker messages or those of the called tools, where an otherwise long list of executed commands is inconvenient.

-SFixups: Generate Fixups in abs File

Group

OUTPUT

Syntax

```
-SFixups
```

Arguments

None

Description

Usually, absolute files do not contain any fixups because all fixups are evaluated at link time. But with fixups, the decoder might symbolically decode the content in absolute files. Some debuggers do not load absolute files which contain fixups because they assume that these fixups are not yet evaluated. But the fixups inserted with this option are actually already handled by this linker.

This option is included to ensure compatibility with previous linker versions.

Example

```
LINKOPTIONS=-SFixups
```

-StackConsumption: ELF/DWARF: Enable Stack Consumption

Group

OUTPUT

Syntax

```
-StackConsumption
```

Arguments

```
None
```

Description

The linker computes maximum stack effect for given application when the option is enabled and places the result in the output .map file.

-StartUpInfo: Emit Startup Information to Library Info File

Group

OPTIMIZATION

Syntax

```
-StartUpInfo
```

Arguments

None

Description

The information about the current startup file and the replacement startup file will be added to the library file(default libFile.txt) and used during the second compile-link step.

-StatF: Specify Name of Statistic File (SmartLinker)

Group

OUTPUT

Syntax

```
-StatF= <fileName>
```

Arguments

`<fileName>`: Name for the file to be written.

Description

With this option set, the linker generates a statistic file. The statistic file reports each allocated object and its attributes. Every attribute is separated by a tab character, so it can be easily imported into a spreadsheet/database program for further processing.

Example

```
LINKOPTIONS=-StatF
```

-T: Show Cycle Count for Each Instruction (Decoder)

Group

OUTPUT

Syntax

```
-T
```

Arguments

None

Description

If you specify this option, each instruction line contains the count of cycles in '[','] braces. The cycle count is written before the mnemonics of the instruction. Note that the cycle count display is not supported for all architectures.

Example

Part of Listing (HC08, ELF) with command line `fibo.o -T:`

```
DISASSEMBLY OF: '.text' FROM 364 TO 448 SIZE 84 (0X54)
Opening source file 'D:/Profiles/B20482/workspace/125/
Sources\main.c'
    4: unsigned int Fibonacci(unsigned int n)
Fibonacci:
00000000 89       [2]    PSHX
00000001 8B       [2]    PSHH
00000002 A7F8     [2]    AIS    #-8
    6: unsigned int  fib1 = 0;
00000004 95       [2]    TSX
00000005 6F01     [5]    CLR    1,X
00000007 7F       [4]    CLR    ,X
    7: unsigned intfib2 = 1;
00000008 AE01     [2]    LDX    #0x01
0000000A 8C       [1]    CLRH
0000000B 9EFF03   [5]    STHX   3,SP
    8: unsigned intfibo = n;
0000000E 9EFE09   [5]    LDHX   9,SP
00000011 9EFF07   [5]    STHX   7,SP
    9: unsigned int i = 2;
00000014 AE02     [2]    LDX    #0x02
00000016 8C       [1]    CLRH
00000017 9EFF05   [5]    STHX   5,SP
   11: while (i <= n) {
0000001A 2024     [3]    BRA    *+38       ;abs = 0x0040
00000019 6C82         [2]    STD   2,SP
```

-V: Prints Version Information

Group

OUTPUT

Syntax

`-V`

Arguments

None

Description

Prints the version and the project directory.

Use this option to determine the SmartLinker project directory.

Example

`-V` produces the following list:

```
Directory: \software\sources\asm
SmartLinker, V5.0.4, Date Apr 20 1997
```

-View: Application Standard Occurrence (PC)

Group

HOST

Syntax

`-View <kind>`

Arguments

`<kind>` is one of:

`Window` : Application window maintains default window size.

`Min` : Minimizes application window.

`Max` : Maximizes application window.

`Hidden` : Hides application window (only if arguments are used).

Default

Application started with arguments: Minimized.

Application started without arguments: Window.

Description

If no arguments are given the application starts as normal window. If the application starts with arguments (e.g. from the maker to compile/link a file) then the application runs minimized to allow batch processing. Use this option to specify window behavior. Using `-ViewWindow` the application appears with its normal window. Using `-ViewMin` the application appears in the task bar. Using `-ViewMax` the application appears maximized (filling the whole screen). Using `-ViewHidden` the application processes arguments (e.g. files to be compiled/linked) invisibly in the back ground (no window/icon in the taskbar visible). However if you use the `-N` option (see -N: Display Notify Box), a dialog box is still possible.

Example

```
-ViewHidden fibo.prm
```

-W: Display Window (Burner)

Group

VARIOUS

Syntax

"`-W`".

Arguments

None

Default

None

Description

In the V2.7 Burner, this option was used to show the Batch Burner Window. This option is ignored with the V5.x versions or later.

NOTE This option is only provided for compatibility reasons, and is NOT present in the dialog box.

Example

```
burner.exe -W
```

-W1: No Information Messages

Group

MESSAGE

Syntax

```
-W1
```

Arguments

None

Description

Prevents the Linker from printing INFORMATION messages, only WARNING and ERROR messages are printed.

Example

```
LINKOPTIONS=-W1
```

-W2: No Information and Warning Messages

Group

MESSAGE

Syntax

```
-W2
```

Arguments

None

Description

Suppresses all messages of type INFORMATION and WARNING, only ERRORs are printed.

Example

```
LINKOPTIONS=-W2
```

-WErrFile: Create “err.log” Error File

Group

MESSAGE

Syntax

```
-WErrFile ( On | Off )
```

Arguments

None

Default

`err.log` is created/deleted

Description

The error feedback from the compiler to called tools is done with a return code. In 16-bit Windows environments, this was not possible, so when an error occurred the compiler created an `err.log`, which included error numbers, to signal an error. When no error occurred, the `err.log` file was deleted. Using UNIX or WIN32, a return code is available, so this option is not needed. To use a 16-bit maker with this tool, you must create the error file to signal any error.

Example

```
-WErrFileOn
```

Creates or deletes `err.log` when the application finishes.

```
-WErrFileOff
```

Existing `err.log` is not modified.

See also

-WStdout: Write to Standard Output

-WOutFile: Create Error Listing File

-Wmsg8x3: Cut File Names in Microsoft Format to 8.3 (PC)

Group

MESSAGE

Syntax

```
-Wmsg8x3
```

Arguments

None

Description

This option truncates the file name in the Microsoft message to the 8.3 format. Some editors (e.g. early versions of WinEdit) expect the file name in a strict 8.3 Microsoft message format. This means the file name can have at most eight characters with not more than a three characters extension.

Example

```
x:\mysourcefile.prm(3): INFORMATION C2901: Unrolling
loop
```

With the option `-Wmsg8x3` set, the above message becomes:

```
x:\mysource.c(3): INFORMATION C2901: Unrolling loop
```

-WmsgCE: RGB Color for Error Messages

Group

MESSAGE

Scope

Function

Syntax

```
-WmsgCE <RGB>
```

Arguments

<RGB>: 24bit RGB (red green blue) value

Default

```
-WmsgCE16711680 (rFF g00 b00, red)
```

Description

Use this option to change the error message color. The value specified must be an RGB (Red/Green/Blue) value, and may be specified in decimal. Use the 0X prefix when using hexadecimal. To produce gray errors use -WmsgCE0x808080.

Example

```
-WmsgCE255 changes the error messages to blue.
```

-WmsgCF: RGB Color for Fatal Messages

Group

MESSAGE

Scope

Function

Syntax

```
-WmsgCF <RGB>
```

Arguments

<RGB>: 24bit RGB (red green blue) value

Default

```
-WmsgCF8388608 (r80 g00 b00, dark red)
```

Description

Use this option to change the fatal message color. The value specified must be an RGB (Red/Green/Blue) value, and may be specified in decimal. Use the 0X prefix when using hexadecimal. To produce gray fatal messages use -WmsgCF0x808080.

Example

`-WmsgCF255` changes the fatal messages to blue.

-WmsgCI: RGB Color for Information Messages

Group

MESSAGE

Scope

Function

Syntax

```
-WmsgCI <RGB>
```

Arguments

```
<RGB>: 24bit RGB (red green blue) value.
```

Default

```
-WmsgCI32768 (r00 g80 b00, green)
```

Description

Use this option to change the information message color. The value specified must be an RGB (Red/Green/Blue) value, and may be specified in decimal. Use the 0X prefix when using hexadecimal. To produce gray information messages use `-WmsgCI0x808080`.

Example

`-WmsgCI255` changes the information messages to blue.

-WmsgCU: RGB Color for User Messages

Group

MESSAGE

Scope

Function

Syntax

```
-WmsgCU <RGB>
```

Arguments

<RGB>: 24bit RGB (red green blue) value.

Default

```
-WmsgCU0 (r00 g00 b00, black)
```

Description

Use this option to change the user message color. The value specified must be an RGB (Red/Green/Blue) value, and may be specified in decimal. Use the 0X prefix when using hexadecimal. To produce gray user messages use -WmsgCU0x808080.

Example:

-WmsgCU255 changes the user messages to blue.

-WmsgCW: RGB Color for Warning Messages

Group

MESSAGE

Scope

Function

Syntax

```
-WmsgCW <RGB>
```

Arguments

<RGB>: 24bit RGB (red green blue) value.

Default

```
-WmsgCW255 (r00 g00 bFF, blue)
```

Description

Sets user message color. User messages use -WmsgCU0x808080.

Use this option to change the warning message color. The value specified must be an RGB (Red/Green/Blue) value, and may be specified in decimal. Use the 0X prefix when using hexadecimal. To produce gray warning messages use `-WmsgCW0x808080`.

Example

`-WmsgCW0` changes the warning messages to black.

-WmsgFb (-WmsgFbi, -WmsgFbm): Set Message File Format for Batch Mode

Group

MESSAGE

Syntax

```
-WmsgFb [ v | m ]
```

Arguments

`v` : Verbose format.

`m` : Microsoft format.

Default

`-WmsgFbm`

Description

You can start the tool with additional arguments. If you start the tool with arguments (for example, from the Make Tool or with the `%f` argument from WinEdit), the tool links the files in a batch mode; that is, no tool window appears and the tool terminates after job completion.

If the linker is in batch mode the linker writes messages to a file instead of to the screen. This file contains only the linker messages (see examples below). By default, the tools use a Microsoft message format to write the tool messages (errors, warnings, information messages) if the linker is in batch mode. With this option, the default format may be changed from the Microsoft format (only line information) to a more verbose error format with line, column and source information.

Example

```
LINK fibo2.abs
NAMES fibo.o start12s.o ansis.lib END
PLACEMENT
 .text INTO READ_ONLY 0x810 TO 0xAFF;
   .data INTO READ_WRITE 0x800 TO 0x80F
END
```

By default, the SmartLinker generates the following error output in the SmartLinker window if it is running in batch mode:

```
X:\fibo2.prm(7): ERROR L1004: ; expected
```

Setting the format to verbose writes more information in the file:

```
LINKOPTIONS=-WmsgFbv
>> in "X:\fibo2.prm", line 7, col 0, pos 159
       .data INTO READ_WRITE 0x800 TO 0x80F
END
^
ERROR L1004: ; expected
```

-WmsgFi: Set Message Format for Interactive Mode

Group

MESSAGE

Syntax

```
-WmsgFi [ v | m ]
```

Arguments

`v` : Verbose format.

`m` : Microsoft format.

Default

```
-WmsgFiv
```

Description

If you start the SmartLinker without additional arguments, the SmartLinker is in the interactive mode (that is, a window is visible).

By default, the SmartLinker uses the verbose error file format to write the SmartLinker messages (errors, warnings, information messages).

With this option, you can change the default format from the verbose format (with source, line and column information) to the Microsoft format (only line information), or from Microsoft format to verbose format.

NOTE Using the Microsoft format may speed up the compilation, because the SmartLinker has to write less information to the screen.

Example

```
PLACEMENT
     .text INTO READ_ONLY 0x810 TO 0xAFF;
     .data INTO READ_WRITE 0x800 TO 0x80F
END
```

By default, the following error output appears in the window if the SmartLinker is running in interactive mode:

```
>> in "X:\fibo2.prm", line 7, col 0, pos 159
     .data INTO READ_WRITE 0x800 TO 0x80F
END
^
ERROR L1004: ; expected
```

Set the format to Microsoft to display less information:

```
LINKOPTIONS=-WmsgFim
X:\fibo2.prm(7): ERROR L1004: ; expected
```

See also

-WmsgFb (-WmsgFbi, -WmsgFbm): Set Message File Format for Batch Mode

-WmsgFob: Message Format for Batch Mode

Group

MESSAGE

Syntax

```
-WmsgFob <string>
```

Arguments

`<string>`: format string (see Table B.4).

Default

```
-WmsgFob"%"%f%e%"(%l): %K %d: %m\n"
```

Description

Use this option to modify the default message format in batch mode. This option supports formats shown in Table B.4 (assumes that the source file is `x:\freescale\sourcefile.prmx`).

Table B.4 WmsgFob-Supported Format String Symbols

Format	Description	Example
`%s`	Source Extract	
`%p`	Path	`x:\freescale\`
`%f`	Path and name	`x:\freescale\sourcefile`
`%n`	File name	`sourcefile`
`%e`	Extension	`.prmx`
`%N`	File (8 chars)	`sourcefi`
`%E`	Extension (3 chars)	`.prm`
`%l`	Line	`3`
`%c`	Column	`47`
`%o`	Pos	`1000`
`%K`	Uppercase kind	`ERROR`

Table B.4 WmsgFob-Supported Format String Symbols (*continued*)

Format	Description	Example
%k	Lowercase kind	error
%d	Number	L1051
%m	Message	text
%"	" if full name contains a space	"
%'	' if full name contains a space	
%%	Percent	%
\n	New line	

Example

```
LINKOPTIONS=-WmsgFob"%'%f%e%'(%l): %k %d: %m\n"
```

Produces a message in the following format:

```
x:\freescale\sourcefile.prmx(3): error L1000: LINK not
found
```

See also

Environment variable: ERRORFILE: Error File Name Specification

-WmsgFb (-WmsgFbi, -WmsgFbm): Set Message File Format for Batch Mode

-WmsgFi: Set Message Format for Interactive Mode

-WmsgFonp: Message Format for No Position Information

-WmsgFonf: Message Format for No File Information

-WmsgFoi: Message Format for Interactive Mode

-WmsgFoi: Message Format for Interactive Mode

Group

MESSAGE

Syntax

```
-WmsgFoi<string>
```

Arguments

<string>: format string (see Table B.5).

Default

```
-WmsgFoi"\n>> in \"%"%f%e%"\", line %l, col %c, pos
%o\n%s\n%K %d: %m\n"
```

Description

Use this option to modify the default message format in interactive mode. The following table shows the supported formats if the source file is x:\freescale\sourcefile.prmx.

Table B.5 WmsgFoi-Supported Format String Symbols

Format	Description	Example
%s	Source Extract	
%p	Path	x:\freescale\
%f	Path and name	x:\freescale\sourcefile
%n	File name	sourcefile
%e	Extension	.prmx
%N	File (8 chars)	sourcefi
%E	Extension (3 chars)	.prm
%l	Line	3
%c	Column	47
%o	Pos	1234
%K	Uppercase kind	ERROR
%k	Lowercase kind	error
%d	Number	L1000
%m	Message	text
%"	" if full name contains a space	"
%'	' if full name contains a space	

Table B.5 WmsgFoi-Supported Format String Symbols (*continued*)

Format	Description	Example
%%	Percent	%
\n	New line	

Example

```
LINKOPTIONS=-WmsgFoi"%f%e(%l): %k %d: %m\n"
```

Produces a message in the following format:

```
x:\freescale\sourcefile.prmx(3): error L1000: LINK not
found
```

See also

Environment variable: ERRORFILE: Error File Name Specification

-WmsgFb (-WmsgFbi, -WmsgFbm): Set Message File Format for Batch Mode

-WmsgFi: Set Message Format for Interactive Mode

-WmsgFonp: Message Format for No Position Information

-WmsgFonf: Message Format for No File Information

-WmsgFob: Message Format for Batch Mode

-WmsgFonf: Message Format for No File Information

Group

MESSAGE

Syntax

```
-WmsgFonf<string>
```

Arguments

<string>: format string (see Table B.6).

Default

```
-WmsgFonf"%K %d: %m\n"
```

Description

When no file information is available for a message (for example, if a message is not related to a specific file), then this message format string is used.

Example

```
LINKOPTIONS=-WmsgFonf"%k %d: %m\n"
```

Produces a message in following format:

```
information L10324: Linking successful
```

Table B.6 WmsgFonf-Supported String Format Symbols

Format	Description	Example
-		
%K	Uppercase kind	ERROR
%k	Lowercase kind	error
%d	Number	L10324
%m	Message	text
%%	Percent	%
\n	New line	

-WmsgFonp: Message Format for No Position Information

Group

MESSAGE

Syntax

```
-WmsgFonp <string>
```

Arguments

<string>: format string (see Table B.7).

Default

```
-WmsgFonp"%"%f%e%": %K %d: %m\n"
```

Description

When no position information available for a message (e.g. if a message is not related to a certain position), then this message format string is used. The following table shows the supported formats, assuming that the source file is `x:\freescale\sourcefile.prmx`.

Table B.7 WmsgFonp-Supported String Formats

Format	Description	Example
-		
%p	Path	x:\freescale\
%f	Path and name	x:\freescale\sourcefile
%n	File name	sourcefile
%e	Extension	.prmx
%N	File (8 chars)	sourcefi
%E	Extension (3 chars)	.prm
%K	Uppercase kind	ERROR
%k	Lowercase kind	error
%d	Number	L10324
%m	Message	text
%"	" if full name contains a space	"
%'	' if full name contains a space	
%%	Percent	%
\n	New line	

Example

```
LINKOPTIONS=-WmsgFonf"%k %d: %m\n"
```

This produces a message in the following format:

```
information L10324: Linking successful
```

See also

Environment variable: ERRORFILE: Error File Name Specification

-WmsgFb (-WmsgFbi, -WmsgFbm): Set Message File Format for Batch Mode
-WmsgFi: Set Message Format for Interactive Mode
-WmsgFonp: Message Format for No Position Information
-WmsgFoi: Message Format for Interactive Mode
-WmsgFob: Message Format for Batch Mode

-WmsgNe: Number of Error Messages

Group

MESSAGE

Syntax

```
-WmsgNe <number>
```

Arguments

```
<number>: Maximum number of error messages.
```

Default

50

Description

Use this option to set the maximum number of error messages, after which the SmartLinker stops the current linking session.

NOTE Subsequent error messages which depend on previous error messages may be confusing.

Example

```
LINKOPTIONS=-WmsgNe2
```

The SmartLinker stops compilation after two error messages.

See also

-WmsgNi: Number of Information Messages
-WmsgNw: Number of Warning Messages

-WmsgNi: Number of Information Messages

Group

MESSAGE

Syntax

```
-WmsgNi <number>
```

Arguments

`<number>`: Maximum number of information messages.

Default

50

Description

Use this option to specify the maximum number of information messages.

Example

```
LINKOPTIONS=-WmsgNi10
```

Logs only ten information messages.

See also

-WmsgNi: Number of Information Messages

-WmsgNw: Number of Warning Messages

-WmsgNe: Number of Error Messages

-WmsgNu: Disable User Messages

Group

MESSAGE

Syntax

```
-WmsgNu [ = { a | b | c | d }]
```

Arguments

`a` : Disable messages about all included files

`b` : Disable messages about reading files (e.g. the files used as input)

`c` : Disable messages about generated files

`d` : Disable messages about processing statistics (At the end of processing, the application may provide statistical information, such as code size, and RAM/ROM usage.)

`e` : Disable informal messages (e.g. memory model, floating point format)

Description

The application produces some messages which are not in the normal message categories (WARNING, INFORMATION, ERROR, FATAL). Use this option to disable such messages. Using this option reduces the number of messages and simplifies the error parsing of other tools.

Example

```
-WmsgNu=c
```

NOTE Depending on the application, not all suboptions may make sense. The system ignores these options.

-WmsgNw: Number of Warning Messages

Group

MESSAGE

Syntax

```
-WmsgNw <number
```

Arguments

`<number>`: Maximum number of warning messages.

Default

50

Description

Use this option the to specify the number of warning messages.

Example

```
LINKOPTIONS=-WmsgNw15
```

Logs only 15 warning messages.

See also

-WmsgNi: Number of Information Messages

-WmsgNw: Number of Warning Messages

-WmsgNe: Number of Error Messages

-WmsgSd: Setting a Message to Disable

Group

MESSAGE

Syntax

```
-WmsgSd <number>
```

Arguments

`<number>`: Message number to be disabled, for example, 1201

Default

None

Description

Use this option to disable a specific message, so it does not appear in the error output.

Example

```
LINKOPTIONS=-WmsgSd1201
```

Disables the message for no stack declaration.

See also

-WmsgSi: Setting a Message to Information

-WmsgSw: Setting a Message to Warning

-WmsgSe: Setting a Message to Error

-WmsgSe: Setting a Message to Error

Group

MESSAGE

Syntax

```
-WmsgSe <number>
```

Arguments

<number>: Message number to be an error, for example, 1201

Description

Allows the user to change a message to an error message.

Example

```
LINKOPTIONS=-WmsgSe1201
```

See also

-WmsgSi: Setting a Message to Information

-WmsgSw: Setting a Message to Warning

-WmsgSe: Setting a Message to Error

-WmsgSi: Setting a Message to Information

Group

MESSAGE

Syntax

```
-WmsgSi <number>
```

Arguments

<number>: Message number to be an information, e.g. 1201.

Description

Use this option to set a message to an information message.

Example

```
LINKOPTIONS=-WmsgSi1201
```

See also

-WmsgSd: Setting a Message to Disable

-WmsgSw: Setting a Message to Warning

-WmsgSe: Setting a Message to Error

-WmsgVrb: Verbose Mode (Maker)

Group

MESSAGE

Syntax

```
-WmsgVrb
```

Arguments

None

Default

None

Description

Maker prints the error messages to an error file, as explained in the section Message/Error Feedback

Example

```
maker.exe test.mak -WmsgVrb
```

-WmsgSw: Setting a Message to Warning

Group

MESSAGE

Syntax

```
-WmsgSw <number>
```

Arguments

`<number>`: Error number to be a warning, for example, 1201.

Description

Use this option to set a message as a warning message.

Example

```
LINKOPTIONS=-WmsgSw1201
```

See also

-WmsgSi: Setting a Message to Information

-WmsgSd: Setting a Message to Disable

-WmsgSe: Setting a Message to Error

-WOutFile: Create Error Listing File

Group

MESSAGE

Syntax

```
-WOutFile ( On | Off )
```

Arguments

None

Default

Creates an error listing file

Description

This option controls whether or not the SmartLinker creates an error listing file. The error listing file contains a list of all messages and errors created during a compilation. Since the text error feedback can be handled with pipes to the calling application, it is possible to obtain this feedback without an explicit file. Control the name of the listing file by using the ERRORFILE environment variable (see ERRORFILE: Error File Name Specification).

Example

```
-WOutFileOn
```

Creates the error file as specified with ERRORFILE.

```
-WOutFileOff
```

Creates no error file.

See also

-WErrFile: Create “err.log” Error File

-WStdout: Write to Standard Output

-WStdout: Write to Standard Output

Group

MESSAGE

Syntax

```
-WStdout ( On | Off )
```

Arguments

None

Default

Writes output to `stdout`.

Description

In Windows applications, the usual standard streams are available, but text written to them does not appear anywhere unless explicitly requested by the calling application. This option controls whether the SmartLinker writes text written to the error file into the `stdout` as well.

Example

```
-WStdoutOn
```

Writes all messages to `stdout`.

```
-WErrFileOff
```

Writes nothing to `stdout`.

See also

-WErrFile: Create “err.log” Error File

-WOutFile: Create Error Listing File

-X: Write Disassembled Listing Only (Decoder)

Syntax

```
-X
```

Arguments

None

Default

None

Description

Writes the pure disassembly listing without any source or comments within the listing.

-Y: Write Disassembled Listing with Source And All Comments (De-

coder)

Syntax

`-Y`

Arguments

None

Default

None

File Format

Only Freescale. ELF Object files are not affected by this option.

Description

Writes the origin source and its comments within the disassembly listing.

C

Messages

This chapter describes messages produced by the tools. Because of the number of messages produced, some may not have been documented at the time of this release. Messages are sorted according to the tool that produces them. Messages for the assembler and compiler are listed in their respective manuals.

NOTE Not all messages have been defined for this release. All descriptions will be available in an upcoming release.

Types of Generated Messages

The following table describes the five types of generated messages.

Table C.1 Types of Generated Messages

Message Type	Behavior
Information	A message prints and compilation continues.
Warning	A message prints and processing continues. These messages indicate possible programming errors.
Error	A message prints and processing stops. These messages indicate incorrect language usage.
Fatal	A message prints and processing aborts. These messages indicate a severe error, which causes processing to stop.
Disable	The message is disabled. No message is issued and processing continues. The application ignores the Disabled message.

Message Details

If the application prints a message, the message contains a one-character alphabetic message code and a four- or five-digit number. Use the code and number to search for the indicated message. Following message codes are supported:

- A for Assembler
- B for Burner
- C for Compiler
- L for Linker
- LM for Libmaker
- M for Maker

All messages generated by the application are documented in ascending order for quick retrieval.

Each message also has a description and if available a short example with a possible solution or tips to fix a problem.

For each message, the type of message is also noted, e.g. `[ERROR]` indicates that the message is an error message.

`[DISABLE, INFORMATION, WARNING, ERROR]`

This indicates that the message is a warning message by default, but the user might change the message to either DISABLE, INFORMATION or ERROR.

After the message type, there may be an additional entry indicating the related language:

- C++: Message is generated for C++
- M2: Message is generated for Modula-2

Message numbers less than 10000 are common to all tools. Not every compiler can issue all messages. For example, many compilers do not support any type of `struct` return. Those compilers will never issue the message `C2500: Expected: No support of class/struct return type`.

Linker Message List

The section describes all linker messages.

L1: Unknown "<message>" occurred

[FATAL]

Description

The application tried to emit a message which was not defined. This is a internal error which should not occur. Please report any occurrences to your support.

Tips

Try to find out the root cause which triggered the message. Check if there is some error setup which caused the not expected message.

L2: Message overflow, skipping <kind> messages

[INFORMATION]

Description

The application did show the number of messages of the specific kind as controlled with the options -WmsgNi, -WmsgNw and -WmsgNe. Further options of this kind are not displayed.

Tips

Use the options -WmsgNi, -WmsgNw and -WmsgNe to change the number of messages.

L50: Input file '<file>' not found

[FATAL]

Description

The Application was not able to find a file needed for processing.

Tips

Check to determine if the file really exists. Check if you are using a file name containing spaces (in this case you have to quote it).

L51: Cannot open statistic log file <file>

[WARNING]

Description

It was not possible to open a statistic output file, therefore no statistics are generated. Note: Not all tools support statistic log files. Even if a tool does not support it, the message still exists, but is never issued in this case.

L52: Error in command line <cmd>

[FATAL]

Description

In case there is an error while processing the command line, this message is issued.

L53: Message <Id> is not used by this version. The mapping of this message is ignored.

[WARNING]

Description

The given message id was not recognized as known message. Usually this message is issued with the options -WmsgS[D|I|W|E]<Num> which should map a specific message to a different message kind.

Example

```
-WmsgSD123456789
```

[WARNING]

Description

The given message id was not recognized as known message. Usually this message is issued with the options -WmsgS[D|I|W|E]<Num> which should map a specific message to a different message kind.

Example

```
-WmsgSD123456789
```

TIP There are various reasons why the tool would not recognize a certain message. Ensure that you are using the option with the right tool, say you do not disable linker messages in the compiler preferences. The message may have existed for an previous version of the tool but was removed for example because a limitation does no longer exist. The message was added in a more recent version and the used old version did not support it yet. The message did never exist. Maybe a typo?

L54: Option <Option>

[INFORMATION]

Description

This information is used to inform about special cases for options. One reason this message is used is for options which a previous version did support but this version does no longer support. The message itself contains a descriptive text how to handle this option now.

Tips

Check the manual for all the current option. Check the release notes about the background of this change.

L56: Option value overridden for option <OptionName

[INFORMATION]

Description

This message occurs when same option is specified more than once with same or different option values.

L64: Line Continuation occurred in <FileName>

[INFORMATION]

Description

In any environment file, the character '\' at the end of a line is taken as line continuation. This line and the next one are handles as one line only. Because the path separation character of MS-DOS is also '\', paths are often incorrectly written ending with '\'. Instead use a '.' after the last '\' to not finish a line with '\' unless you really want a line continuation.

Example

Current Default.env:

```
...
LIBPATH=c:\Codewarrior\lib\
OBJPATH=c:\Codewarrior\work
...
```

Is taken identical as

```
...
LIBPATH=c:\Codewarrior\libOBJPATH=c:\Codewarrior\work
...
```

Tips

To fix it, append a '.' behind the '\'

```
...
LIBPATH=c:\Codewarrior\lib\.
OBJPATH=c:\Codewarrior\work
...
```

Note Because this information occurs during the initialization phase of the application, the message prefix might not occur in the error message. So it might occur as "64: Line Continuation occurred in \<FileName>".

Note Because this information occurs during the initialization phase of the application, the message prefix might not occur in the error message. So it might occur as "64: Line Continuation occurred in \<FileName>".

L65: Environment macro expansion message '' for <variablename>

[INFORMATION]

Description

During a environment variable macro substitution an problem did occur. Possible causes are that the named macro did not exist or some length limitation was reached. Also recursive macros may cause this message.

Example

Current variables:

```
...
LIBPATH=${LIBPATH}
...
```

Tips

Check the definition of the environment variable.

L66: Search path <Name> does not exist

[INFORMATION]

Description

The tool did look for a file which was not found. During the failed search for the file, a non existing path was encountered.

Tips

Check the spelling of your paths. Update the paths when moving a project. Use relative paths.

L1000: <command name>=""> not found

[ERROR]

Description

The mandatory commands are:

- LINK, which contains the name of the absolute file to generate. If the option -O is specified on the command line this message is not generated when the command LINK is missing in the PRM file.

When the LINK command is missing the message will be:

```
'LINK not found'
```

L1001: <command name>=""> multiply defined

[ERROR]

Description

This message is generated when a linker command, which is expected only once, is detected several times in the PRM file. <command name>: name of the command, which is found twice in the PRM file. The commands, which cannot be specified several times in a PRM file, are:

- LINK, which contains the name of the absolute file to generate.

When the LINK command is detected several times the message will be:

```
'LINK multiply defined'
```

L1003: Only a single SEGMENTS or SECTIONS block is allowed

[ERROR]

Description

The PRM file contains both a SECTIONS and a SEGMENTS block. The SECTIONS block is a synonym for the SEGMENTS block. It is supported for compatibility with old style HIWARE PRM file.

Example

```
LINK  fibo.abs
NAMES fibo.o startup.o ansi.lib END
SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
END
SECTIONS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
PLACEMENT
  .text  INTO MY_ROM;
  .data  INTO MY_RAM;
  .stack INTO MY_STK;
END
\\ Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Remove either the SEGMENTS or the SECTIONS block.

L1004: <Token> expected

[ERROR]

Description

This message is generated, when the specified <Token> is missing at a position where it is expected. <Token>: character or expression expected.

Example

```
SEGMENTS
 MY_RAM  = READ_WRITE 0x800 TO 0x8FF
      ALIGN [2TO 4, 4]
            ^
ERROR: : expected.
```

Tips

Insert the specified separator at the expected position.

L1005: Fill pattern will be truncated (>0xFF)

[ERROR]

Description

This message is generated when the constant specified as fill pattern cannot be coded on a byte. The constant truncated to a byte value will be used as fill pattern.

Example

```
SEGMENTS
  MY_RAM = READ_WRITE 0x0800 TO 0x8FF FILL 0xA34;
END
```

Tips

To avoid this message, split the constant you specify into two byte constants.

Example

```
SEGMENTS
  MY_RAM = READ_WRITE 0x0800 TO 0x8FF FILL 0xA 0x34;
END
```

L1006: <Token> not allowed

[ERROR]

Description

This message is generated when a file name followed by a * is specified in a OBJECT_ALLOCATION or LAYOUT block. This is not possible, because a section is either a read only or a read write section. When all objects defined in a file are moved to a section, the destination section will contain both code and variable. This is logically not possible.

Example

```
OBJECT_ALLOCATION
  fibo.o:* INTO mySec;
     ^
ERROR: * not allowed
END
```

Tips

Move either all functions, or all variables, or all constants to the destination section.

Example

```
OBJECT_ALLOCATION
  fibo.o:CODE[*] INTO mySec;
END
```

L1007: <character> not allowed in file name (restriction)

[ERROR]

Description

A file name specified in the PRM file contains an illegal character. <character>: list of characters, which are not allowed in a file name at the pointed position. Following characters are not allowed in a file name:

- ':', which is used as separator to specify a local object (function or variable) in a PRM file.

Example

```
NAMES
  file:1.o;
    ^
ERROR: ':' or '>' not allowed in file name (restriction)
END
```

or

```
NAMES
  file1.o file>2.lib;
        ^
ERROR: ':' or '>' not allowed in file name (restriction)
END
```

Tips

Change the file name and avoid the illegal characters.

L1008: Only single object allowed at absolute address

[ERROR]

Description

Multiple objects are placed at an absolute address in an OBJECT_ALLOCATION block. Only single objects are allowed there.

Example

```
OBJECT_ALLOCATION
  var1 var2 AT 0x0800;
         ^
ERROR: Only single object allowed at absolute address
END
```

or

```
OBJECT_ALLOCATION
   file.o:DATA[*] AT 0x900;
            ^
ERROR: Only single object allowed at absolute address
END
```

Tips

Split the faulty command from the OBJECT_ALLOCATION command in several commands referring to single object.

Example

```
OBJECT_ALLOCATION
  var1 AT 0x0800;
  var2 AT 0x0802;
END
```

L1009: Segment Name <segment name>=""> unknown

[ERROR]

Description

The segment specified in a PLACEMENT or LAYOUT command line was not previously defined in the SEGMENTS block. <segment name>: name of the segment, which is not known.

Example

```
LINK  fibo.abs
NAMES fibo.o startup.o ansi.lib END
SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
END
PLACEMENT
  .text  INTO ROM_AREA;
            ^
ERROR: Segment Name ROM_AREA unknown
  .data  INTO MY_RAM;
  .stack INTO MY_STK;
END
\\ Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Define the requested segment names in the SEGMENTS block.

Example

```
LINK  fibo.abs
NAMES fibo.o startup.o ansi.lib END
SEGMENTS
  RAM_AREA = READ_WRITE 0x800 TO 0x80F;
  ROM_AREA = READ_ONLY 0x810 TO 0xAFF;
  STK_AREA = READ_WRITE 0xB00 TO 0xBFF;
END
PLACEMENT
  .text  INTO ROM_AREA;
  .data  INTO RAM_AREA;
  .stack INTO STK_AREA;
END
\\ Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

L1010: Section Name <section name>=""> unknown

[ERROR]

Description

The section name specified in a command from the OBJECT_ALLOCATION block was not previously specified in the PLACEMENT block.

- <section name>: name of the section, which is not known.

Example

```
LINK  fibo.abs
NAMES fibo.o startup.o ansi.lib END
SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
END
PLACEMENT
  .text  INTO MY_ROM;
  .data  INTO MY_RAM;
  .stack INTO MY_STK;
END
OBJECT_ALLOCATION
  fibo.o:DATA[*] IN dataSec;
                 ^
ERROR: Section Name dataSec unknown
END
\\ Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Specify the section in the PLACEMENT block.

Example

```
LINK  fibo.abs
NAMES fibo.o startup.o ansi.lib END
SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
END
PLACEMENT
  .text      INTO MY_ROM;
  .data, dataSec  INTO MY_RAM;
  .stack      INTO MY_STK;
END
OBJECT_ALLOCATION
  fibo.o:DATA[*] IN dataSec;
END
\\ Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

L1011: Incompatible segment qualifier: <qualifier1> in previous segment and <qualifier> in <segment name>=""

[ERROR]

Description

Two segments specified in the same command line from the PLACEMENT block are not defined with the same qualifier.

- <qualifier1>: segment qualifier associated with the previous segment in the list. This qualifier may be READ_ONLY, READ_WRITE, NO_INIT, PAGED.

Example

```
LINK  fibo.abs
NAMES fibo.o startup.o ansi.lib END
SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  SEC_RAM= READ_WRITE 0x020 TO 0x02F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
END
PLACEMENT
  .data   INTO MY_RAM;
  .text   INTO MY_ROM, SEC_RAM;
                ^
ERROR: Incompatible segment qualifier: READ_ONLY in
previous segment and READ_WRITE in SEC_RAM
  .stack  INTO MY_STK;
END
\\ Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Modify the qualifier associated with the specified segment.

Example

```
LINK  fibo.abs
NAMES fibo.o startup.o ansi.lib END
SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  SEC_ROM= READ_ONLY 0x020 TO 0x02F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
END
PLACEMENT
  .data   INTO MY_RAM;
  .text   INTO MY_ROM, SEC_ROM;
  .stack  INTO MY_STK;
END
\\ Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

L1012: Segment is not aligned on a <bytes> boundary

[WARNING]

Description

Some targets (M-CORE, M68k) require aligned access for some objects.

Example

For M-CORE: All 4 byte accesses must be aligned to 4. According to the EABI, 8 byte doubles must be aligned to 8. But if a 8 byte structure only contains chars, then alignment is not needed.

Tips

Check whether the section contains objects which must be aligned.

L1013: Section is not aligned on a <bytes> boundary

[WARNING]

Description

Some targets (M-CORE, M68k) require aligned access for some objects.

Example

For M-CORE: All 4 byte accesses must be aligned to 4. According to the EABI, 8 byte doubles must be aligned to 8. But if a 8 byte structure only contains chars, then alignment is not needed.

Tips

Check whether the section contains objects which must be aligned.

L1015: No binary input file specified

[ERROR]

Description

No file names specified in the NAMES block.

Example

```
LINK  fibo.abs
NAMES END
SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
END
PLACEMENT
  .text   INTO MY_ROM;
  .data   INTO MY_RAM;
  .stack  INTO MY_STK;
END
\\ Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Specify at least a file name in the NAMES block.

L1016: File <filename> found twice

[WARNING]

Description

A file name is detected several times. The file may be specified in the NAMES block in the link parameter file or it may have been added by the option -Add.

- <file name>: name of the file, which is detected twice. Note that CodeWarrior is using the option -Add to add object files which are in the project. Therefore these files should not be mentioned in the PRM file as well.

Example

```
LINK  fibo.abs
NAMES fibo.o startup.o fibo.o END
                ^
WARNING L1016: File fibo.o found twice
SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
END
PLACEMENT
  .text   INTO MY_ROM;
  .data   INTO MY_RAM;
  .stack  INTO MY_STK;
END
// Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Remove the second occurrence of the specified file.

L1017: Section <Object/Section> in module <ModuleName> is incompatible with previous usages of this section

[WARNING]

Description

In the ELF object file format, two object files do contain the same section with incompatible modes. Sections containing code are for example incompatible with sections containing not initialized variable.

Example

```
file1.c:
#pragma DATA_SEG MY_SEG
int i;
file2.asm
MY_SEG: SECTION
  NOP
file.prm
LINK file.abs
NAMES file1.o file2.o .. END
...              ^
```

Tips

Use different section names for different types of sections.

L1018: Checksum error

[ERROR]

Description

The checksum function has found a problem with the checksum configuration.

L1019: Checksum error: starting address 0x<Address> not aligned with checksum size <Address>

[ERROR]

Description

This message occurs if the address specified in INTO field of CHECKSUM entry in PRM is not aligned with the size.

For example:

```
CHECKSUM
CHECKSUM_ENTRY
METHOD_CRC_CCITT
OF READ_ONLY 0xE020 TO 0xEEFF
INTO READ_ONLY 0xE010 SIZE 3
END
END
```

L1020: Checksum error: size of checksum area 0x<Address> to 0x<Address> res aligned with the checksum size <Address>

[ERROR]

Description

This message occurs for OF field of CHECKSUM entry if the size of the memory area that is the difference between start and end address for which checksum is to be calculated is not in alignment with the size specified in the INTO field of CHECKSUM entry.

L1021: Checksum error: Memory Overlap of 0x<Address> - 0x<Address> and 0x<Address>

[ERROR]

Description

This message occurs if there is any overlap in memory areas specified in CHECKSUM entry.

L1022: Checksum error: Start Address 0x<Address> is greater than End Address 0x<Address>

[ERROR]

Description

This message occurs if the start address specified in OF field of CHECKSUM entry is greater than the end address specified.

L1023: Object <object> spans multiple pages

[INFORMATION]

Description

RS08-specific: the object start and end addresses are in different memory pages. If the object is part of a paged or near section the result of accessing the object may be wrong since PAGESEL is not updated when reaching the page boundary.

Tips

- Place the object in a far section or use far pointers to access it.

L1037: ***** Linking of <Linkparameterfile> failed ****

[ERROR]

Description

An error occurred in the linking process and the linking was interrupted and no output is written. The destination absolute file and the map file are killed by the Linker.

Tips

See the last error message for interpretation.

L1038: Success. Executable file written to <absfile>

[DISABLE]

Description

The application was successfully linked and the specified application was created. When the linking fails, L1037: ***** Linking of <Linkparameterfile> failed ****

is issued. If the linking succeeds this message is issued, but as it is disabled by default, it is only visible if it was enabled with a command line option.

See also

Command line option -WmsgSi.

L1052: User requested stop

[INFORMATION]

Description

The user has pressed the stop button in the toolbar. The linker stops execution as soon as possible.

L1100: Segments <segment1 name>=""> and <segment2 name>=""> overlap

[ERROR]

Description

Two segments overlap.

- <segment1 name>: name of the first overlapping segment.

The segments can be defined explicitly in the prm file or implicitly with absolutely allocated objects.

Example

```
Segments MY_RAM and MY_ROM overlap
LINK  fibo.abs
NAMES fibo.o startup.o END
SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x805 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
END
PLACEMENT
  .text   INTO MY_ROM;
  .data   INTO MY_RAM;
  .stack  INTO MY_STK;
END
// Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

Example

file test1.c:

```
int glob @ 0x1234;
```

Tips

Modify the segment definition to remove the overlap.

Example

```
LINK  fibo.abs
NAMES fibo.o startup.o END
SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
END
PLACEMENT
  .text   INTO MY_ROM;
  .data   INTO MY_RAM;
  .stack  INTO MY_STK;
END
// Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

Check why two variables have explicitly the same address. If they are to model the same port, for example, reuse the same variable. If they model different objects, use different addresses.

Example

```
int glob @ 0x1234;
```

L1102: Out of allocation space in segment <segment name>=""> at address <first address="" free>="">

[ERROR]

Description

The specified segment is not big enough to contain all objects from the sections placed in it.

- <segment name>: is the name of the segment, which is too small.

Example

In the following example, suppose the section .data contains a character variable and then a structure which size is 5 bytes.

```
Out of allocation space in segment MY_RAM at address
0x801
LINK  fibo.abs
NAMES fibo.o startup.o END
SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x803;
  MY_ROM = READ_ONLY 0x805 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
END
PLACEMENT
  .text   INTO MY_ROM;
  .data   INTO MY_RAM;
  .stack  INTO MY_STK;
END
// Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Set the end address of the specified segment to an higher value.

L1103: <section name>=""> not specified in the PLACEMENT block

[ERROR]

Description

Indicates that one of the mandatory sections is not specified in the PLACEMENT block. The sections, which must always be specified in the PLACEMENT block, are .text and .data.

Example

```
ERROR: .text not specified in the PLACEMENT block
LINK  fibo.abs
NAMES fibo.o startup.o END
SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
END
PLACEMENT
  .init, .rodata   INTO MY_ROM;
  .data   INTO MY_RAM;
  .stack  INTO MY_STK;
END
// Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Insert the missing section in the PLACEMENT block. Note: The sections DEFAULT_RAM is a synonym for .data and DEFAULT_ROM is a synonym for .text. These two sections name have been defined for compatibility with the old style HIWARE Linker.

L1104: Absolute object <Object name>=""> overlaps with segment <Segment name>="">

[ERROR]

Description

An absolutely allocated object overlaps with a segment, where some section is allocated. This is not allowed, because this may cause multiple objects to be allocated at the same address.

Example

```
ERROR: Absolute object globInt overlaps with segment
```

```
MY_RAM
LINK  fibo.abs
NAMES fibo.o startup.o END
SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
END
PLACEMENT
  .text, .rodata   INTO MY_ROM;
  .data   INTO MY_RAM;
  .stack  INTO MY_STK;
END
OBJECT_ALLOCATION
   fiboCount AT 0x802;
END
// Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Move the object to a free address.

Example

```
LINK  fibo.abs
NAMES fibo.o startup.o END
SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
END
PLACEMENT
  .text   INTO MY_ROM;
  .data   INTO MY_RAM;
  .stack  INTO MY_STK;
END
OBJECT_ALLOCATION
   fiboCount AT 0xC00;
END
// Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

Note: An absolute object can also be placed in a segment, in which no sections are assigned.

Example

```
LINK  fibo.abs
NAMES fibo.o startup.o END
SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
  ABS_MEM= READ_WRITE 0xC00 TO 0xC0F;
END
PLACEMENT
  .text   INTO MY_ROM;
  .data   INTO MY_RAM;
  .stack  INTO MY_STK;
END
OBJECT_ALLOCATION
   fiboCount AT 0xC00;
END
// Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

L1105: Absolute object <object name>=""> overlaps with another absolutely allocated object or with a vector

[ERROR]

Description

An absolutely allocated object overlaps with another absolute object or with a vector.

Example

```
ERROR: Absolute object globChar overlaps with another
```

```
absolutely allocated object or with a vector
LINK fibo.abs
NAMES fibo.o startup.o END
SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
END
PLACEMENT
  .text, .rodata   INTO MY_ROM;
  .data   INTO MY_RAM;
  .stack  INTO MY_STK;
END
OBJECT_ALLOCATION
   fiboCount AT 0xC02;
   counter  AT 0xC03;
END
// Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Move the object to a free position.

L1106: <Object name>=""> not found

[ERROR]

Description

An object referenced in the PRM file or in the application is not found anywhere in the application. This message is generated in following cases:

- An object moved to another section in the OBJECT_ALLOCATION block is not found anywhere in the application (WARNING).

Example

```
ERROR: globInt not found
LINK  fibo.abs
NAMES fibo.o startup.o END

SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
END
PLACEMENT
  .text, .rodata   INTO MY_ROM;
  .data   INTO MY_RAM;
  .stack  INTO MY_STK;
END

OBJECT_ALLOCATION
   globInt AT 0xC02;
END

// Set reset vector on _Startup
 VECTOR ADDRESS 0xFFFE _Startup
```

Tips

The missing object must be implemented in one of the module building the application. Make sure that your definition of the OBJPATH and GENPATH is correct and that the Linker uses the last version of the object files. You can also check if all the binary files building the application are enumerated in the NAMES block.

L1107: <Object name>=""> not found

[WARNING]

Description

An object referenced in the PRM file or in the application is not found anywhere in the application. This message is generated in following cases:

- An object moved to another section in the OBJECT_ALLOCATION block is not found anywhere in the application (WARNING).

Example

```
ERROR: globInt not found
LINK  fibo.abs
NAMES fibo.o startup.o END

SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
END
PLACEMENT
  .text, .rodata   INTO MY_ROM;
  .data   INTO MY_RAM;
  .stack  INTO MY_STK;
END

OBJECT_ALLOCATION
   globInt AT 0xC02;
END

// Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

Tips

The missing object must be implemented in one of the module building the application. Make sure that your definition of the OBJPATH and GENPATH is correct and that the Linker uses the last version of the object files. You can also check if all the binary files building the application are enumerated in the NAMES

block. A missing _startupData is only issued if there is a non assembly object file or library linked.

L1108: Initializing of Vector <Name> failed because of <Reason>

[ERROR]

Description

The linker cannot initialize the named vector because of some target restrictions. Some processors do not imply any restrictions, while others do only allow the VECTORs to point into a certain address range or have alignment constraints.

Tips

Try to allocate the interrupt function in a special segment and allocate this segment separately.

L1109: <Segment name>=""> appears twice in SEGMENTS block

[ERROR]

Description

A segment name is specified twice in a PRM file. This is not allowed. When this segment name is referenced in the PLACEMENT block, the Linker cannot detect which memory area is referenced.

Example

```
LINK  fibo.abs
NAMES fibo.o startup.o END

SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
  MY_RAM = READ_WRITE 0xC00 TO 0xCFF;
     ^
ERROR: MY_RAM appears twice in SEGMENTS block
END
PLACEMENT
  .text, .rodata   INTO MY_ROM;
  .data   INTO MY_RAM;
  .stack  INTO MY_STK;
END

// Set reset vector on _Startup
 VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Change one of the segment names, to generate unique segment names. If the same memory area is defined twice, you can remove one of the definitions.

L1110: <Segment name>=""> appears twice in PLACEMENT block

[ERROR]

Description

The specified segment appears twice in a PLACEMENT block, and in one of the PLACEMENT line, it is part of a segment list. A segment name may appear in several lines in the PLACEMENT block, if it is the only segment specified in the

segment list. In that case the section lists specified in both PLACEMENT line are merged in one single list of sections, which are allocated in the specified segment.

Example

```
LINK  fibo.abs
NAMES fibo.o startup.o END

SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
  ROM_2 = READ_ONLY 0x500 TO 0x7FF;
END
PLACEMENT
  .text, .rodata   INTO MY_ROM;
  .data        INTO MY_RAM;
  .stack        INTO MY_STK;
  codeSec1, codeSec2 INTO ROM_2, MY_ROM;
                     ^
ERROR: MY_ROM appears twice in PLACEMENT block
END

// Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Remove one of the instance of the segment in the PLACEMENT block.

L1111: <Section name>=""> appears twice in PLACEMENT block

[ERROR]

Description

The specified section appears multiple times in a PLACEMENT block.

Example

```
LINK  fibo.abs
NAMES fibo.o startup.o END

SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
  ROM_2 = READ_ONLY 0x500 TO 0x7FF;
END
PLACEMENT
  .text, .rodata   INTO MY_ROM;
  .data        INTO MY_RAM;
  .stack        INTO MY_STK;
  .text        INTO ROM_2;
    ^
ERROR: .text appears twice in PLACEMENT block
END

// Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Remove one of the occurrence of the specified section from the PLACEMENT block.

L1112: The <Section name>=""> section has segment type <Type> (illegal)

[ERROR]

Description

A section is placed in a segment, which has been defined with an incompatible qualifier. This message is generated in following cases:

- The section .stack is placed in a READ_ONLY segment.

Example

```
 ERROR: The .data section has segment type READ_ONLY
(illegal)
 LINK  fibo.abs
 NAMES fibo.o startup.o END

 SEGMENTS
   MY_RAM = READ_WRITE 0x800 TO 0x80F;
   MY_ROM = READ_ONLY 0x810 TO 0xAFF;
   MY_STK = READ_WRITE 0xB00 TO 0xBFF;
   ROM_2 = READ_ONLY 0x500 TO 0x7FF;
 END
 PLACEMENT
   .text, .rodata   INTO MY_ROM;
   .data            INTO ROM_2;
   .stack           INTO MY_STK;
 END

// Set reset vector on _Startup
 VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Place the specified section in a segment, which has been defined with an appropriated qualifier.

Example

```
LINK  fibo.abs
NAMES fibo.o startup.o END

SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
  ROM_2 = READ_ONLY 0x500 TO 0x7FF;
END
PLACEMENT
  .text   INTO MY_ROM;
  .data   INTO MY_RAM;
  .stack  INTO MY_STK;
END

// Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

L1113: The <Section name>=""> section has segment type <Segment qualifier>=""> (illegal)

[WARNING]

Description

A section is placed in a segment, which has been defined with an incompatible qualifier. This message is generated in following cases:

- The section .stack is placed in a READ_ONLY segment.

Example

```
ERROR: The .data section has segment type READ_ONLY
```

```
(illegal)
 LINK  fibo.abs
 NAMES fibo.o startup.o END

 SEGMENTS
   MY_RAM = READ_WRITE 0x800 TO 0x80F;
   MY_ROM = READ_ONLY 0x810 TO 0xAFF;
   MY_STK = READ_WRITE 0xB00 TO 0xBFF;
   ROM_2  = READ_ONLY 0x500 TO 0x7FF;
 END
 PLACEMENT
   .text, .rodata   INTO MY_ROM;
   .data            INTO ROM_2;
   .stack           INTO MY_STK;
 END

// Set reset vector on _Startup
 VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Place the specified section in a segment, which has been defined with an appropriated qualifier.

Example

```
LINK  fibo.abs
NAMES fibo.o startup.o END

SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
  ROM_2 = READ_ONLY 0x500 TO 0x7FF;
END
PLACEMENT
  .text   INTO MY_ROM;
  .data   INTO MY_RAM;
  .stack  INTO MY_STK;
END

// Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

L1114: The <Section name>=""> section has segment type <Segment qualifier>=""> (initialization problem)

[WARNING]

Description

The specified section is loaded in a segment, which has been defined with the qualifier NO_INIT or PAGED. This may generate a problem because the section contains some initialized constants, which will not be initialized at application startup. This message is generated in following cases:

- The section .rodata is placed in a NO_INIT or PAGED segment.

Example

```
ERROR: The .rodata section has segment type NO_INIT
```

```
(initialization problem)
 LINK  fibo.abs
 NAMES fibo.o startup.o END

 SEGMENTS
   MY_RAM = READ_WRITE 0x800 TO 0x80F;
   MY_ROM = READ_ONLY 0x810 TO 0xAFF;
   MY_STK = READ_WRITE 0xB00 TO 0xBFF;
   RAM_2 = NO_INIT  0x500 TO 0x7FF;
 END
 PLACEMENT
   .text  INTO MY_ROM;
   .data  INTO MY_RAM;
   .stack INTO MY_STK;
   .rodata INTO RAM_2;
 END

// Set reset vector on _Startup
 VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Place the specified section in a segment defined with either the READ_ONLY or the READ_WRITE qualifier.

Example

```
LINK  fibo.abs
NAMES fibo.o startup.o END

SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
  RAM_2 = NO_INIT  0x500 TO 0x7FF;
END
PLACEMENT
  .text   INTO MY_ROM;
  .data   INTO MY_RAM;
  .stack  INTO MY_STK;
  .rodata  INTO MY_ROM;
END

// Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

L1115: Function <Function name>=""> not found

[ERROR]

Description

The specified function is not found in the application. This message is generated in following cases:

- No main function available in the application. This function is not required for assembly application. For ANSI-C application, if no main function is available in the application, it is the programmer responsibility to ensure that application startup is performed correctly. Usually the main function is called main, but you can define your own main function using the linker command MAIN.

Tips

Provide the application with the requested function.

L1116: Function <Function name>=""> not found

[WARNING]

Description

The specified function is not found in the application. This message is generated for following cases:

- No main function available in the application. This function is not required for assembly application. For ANSI-C application, if no main function is available in the application, it is the programmer's responsibility to ensure that application startup is performed correctly. Usually the main function is called main, but you can define your own main function using the linker command MAIN.

Tips

Provide the application with the requested function.

L1117: <Object name>=""> allocated at absolute address <Address> overlaps with sections placed in segment <Segment name>="">

[ERROR]

Description

The specified absolutely allocated object is allocated inside of a segment, which is specified in the PLACEMENT block. This is not allowed, because the object may then overlap with object defined in the sections, which are placed in the specified segment. An absolutely allocated object may be allocated inside of a segment, which do not appear in the PLACEMENT block.

Example

```
ERROR: fiboCount allocated at absolute address 0x804
```

```
overlaps with sections placed in segment MY_RAM
 LINK  fibo.abs
 NAMES fibo.o startup.o END

 SEGMENTS
   MY_RAM = READ_WRITE 0x800 TO 0x80F;
   MY_ROM = READ_ONLY 0x810 TO 0xAFF;
   MY_STK = READ_WRITE 0xB00 TO 0xBFF;
   RAM_2 = NO_INIT  0x500 TO 0x7FF;
 END
 PLACEMENT
   .text  INTO MY_ROM;
   .data  INTO MY_RAM;
   .stack INTO MY_STK;
   .rodata INTO RAM_2;
 END

 OBJECT_ALLOCATION
   counter  AT 0x500;
   fiboCount AT 0x804;
 END
// Set reset vector on _Startup
 VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Move the absolutely allocated object to an unused address.

Example

```
LINK  fibo.abs
NAMES fibo.o startup.o END

SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
  RAM_2 = NO_INIT  0x500 TO 0x7FF;
END
PLACEMENT
  .text   INTO MY_ROM;
  .data   INTO MY_RAM;
  .stack  INTO MY_STK;
  .rodata  INTO MY_ROM;
END

OBJECT_ALLOCATION
  counter  AT 0x500;
  fiboCount AT 0x404;
END

// Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

L1118: Vector allocated at absolute address <Address> overlaps with another vector or an absolutely allocated object

[ERROR]

Description

A vector overlaps with an absolute object or with another vector.

```
\section example Example
 ERROR: Vector allocated at absolute address 0xFFFE
overlaps with another vector or an absolutely allocated
object
 LINK  fibo.abs
 NAMES fibo.o startup.o END

 SEGMENTS
   MY_RAM = READ_WRITE 0x800 TO 0x80F;
   MY_ROM = READ_ONLY 0x810 TO 0xAFF;
   MY_STK = READ_WRITE 0xB00 TO 0xBFF;
 END
 PLACEMENT
   .text, .rodata   INTO MY_ROM;
   .data   INTO MY_RAM;
   .stack  INTO MY_STK;
 END

 OBJECT_ALLOCATION
   counter  AT 0xFFFD;
 END

// Set reset vector on _Startup
 VECTOR ADDRESS 0xFFFE _Startup
\section tips Tips
Move the object or vector to a free position.
```

L1119: Vector allocated at absolute address <Address> overlaps

with sections placed in segment <Segment name>="">

[ERROR]

Description

The specified vector is allocated inside of a segment, which is specified in the PLACEMENT block. This is not allowed, because the vector may then overlap with object defined in the sections, which are placed in the specified segment. A vector may be allocated inside of a segment which does not appear in the PLACEMENT block.

Example

```
 ERROR: Vector allocated at absolute address 0xFFFE
overlaps with sections placed in segment ROM_2
 LINK  fibo.abs
 NAMES fibo.o startup.o END

 SEGMENTS
   MY_RAM = READ_WRITE 0x800 TO 0x80F;
   MY_ROM = READ_ONLY 0x810 TO 0xAFF;
   MY_STK = READ_WRITE 0xB00 TO 0xBFF;
   ROM_2 = READ_ONLY 0xFF00 TO 0xFFFF;
 END
 PLACEMENT
   .text  INTO MY_ROM;
   .data  INTO MY_RAM;
   .stack INTO MY_STK;
   .rodata INTO ROM_2;
 END

// Set reset vector on _Startup
 VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Define the specified segment outside of the vector table.

Example

```
LINK  fibo.abs
NAMES fibo.o startup.o END

SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
  ROM_2 = READ_ONLY 0xC00 TO 0xCFF;
END
PLACEMENT
  .text  INTO MY_ROM;
  .data  INTO MY_RAM;
  .stack INTO MY_STK;
  .rodata INTO ROM_2;
END

// Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

L1120: Vector allocated at absolute address <Address> placed in segment <Segment name>="">, which has not READ_ONLY qualifier

[ERROR]

Description

The specified vector is defined inside of a segment, which is not defined with the qualifier READ_ONLY. The vector table should be initialized at application loading time during the debugging phase. It should be burned into EPROM, when application development is terminated. For these reason, the vector table must always be located in a READ_ONLY memory area.

Example

```
 ERROR: Vector allocated at absolute address 0xFFFE
placed in segment RAM_2 which has not READ_ONLY qualifier
 LINK  fibo.abs
 NAMES fibo.o startup.o END

 SEGMENTS
   MY_RAM = READ_WRITE 0x800 TO 0x80F;
   MY_ROM = READ_ONLY 0x810 TO 0xAFF;
   MY_STK = READ_WRITE 0xB00 TO 0xBFF;
   RAM_2 = READ_WRITE 0xFF00 TO 0xFFFF;
 END
 PLACEMENT
   .text  INTO MY_ROM;
   .data  INTO MY_RAM;
   .stack INTO MY_STK;
 END

// Set reset vector on _Startup
 VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Define the specified segment with the qualifier READ_ONLY.

L1121: Out of allocation space at address <Address> for .copy section

[ERROR]

Description

There is not enough memory available to store all the information about the initialized variables in the .copy section.

Tips

Specify an higher end address for the segment, where the .copy section is allocated.

L1122: Section .copy must be the last section in the section list

[ERROR]

Description

The section .copy is specified in a section list from the PLACEMENT block, but it is not specified at the end of the list. As the size from this section cannot be evaluated before all initialization values are written, the .copy section must be the last section in a section list.

Example

```
 ERROR: Section .copy must be the last section in the
section list


 LINK  fibo.abs
 NAMES fibo.o startup.o END


 SEGMENTS
   MY_RAM = READ_WRITE 0x800 TO 0x80F;
   MY_ROM = READ_ONLY 0x810 TO 0xAFF;
   MY_STK = READ_WRITE 0xB00 TO 0xBFF;
 END
 PLACEMENT
   .copy, .text  INTO MY_ROM;
   .data     INTO MY_RAM;
   .stack     INTO MY_STK;
 END

// Set reset vector on _Startup
 VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Move the section .copy to the last position in the section list or define it on a separate PLACEMENT line in a separate segment. Please note that .copy is also a synonym for COPY (e.g. used in HIWARE object file format PRM files).

Example

```
LINK  fibo.abs
NAMES fibo.o startup.o END

SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
  ROM_2 = READ_ONLY 0xC00 TO 0xDFF;
END
PLACEMENT
  .text  INTO MY_ROM;
  .data  INTO MY_RAM;
  .stack INTO MY_STK;
  .copy  INTO ROM_2;
END

// Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

L1123: Invalid range defined for segment <Segment name>="">. End address must be bigger than start address

[ERROR]

Description

The memory range specified in the specified segment definition is not valid. The segment end address is smaller than the segment start address.

Example

```
 LINK  fibo.abs
 NAMES fibo.o startup.o END

 SEGMENTS
   MY_RAM = READ_WRITE 0x800 TO 0x7FF;
                     ^
 ERROR: Invalid range defined for segment MY_RAM. End
address must be bigger than start address
   MY_ROM = READ_ONLY 0x810 TO 0xAFF;
   MY_STK = READ_WRITE 0xB00 TO 0xBFF;
 END
 PLACEMENT
  .text       INTO MY_ROM;
   .data      INTO MY_RAM;
   .stack      INTO MY_STK;
 END

// Set reset vector on _Startup
 VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Change either the segment start or end address to define a valid memory range.

L1124: '+' or '-' should directly follow the file name

[ERROR]

Description

The '+' or '-' suffix specified after a file name in the NAMES block does not directly follow the file name. There is at least a space between the file name and the suffix.

Example

```
LINK  fibo.abs
NAMES fibo.o + startup.o END
       ^
ERROR: '+' or '-' should directly follow the file name
SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
END
PLACEMENT
  .text     INTO MY_ROM;
  .data     INTO MY_RAM;
  .stack     INTO MY_STK;
END

// Set reset vector on _Startup
 VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Remove the superfluous space after the file name in the list.

Example

```
LINK  fibo.abs
NAMES fibo.o+ startup.o END
SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
END
PLACEMENT
  .text     INTO MY_ROM;
  .data     INTO MY_RAM;
  .stack     INTO MY_STK;
END

// Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

L1125: In small memory model, code and data must be located on bank 0. (StartAddr EndAddr)

[ERROR]

Description

The application has been assembled or compiled in small memory model and the memory area specified for some segment is not located on the first 64K (0x0000 to 0xFFFF). This message is not issued for all processors.

Example

```
ERROR: In small memory model, code and data must be
```

```
located on bank 0
 LINK  fibo.abs
 NAMES fibo.o startup.o END
 SEGMENTS
   MY_RAM = READ_WRITE 0x800 TO 0x80F;
   MY_ROM = READ_ONLY 0x10810 TO 0x10AFF;
   MY_STK = READ_WRITE 0xB00 TO 0xBFF;
 END
 PLACEMENT
   .text     INTO MY_ROM;
   .data     INTO MY_RAM;
   .stack     INTO MY_STK;
 END

// Set reset vector on _Startup
 VECTOR ADDRESS 0xFFFE _Startup
```

Tips

If some memory upper than 0xFFFF is required for the application, the application must be assembled or compiled using the medium memory model. If no memory upper than 0xFFFF is required, modify the memory range and place it on the first 64K of memory.

L1127: Placement located outside 16 bit area in small memory model in area StartAddr .. EndAddr

[DISABLE]

Description

The application has been assembled or compiled in small memory model and the memory area specified for some segment is not located on the first 64K (0x0000 to 0xFFFF). This message is only issued for the HC12 and note that this message is disabled by default.

Example

```
 Warning: Placement located outside 16 bit area in small
memory model in area 0x10810.. 0x10AFF
 LINK  fibo.abs
 NAMES fibo.o startup.o END
 SEGMENTS
   MY_RAM = READ_WRITE 0x800 TO 0x80F;
   MY_ROM = READ_ONLY 0x10810 TO 0x10AFF;
   MY_STK = READ_WRITE 0xB00 TO 0xBFF;
 END
 PLACEMENT
   .text      INTO MY_ROM;
   .data      INTO MY_RAM;
   .stack      INTO MY_STK;
 END

// Set reset vector on _Startup
 VECTOR ADDRESS 0xFFFE _Startup
```

Tips

If some memory upper than 0xFFFF is required for the application, the application must be assembled or compiled using the medium memory model. If no memory upper than 0xFFFF is required, modify the memory range and place it on the first 64K of memory.

L1128: Cutting value <ItemName> from <FullValue> to <WrittenValue>

[WARNING]

Description

The linker does want to write a startup information entry which does not fit into the size available. The startup code defines the size available for an address, for example. If then larger addresses have to be written, this message is generated.

Example

For a startup code with 16 bits:

```
int i@0x12345678=7;
```

Tips

Check which kind of information did cause this message. Some startup codes do only support to initialize some part of the address space. This is especially the case when using small memory models and allocate variables in paged areas. To avoid to generate (non working) initialization data, variables can be placed in a NO_INIT section. The startup code can be adapted to support larger addresses. Different memory models do have different limitations.

L1130: Section .checksum must be the last section in the section list

[ERROR]

Description

The section .checksum which will contain the linker generated checksum should itself not be considered for the checksum calculation. Therefore this section has to be after all other sections.

Example

```
LINK chesksum.abs
NAMES chesksum.o startup.o END

SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
END
PLACEMENT
  .checksum,.text INTO MY_ROM;
  .data       INTO MY_RAM;
END
STACKSIZE 0x60
// Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Mention the .checksum section at the end of the section list or don't mention it at all.

See also

- Chapter CHECKSUM

L1200: Both STACKTOP and STACKSIZE defined

[ERROR]

Description

Both STACKTOP and STACKSIZE commands are specified in the PRM file. This is not allowed, because it generates an ambiguity on the definition of the stack.

Example

```
LINK  fibo.abs
NAMES fibo.o startup.o END

STACKTOP 0xBFE
SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
END
PLACEMENT
  .text       INTO MY_ROM;
  .data      INTO MY_RAM;
END
STACKSIZE 0x60
// Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Remove either the STACKTOP or the STACKSIZE command from the PRM file.

L1201: No stack defined

[WARNING]

Description

The PRM file does not contains any stack definition. In that case it is the programmer responsibility to initialize the stack pointer inside of his application code. The stack can be defined in the PRM file in one of the following way: Trough the STACKTOP command in the PRM file. Trough the STACKSIZE command in the PRM file. Trough the specification of the section .stack in the PLACEMENT block.

Example

```
WARNING: No stack defined
 LINK  fibo.abs
 NAMES fibo.o startup.o END

 SEGMENTS
   MY_RAM = READ_WRITE 0x800 TO 0x80F;
   MY_ROM = READ_ONLY 0x810 TO 0xAFF;
 END
 PLACEMENT
   .text      INTO MY_ROM;
   .data      INTO MY_RAM;
 END
// Set reset vector on _Startup
 VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Define the stack in one of the three way specified above. Note: If the customer initializes the stack pointer inside of his source code, the initialization from the linker will be overwritten.

L1202: .stack cannot be allocated on more than one segment

[ERROR]

Description

The section .stack is specified on a PLACEMENT line, where several segments are enumerated. This is not allowed, because the memory area reserved for the stack must be contiguous and cannot be split over different memory range.

Example

```
 ERROR: stack cannot be allocated on more than one
```

```
segment
 LINK  fibo.abs
 NAMES fibo.o startup.o END
 SEGMENTS
   MY_RAM = READ_WRITE 0x800 TO 0x80F;
   MY_ROM = READ_ONLY 0x810 TO 0xAFF;
   STK_1 = READ_WRITE 0xB00 TO 0xBFF;
   STK_2 = READ_WRITE 0xD00 TO 0xDFF;
 END
 PLACEMENT
   .text      INTO MY_ROM;
   .data      INTO MY_RAM;
   .stack      INTO STK_1, STK_2;
 END

// Set reset vector on _Startup
 VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Define a single segment with qualifier READ_WRITE or NO_INIT to allocate the stack.

L1203: STACKSIZE command defines a size of <Size> but .stack specifies a stacksize of <Size>

[ERROR]

Description

The stack is defined trough both a STACKSIZE command and PLACEMENT of the .stack section in a READ_WRITE or NO_INIT segment, but the size specified in the STACKSIZE command is bigger than the size of the segment where the stack is allocated.

Example

```
 ERROR: STACKSIZE command defines a size of 0x120 but
<tt>.stack</tt> specifies a stacksize of 0x100
 LINK  fibo.abs
 NAMES fibo.o startup.o END
 SEGMENTS
   MY_RAM = READ_WRITE 0x800 TO 0x80F;
   MY_ROM = READ_ONLY 0x810 TO 0xAFF;
   STK_1  = READ_WRITE 0xB00 TO 0xBFF;
 END
 PLACEMENT
   .text     INTO MY_ROM;
   .data     INTO MY_RAM;
   .stack    INTO STK_1;
 END

 STACKSIZE 0x120
// Set reset vector on _Startup
 VECTOR ADDRESS 0xFFFE _Startup
```

Tips

To avoid this message you can either adapt the size specified in the STACKSIZE command to fit into the segment where .stack is allocated or simply remove the command STACKSIZE. If you remove the command STACKSIZE from the previous example, The linker will initialized a stack from 0x100 bytes. The stack pointer initial value will be set to 0xBFE.

Example

```
LINK  fibo.abs
NAMES fibo.o startup.o END
SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
END
PLACEMENT
  .text     INTO MY_ROM;
  .data     INTO MY_RAM;
  .stack     INTO MY_STK;
END

// Set reset vector on _Startup
 VECTOR ADDRESS 0xFFFE _Startup
```

<segment start address> + <size in STACKSIZE> - <Additional Byte Required by the processor.>

Example

```
LINK  fibo.abs
NAMES fibo.o startup.o END
SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
END
PLACEMENT
  .text     INTO MY_ROM;
  .data     INTO MY_RAM;
  .stack     INTO MY_STK;
END
STACKSIZE 0x60
// Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

In the previous example, the initial value for the stack pointer is evaluated as:

```
0xB00 + 0x60s -2 = 0xB5E
```

L1204: STACKTOP command defines an initial value of <stack top=""> but .stack specifies an initial value of <Initial value="">

[ERROR]

Description

The stack is defined trough both a STACKTOP command and PLACEMENT of the .stack section in a READ_WRITE or NO_INIT segment, but the value specified in the STACKTOP command is bigger than the end address of the segment where the stack is allocated.

Example

```
ERROR: STACKTOP command defines an initial value of
```

```
0xCFE but .stack specifies an initial value of 0xBFF
 LINK  fibo.abs
 NAMES fibo.o startup.o END
 SEGMENTS
   MY_RAM = READ_WRITE 0x800 TO 0x80F;
   MY_ROM = READ_ONLY 0x810 TO 0xAFF;
   STK_1 = READ_WRITE 0xB00 TO 0xBFF;
 END
 PLACEMENT
   .text     INTO MY_ROM;
   .data     INTO MY_RAM;
   .stack     INTO STK_1;
 END

 STACKTOP 0xCFE
// Set reset vector on _Startup
 VECTOR ADDRESS 0xFFFE _Startup
```

Tips

To avoid this message you can either adapt the address specified in the STACKTOP command to fit into the segment where .stack is allocated or simply

remove the command STACKTOP. If you remove the command STACKTOP from the previous example, the stack pointer initial value will be set to 0xBFE.

```
\section example Example
 LINK  fibo.abs
 NAMES fibo.o startup.o END
 SEGMENTS
   MY_RAM = READ_WRITE 0x800 TO 0x80F;
   MY_ROM = READ_ONLY 0x810 TO 0xAFF;
   MY_STK = READ_WRITE 0xB00 TO 0xBFF;
 END
 PLACEMENT
   .text     INTO MY_ROM;
   .data     INTO MY_RAM;
   .stack     INTO MY_STK;
 END

// Set reset vector on _Startup
 VECTOR ADDRESS 0xFFFE _Startup
```

L1205: STACKTOP command incompatible with .stack being part of a list of sections

[ERROR]

Description

The stack is defined trough both a STACKTOP command and PLACEMENT of the .stack section in a READ_WRITE or NO_INIT segment, but the .stack section is specified inside of a list of section in the PLACEMENT block.

Example

```
 ERROR: STACKTOP command incompatible with .stack being
```

```
part of a list of sections
 LINK  fibo.abs
 NAMES fibo.o startup.o END
 SEGMENTS
   MY_RAM = READ_WRITE 0x800 TO 0x80F;
   MY_ROM = READ_ONLY 0x810 TO 0xAFF;
   STK_1 = READ_WRITE 0xB00 TO 0xBFF;
 END
 PLACEMENT
   .text     INTO MY_ROM;
   .data, .stack INTO STK_1;
 END

 STACKTOP 0xBFE
// Set reset vector on _Startup
 VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Specify the .stack section in a PLACEMENT line, where the stack alone is specified.

L1206: .stack overlaps with a segment which appear in the PLACEMENT block

[ERROR]

Description

The stack is defined trough the command STACKTOP, and the specified initial value is inside of a segment, which is used in the PLACEMENT block. This is not allowed, because the stack may overlap with some allocated objects.

Example

```
 ERROR: .stack overlaps with a segment which appear in
```

```
the PLACEMENT block
 LINK  fibo.abs
 NAMES fibo.o startup.o END
 SEGMENTS
   MY_RAM = READ_WRITE 0x800 TO 0x80F;
   MY_ROM = READ_ONLY 0x810 TO 0xAFF;
   STK_1 = READ_WRITE 0xB00 TO 0xBFF;
 END
 PLACEMENT
   .text     INTO MY_ROM;
   .data     INTO STK_1;
 END

 STACKTOP 0xBFE
// Set reset vector on _Startup
 VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Define the stack initial value outside of all the segments specified in the PLACEMENT block.

Example

```
LINK  fibo.abs
NAMES fibo.o startup.o END
SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  MY_STK = READ_WRITE 0xB00 TO 0xBFF;
END
PLACEMENT
  .text     INTO MY_ROM;
  .data     INTO MY_RAM;
END
STACKTOP 0xBFE

// Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

L1208: Failed to calculate checksum

[ERROR]

Description

The linker is not able to calculate the checksum for a given object.

Example

Checksum PRM file:

```
CHECKSUM
  CHECKSUM_ENTRY
    METHOD_CRC_CCITT
    OF READ_ONLY 0xE020 TO 0xFEFF
    INTO READ_ONLY 0xE010 SIZE 2
    UNDEFINED 0xff
  END
END
```

Tips

Check if the object files are not corrupted.

See also

- CHECKSUM chapter

L1207: STACKSIZE command is missing

[ERROR]

Description

The stack is defined only trough the PLACEMENT of the .stack section in a READ_WRITE or NO_INIT segment, but the .stack section is not alone in the section list. In this case a STACKSIZE command is required, to specify the size required for the stack by the application.

Example

```
LINK  fibo.abs
NAMES fibo.o startup.o END
SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  STK_1 = READ_WRITE 0xB00 TO 0xBFF;
END
PLACEMENT
  .text     INTO MY_ROM;
  .data, .stack INTO STK_1;
END

// Set reset vector on _Startup
 VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Indicate the requested stack size in a STACKSIZE command.

L1301: Cannot open file <File name>=""

[ERROR]

Description

The linker is not able to open the application map or absolute file or to open one of the binary file building the application.

Tips

- If the abs or map file cannot be found, check if there is enough memory on the directory where you want to store the file. Check also if you have read/write access on this directory.

L1302: File <File name>=""> not found

[ERROR]

Description

A file required during the link session cannot be found. This message is generated in following case: The parameter file specified on the command line cannot be found.

Tips

- Make sure the file really exist and his name is correctly spelled.

L1303: <File name>=""> is not a valid ELF file

[ERROR]

Description

The specified file is not a valid ELF binary file. The linker is only able to link ELF binary files.

Tips

- Check that you have compiled or assembled the specified file with the correct option to generate an ELF binary file.

L1305: <File name>=""> is not an ELF format object file (ELF object file expected)

[ERROR]

Description

The specified file is an old style HIWARE object file format binary file. The linker is only able to link ELF binary files.

Tips

- Check that you have compiled or assembled the specified file with the correct option to generate an ELF binary file.

L1400: Incompatible processor: <Processor name>=""> in previous files and <Processor name>=""> in current file

[ERROR]

Description

The binary files building the application have been generated for different target processor. In this case, the linked code cannot be compatible. Note that when this message is disabled, the produced absolute file may or may not work. The processor of the first read file is taken for the generation of fixups and similar entries. Because different processors define fixups and other topics differently, it is not predictable which combinations do really work.

Tips

Make sure you are compiling or assembling all your sources for the same processor. Check if your paths are defined correctly. The binary files must be located in one of the paths enumerated in the environment variable OBJPATH or GENPATH or in the working directory

---

L1401: Incompatible memory model: <Memory model="" name>=""> in previous files and <Memory model="" name>=""> in current file

[ERROR]

Description

The binary files building the application have been generated for different memory model. In this case, the linked code cannot be compatible.

Tips

- Make sure you are compiling or assembling all your sources in the same memory model.

L1403: Unknown processor <Processor constant>=""

[ERROR]

Description

The processor encoded in the binary object file is not a valid processor constant.

Tips

- Check if your paths are defined correctly. The binary files must be located in one of the paths enumerated in the environment variable OBJPATH or GENPATH or in the working directory.

L1404: Unknown memory model <Memory model="" constant>=""

[ERROR]

Description

The memory model encoded in the binary object file is not a valid memory model for the target processor.

Tips

- Check if your paths are defined correctly. The binary files must be located in one of the paths enumerated in the environment variable OBJPATH or GENPATH or in the working directory.

L1406: Unknown target

[ERROR]

Description

The linker is not able to process the target CPU for the given input files.

Tips

Check if the linker really supports the given target. Otherwise contact support.

L1407: Unknown address space for <Object> <Address>

[ERROR]

Description

The linker has found an unknown address space. Address spaces are used for some targets only.

Tips

Please report to support.

L1408: Conversion of address for <Object> overflowed <Address>

[WARNING]

Description

The linker failed to convert an address because of an overflow.

Tips

One reason this may happen is if extremely much debug information is linked and this overflows the supported address range for the target. In ELF addresses referring to the debug information are encoded with the same kind of mechanism as target addresses, therefore additional limitations may apply to the debug information. This is message is target specific. This message can happen if addresses outside of the usual area are used. Check if the used addresses in the prm file do fit into the architecture limits.

L1501: <Symbol name>=""> cannot be moved in section <Section name>=""> (invalid qualifier <Segment qualifier>="">)

[ERROR]

Description

An invalid move operation has been detected from an object inside of a section, which appears only in the PRM file. In that case, the first object moved in a section determines the attribute associated with the section.

- If the object is a function, the section is supposed to be a code section,

Example

```
ERROR: counter cannot be moved in section sec2 (invalid
qualifier READ_ONLY)
 LINK  fibo.abs
 NAMES fibo.o startup.o END
 SEGMENTS
   MY_RAM = READ_WRITE 0x800 TO 0x80F;
   MY_ROM = READ_ONLY 0x810 TO 0xAFF;
   STK_1 = READ_WRITE 0xB00 TO 0xBFF;
 END
 PLACEMENT
   .text, sec2  INTO MY_ROM;
   .data     INTO MY_RAM;
   .stack    INTO STK_1;
 END

 OBJECT_ALLOCATION
  counter IN sec2;
 END
// Set reset vector on _Startup
 VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Move the section in a segment with the required qualifier or remove the move command.

L1502: <Object name>=""> cannot be moved from section <Source section="" name>=""> to section <Destination section="" name>="">

[ERROR]

Description

An invalid move operation has been detected from an object inside of a section, which appears also in a binary file. This message is generated:

- When a variable is moved in a code or constant section

Example

```
 ERROR: counter cannot be moved from section .data to
section .text
 LINK  fibo.abs
 NAMES fibo.o startup.o END
 SEGMENTS
   MY_RAM = READ_WRITE 0x800 TO 0x80F;
   MY_ROM = READ_ONLY 0x810 TO 0xAFF;
   STK_1 = READ_WRITE 0xB00 TO 0xBFF;
 END
 PLACEMENT
   .text      INTO MY_ROM;
   .data      INTO MY_RAM;
   .stack     INTO STK_1;
 END

 OBJECT_ALLOCATION
  counter IN .text;
 END
// Set reset vector on _Startup
 VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Move the object in a section with the required attribute or remove the move command.

L1503: <Object name>=""> (from file <File name>="">) cannot be moved from section <Source section="" name>=""> to section

<Destination section="" name>="">

[ERROR]

Description

An invalid move operation has been detected from objects defined in a binary file inside of a section. This message is generated:

- When a variable is moved in a code or constant section

Example

```
ERROR: counter (from file fibo.o) cannot be moved from
section .data to section .text
 LINK  fibo.abs
 NAMES fibo.o startup.o END
 SEGMENTS
   MY_RAM = READ_WRITE 0x800 TO 0x80F;
   MY_ROM = READ_ONLY 0x810 TO 0xAFF;
   STK_1 = READ_WRITE 0xB00 TO 0xBFF;
 END
 PLACEMENT
   .text     INTO MY_ROM;
   .data     INTO MY_RAM;
   .stack    INTO STK_1;
 END

 OBJECT_ALLOCATION
  fibo.o:[DATA] IN .text;
 END
// Set reset vector on _Startup
 VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Move the specified object in a section with the required attribute or remove the move command.

L1504: <Object name>=""> (from section <Section name>="">) cannot be moved from section <Source section="" name>=""> to section <Destination section="" name>="">

[ERROR]

Description

An invalid move operation has been detected from objects defined in a section inside of another section. This message is generated:

- When a variable is moved in a code or constant section

Example

```
ERROR: counter (from section .data) cannot be moved from
section .data to section .text
LINK  fibo.abs
NAMES fibo.o startup.o END
SEGMENTS
  MY_RAM = READ_WRITE 0x800 TO 0x80F;
  MY_ROM = READ_ONLY 0x810 TO 0xAFF;
  STK_1 = READ_WRITE 0xB00 TO 0xBFF;
END
PLACEMENT
  .text     INTO MY_ROM;
  .data     INTO MY_RAM;
  .stack     INTO STK_1;
END
OBJECT_ALLOCATION
 .data>[*] IN .text;
END
// Set reset vector on _Startup
VECTOR ADDRESS 0xFFFE _Startup
```

Tips

Move the specified object in a section with the required attribute or remove the move command.

L1600: main function detected in ROM library

[WARNING]

Description

A main function has been detected in a ROM library. As ROM libraries are not self executable applications, no main function is required there.

Tips

- If the MAIN command is present in the PRM file, remove it.

L1601: startup function detected in ROM library

[WARNING]

Description

An application entry point has been detected in a ROM library. As ROM libraries are not self executable applications, no application entry point is required there.

Tips

- If the INIT command is present in the PRM file, remove it.

L1620: Bad digit in binary number

[ERROR]

Description

Syntax Error. Illegal character in a binary number.

L1621: Bad digit in octal number

[ERROR]

Description

Syntax Error. Illegal character in a octal number.

L1622: Bad digit in decimal number

[ERROR]

Description

Syntax Error. Illegal character in a decimal number.

L1623: Number too big

[ERROR]

Description

Syntax Error. An identifier in the link parameter file is limited to a length of 31 characters.

Tips

Reduce the length of the identifier.

L1624: Ident too long. Cut after 255 characters

[ERROR]

Description

Syntax Error. An identifier in the link parameter file is limited to a length of 255 characters. The identifier string is cut after that length.

Tips

Reduce the length of the identifier or move this message to a warning.

L1625: Comment not closed

[ERROR]

Description

An ANSI-C comment

```
/*  ....
```

Tips

Close the comment.

L1626: Unexpected end of file

[ERROR]

Description

The end of file encountered and the scanner was involved in the inner scope of an expression or structure nesting. This is illegal.

Tips

Check the syntax of the link parameter file.

L1627: PRESTART command not supported, ignored

[ERROR]

Description

This message is issued by the linker when an ELF application is linked and the used link parameter file contains a PRESTART directive, which is not supported for ELF. The PRESTART command is only recognized from the parser to be able to skip it, but it is not implemented.

Tips

The prestart functionality can be achieved easily by adapting the startup code.

L1629: START_DATA command not supported yet

[ERROR]

Description

The START_DATA command is already recognized from the parser, but not implemented yet.

Tips

Contact your vendor for the features of the next release.

L1631: HAS_BANKED_DATA not needed for ELF Object File Format

[WARNING]

Description

The HAS_BANKED_DATA entry in the PRM file is needed in the HIWARE file to define the size of pointers in the zero out and in the copy-down data structures. In the ELF format, the linker reads the sizes of the pointers from the DWARF2 debug info. When only DWARF1 is present, only one default pointer size per target is supported. The HAS_BANKED_DATA is completely ignored in the ELF Format.

L1632: Filename too long

[ERROR]

Description

A file name was longer as the limit for this file system.

Tips

As one filename can be longer than 250 characters under Win32 or most UNIX derivatives, the name did probably contain many paths. Try to use relative paths or use shorter path names.

L1633: Illegal Filename

[ERROR]

Description

A filename did contain an illegal character or does consist only out of a single + or - character.

Tips

Win32 does not allow / \ : * ? " < > | in filenames as they have a special semantic. Do use a different name instead. To use the + to switch off smart linking for a certain file, use it just after the filename with no space in between. Using '"fibo.o" +' is treated as two filenames (with the second one causing this message).

L1634: Illegal Prestart

[WARNING]

Description

The PRESTART link parameter file does not have correct parameters.

Tips

Prestart is not supported in ELF. Initialize your application in the startup code.

L1635: Bad input number for RESERVE field

[ERROR]

Description

This message is related to specifying EMPTY segments in PRM file. The syntax is PLACEMENT ..EMPTY RESERVE abc INTO ROM;.. END

This message occurs if the numeric value specified in RESERVE field is incorrect.

L1636: ROOT sub entry expected for STACK_CONSUMPTION

[WARNING]

Description

The message occurs if ROOT directive sub entry is not specified under STACK_CONSUMPTION directive.

L1637: END entry expected

[ERROR]

Description

This message occurs if END entry is not specified for STACK_CONSUMPTION directive in PRM file.

L1638: Invalid Identifiers

[ERROR]

Description

This message occurs if any invalid string is given in STACK_CONSUMPTION entry.

L1639: Bad input number for RECURSION_FACTOR field

[ERROR]

Description

This message occurs for RECURSION_FACTOR entry of PRM, if invalid input is given for recursion factor.

L1640: Bad input number for CONSUMPTION field

[ERROR]

Description

This message occurs for CONSUMPTION entry of PRM file, if invalid number is specified for stack usage of function.

L1642: Bad input number (stacksize) for FUNCTION_PAIR field

[ERROR]

Description

This message occurs for FUNCTION_PAIR directive if invalid number for stack usage is specified.

L1643: Bad input number (stacksize) for INTERRUPT_FUNCTION field

[ERROR]

Description

This message occurs for INTERRUPT_FUNCTION directive if invalid number is specified for stack usage.

L1650: The encoding of <Object> in the special section .overlap was not recognized. The object is not overlapped

[WARNING]

Description

To overlap <Object> it must be known to which function this object belongs. The name of this function should be encoded into the object name. If the encoding is not correct, this message appears.

Tips

Do not use the sections .overlap and _OVERLAP for objects which should not be overlapped. The compiler knows the section internally, so that these section names should only appear in the PRM file and not in C sources.

L1651: The function <Function> of the overlap object <Object> was not found. The object is not overlapped

[WARNING]

Description

To overlap <Object> it must be known to which function this object belongs. The name of this function should be encoded into the object name. The encoding was recognized, but the corresponding function was not found or not linked.

Tips

Do not use the sections .overlap and _OVERLAP for objects which should not be overlapped. The compiler knows the section internally, so that these section names should only appear in the PRM file and not in C sources.

L1653: The object <Object> was not overlapped allocate

[WARNING]

Description

The specified object is in the section .overlap and it's depending function was recognized. However, no root function did reached the function which corresponds to this object.

Tips

Add the name of the function to a OVERLAP_GROUP PRM file entry.

L1654: <Object> was not marked as root for overlapping

[WARNING]

Description

The <Object>, which may be a object file was not considered as root for the overlap analysis.

Tips

Add the name of all root functions into one or several OVERLAP_GROUP PRM file entries.

L1655: Overlapping <Object> depends on itself

[WARNING]

Description

During the execution, the same function with overlapping objects must not be invoked twice. The linker has detected that one function depends on itself.

Example

As recursion is not allowed with overlapping the following implementation is not only inefficient, it will even fail with overlapped variables.

```
int fibonacci(int i) {
 return fibonacci(i-1)+fibonacci(i-2);
}
```

Tips

If the dynamic behavior of the function guarantees that no recursion takes place, ignore this warning. Otherwise change your code to avoid any recursion.

L1656: Overlapping <Object> depends on multiple roots

[WARNING]

Description

During the execution, the same function with overlapping objects must not be invoked twice. The linker has detect that one function depends on two root functions. This message is not issued for root objects.

Example

In this example, the parameters of Mul are destroyed when Mul is invoked twice. As this happens only when the higher priority interrupt intercept the lower interrupt function, this bug is hard to catch with other tests. When both interrupt functions have the same priority, a OVERLAP_GROUP PRM file entry should be used.

```
long l0,l1,l2,l3,l4,l5;

long Mul(long a, long b) {
 return a*b;
}

void interrupt 1 interrupt1(void) {
 l0=Mul(l1,l2);
}

void interrupt 2 interrupt2(void) {
 l3=Mul(l4,l5);
}
```

Tips

- Check whether it is possible if the function is called twice at the same time. If so correct the code. Otherwise ignore this warning.

L1700: File <File name>=""> should contain DWARF information

[ERROR]

Description

The binary file, where the startup structure is defined does not contain any DWARF information. This is required, because the type of the startup structure is

not fixed by the linker, but depends on the field and field position inside of the user defined structure.

Tips

Recompile the ANSI-C file containing the definition of the startup structure and insert DWARF information there.

L1701: Start up data structure is empty

[WARNING]

Description

The size of the user defined startup structure is 0 bytes.

Tips

Check if you really do not need any startup structure. If a startup structure is available, check if the field name in the structure matches the name of the field expected by the linker.

L1702: Startup data structure field <name> is unknown

[WARNING]

Description

In the ELF object file format, the linker reads the debug information to build the startup data structures as the compiler expects them. Therefore no names in the startup structure should be changed. The linker did not find the information about the mentioned field, so no adoption takes place.

Tips

Check if the mentioned field exists in the startup data structure. Check that all fields have the correct type. If the startup information is not actually used, then it can be removed from the startup descriptor.

L1800: Read error in <File>

[ERROR]

Description

An error occurred while reading one of the ELF input object files. The object file is corrupt.

Tips

Recompile your sources. Contact your vendor, if the error appears again.

L1803: Out of memory in <Function name>="">

[FATAL]

Description

There is not enough memory to allocate the internal structure required by the linker.

L1818: Symbol <Symbol number>="" > - <Symbol name>="" > duplicated in <First file="" name>="" > and <Second file="" name>="" >

[ERROR]

Description

The specified global symbol is defined in two different binary files.

Example

```
// foo.h
int i;
// foo1.c
#include "foo.h"
// foo2.c
#include "foo.h"
```

Tips

Rename the symbol defined in one on the specified files or check if a definition is present in a header file and included more than once (defined more than once).

L1820: Weak symbol <Symbol name>=""> duplicated in <First file="" name>=""> and <Second file="" name>="">

[WARNING]

Description

The specified weak symbol is defined in two different binary files.

Tips

Rename the symbol defined in one on the specified files.

L1821: Symbol <id1> conflicts with <id2> in file <File> (same code)

[ERROR]

Description

A static symbol is defined twice in the same module.

Tips

Rename one of the symbols in the module.

L1822: Symbol <Symbol name>=""> in file <File name>=""> is undefined

[ERROR]

Description

The specified symbol is referenced in the file specified, but is not defined anywhere in the application.

Tips

Check if there is no object file missing in the NAMES block and if you are using the correct binary file. Check if your paths are defined correctly. The binary files must be located in one of the paths enumerated in the environment variable OBJPATH or GENPATH or in the working directory

L1823: External object <Symbol name>=""> in <File name>=""> created by default

[WARNING]

Description

Unresolved external. The specified symbol is referenced in the file specified, but is not defined anywhere in the application, but an external declaration for this object is available in at least one of the binary file. The object is supposed to be defined in the first binary file where it is externally defined. This is only valid for ANSI-C applications. In this case an external definition for a variable var looks like:

```
extern int var;
```

Tips

Define the specified symbol in one of the files building the application.

L1824: Invalid mark type for <Ident>

[ERROR]

Description

Internal error. The object file is corrupt.

Tips

Recompile your sources and contact your vendor if this leads to the same results.

L1826: Can't read file. <Filename> is a not an ELF library containing

ELF objects (ELF objects expected)

[ERROR]

Description

The specified file is not a valid library. The linker is only able to link uniform binary files together (Not ELF and HIWARE mixed).

Tips

Recompile the source file to ELF object file format.

L1827: Symbol <Ident> has different size in <Filename> (<Size> bytes) and <Filename> (<Size> bytes)

[WARNING]

Description

An object was specified with different sizes in different object files. This message is only issued if both sizes are specified in a object file. If one object file is contained in a library, L1828: Library: Symbol <Ident> has different size in <Filename> (<Size> bytes) and <Filename> (<Size> bytes) is issued.

Example

```
a.h : exten char * buf;
   extern long intvar;
a.c : char buf[100];
   long intvar;
```

Tips

- Check if all declarations and definitions of the named object match.

See also

- L1828: Library: Symbol <Ident> has different size in <Filename> (<Size> bytes) and <Filename> (<Size> bytes)

L1828: Library: Symbol <Ident> has different size in <Filename>

(<Size> bytes) and <Filename> (<Size> bytes)

[DISABLE]

Description

An object was specified with different sizes in different object files. One of the two object files is contained in a library. This message is only issued if one object file is contained in a library. If both sizes are specified in a object file, L1827: Symbol <Ident> has different size in <Filename> (<Size> bytes) and <Filename> (<Size> bytes) is issued.

Tips

- Check if all declarations and definitions of the named object match.

See also

- L1827: Symbol <Ident> has different size in <Filename> (<Size> bytes) and <Filename> (<Size> bytes)

L1829: Cannot resolve label 'Ident'

[ERROR]

Description

The value of a label cannot be determined. This message may only be generated by assembly files.

Tips

Check the definition of the label.

L1830: The label <labelname> cannot be resolved because of a recursion.

[ERROR]

Description

Some labels cannot be resolved because they depend on each other. For example label is defined as label_b plus some offset and label_b is defined as label a plus some offset.

Tips

- Check the label definition.

L1831: Could not allocate memory for <Section> section

[ERROR]

Description

The message occurs if the memory cannot be allocated for EMPTY sections.

For example:

```
C source:
void main(void) {


}


Linker PRM:
..
MY_ROM     = READ_ONLY 0x4000 TO   0x400A; /* size of segment
     is 10 bytes */
PLACEMENT                  ;
EMPTY        RESERVE 0xE INTO MY_ROM; /* Tries to reserve 14
     bytes */
END
..
```

L1903: Unexpected Symbol in Linkparameter file

[ERROR]

Description

Syntax error in link parameter file. An illegal character appeared.

Tips

- It may accidentally happen that the link process is started with the name of the executable as file argument on command line instead of the link parameter file. In this case type the right file name.

L1906: Fixup out of buffer (<Obj> referenced at offset <Address>)

[ERROR]

Description

An illegal relocation of an object is detected in the object file <Object> at address <Address>. The type of the object is given in <objType>.

Tips

Check the relocation at that address. The offset may be out of range for this relocation type. If not it may be caused by a corrupt object file. Recompile your sources and try to link again. If this leads to the same result, contact your vendor for support

---

L1907: Fixup overflow in <Object>, type <objType> at offset <Address>

[ERROR]

Description

An illegal relocation of an object is detected in the object file <Object> at address <Address>. The type of the object is given in <objType>.

Tips

- Check the relocation at that address. The offset may be out of range for this relocation type. If not it may be caused by a corrupt object file.

L1908: Fixup error in <Object>, type <objType> at offset <Address>

[ERROR]

Description

An illegal relocation of an object is detected in the object file <Object> at address <Address>. The type of the object is given in <objType>.

Tips

Check the relocation at that address. The offset may be out of range for this relocation type. If not it may be caused by a corrupt object file. Recompile your sources and try to link again. If this leads to the same result, contact your vendor for support

L1910: Invalid section attribute for program header

[ERROR]

Description

A program header needs specific section attributes that have no sense to be changed.

Tips

- The cause of the error is internal and may be caused by a corrupt object file.

L1912: Object <obj> overlaps with another (last addr: <addr>, object address: <objadr>

[ERROR]

Description

The object with name <obj> overlaps with another object at address <addr>. The address of the object is given in <objadr>.

Tips

Do place one of the objects somewhere else.

L1914: Invalid object: <Object>

[ERROR]

Description

An object of unknown type is detected in an object file.

Tips

- The cause of the error is internal and may be caused by a corrupt object file or incompatibility of the object formats.

L1916: Section name <Section> is too long. Name is cut to 90 characters length

[WARNING]

Description

The length of a name is limited to 90 characters.

Tips

Rename the section and recompile your sources.

L1919: Duplicate definition of <Object> in library file(s) <File1> and/or <File2> discarded

[WARNING]

Description

A definition of an object is duplicated in a library. (In object file <File1> and <File2>.

Tips

Rename one of the objects and recompile your sources.

L1921: Marking: too many nested procedure calls

[ERROR]

Description

The object file is corrupt or your application.

Tips

Recompile your sources and try to link again. If this leads to the same result, contact your vendor for support.

L1922: File <filename> has DWARF data of different version, DWARF data may not be generated

[WARNING]

Description

The files linked have different versions of the debug info sections (ELF/DWARF).

Tips

- Recompile your sources with an unique version of output. See the compiler manual for the right option settings.

L1923: File <filename> has no DWARF debug info

[WARNING]

Description

The mentioned file contains no recognized debug information. For the named object file the debugger will probably not show source files and other symbolic information. Its code can only be debugged on assembly level.

Tips

- Codewarrior compilers contain an option to avoid the generation of debug information.

L1924: Objects <Object1> and <Object2> overlap

[ERROR]

Description

The two objects do share the same address. This may be ok or not depending on the character of the actual objects.

Tips

- Check that no areas in the PRM file overlap

L1925: Address conversion error in fixup evaluation in <Ident>, to <Offset> fixup type <Type>, at offset <Offset>

[ERROR]

Description

In the fixup address computation, an address conversion failed. This error is different from the fixup overflow error L1907 in that a impossible conversion was done, not just an overflow. L1925 only happens for targets with multiple address spaces which have to be converted.

Tips

Check that address spaces are properly defined. Some address spaces do only cover a part of all possible values.

L1926: Alias nesting too deep for <Object> object. Maximum depth allowed is <Num>.

[ERROR]

Description

This message occurs if the nesting depth of labels defined in assembly source is greater than 400.

For example:

```
A1 EQU 6
A2 EQU A1
A3 EQU A2
..
A401 EQU A402
Main:
   LDA A402
```

L1930: Unknown fixup type in <ident>, type <type>, at offset <offset>

[ERROR]

Description

The object file is corrupt or your linker version does not support compiler instructions.

Tips

Recompile your sources and try to link again. If this leads to the same result, contact your vendor for support.

L1931: Fixup to not allocated object <Ident> in <Ident> typr <Type>, at offset 0xOffset >

[ERROR]

Description

This message occurs if the fixup object is not allocated any memory.

TL1933: ELF: <details>

[WARNING]

Description

Warning while reading an ELF object file. The data in the file are not complete or consistent, but the ELF Linker can continue. <details> specifies the cause of the warning. Possible values are listed in L1934: ELF: <details>.

L1934: ELF: <details>

[ERROR]

Description

Error while reading an ELF object file. <details> specifies the cause of the error. Possible causes are:

- Cannot open <File> - See message L1309

L1936: ELF output: <details>

[ERROR]

Description

Error in ELF. <details> specifies the cause of the error. Possible causes are:

- Cannot open <File> - See L1309: Cannot open <File>

L1937: LINK_INFO: <details>

[WARNING]

Description

The compiler does put with the pragma LINK_INFO some information entries into the ELF file. This message is used if incompatible information entries exist.

Tips

- Check the pragma LINK_INFO in the compiler source.

L1951: Function <Function> is allocated inside of <Object> with offset <Offset>. Debugging may be affected

[WARNING]

Description

The common code optimization of the linker has optimized one function. It is now allocated in the specified object. As both the function and the object are allocated at the same addresses, the debugger cannot distinguish them. Be aware that the debugger may display information for the wrong object.

Tips

- If the two functions are identical per design, for example C++ inline functions, ignore the warning. If the function is very small, its influence might not be as large either. Check for large functions why your source does not only contain one instance.

L1952: Ident <name> too long. Cut after <size> characters

[WARNING]

Description

A very long identifier is truncated to the given length. Different as long identifiers with the same start until <Offset> may be mapped to the same name.

Tips

- The linker supports more than 1000 character long names, so this message only occurs with really long names.

L1970: Modifying code in function <function> at address <ad-

dress> for ECALL

[WARNING]

Description

This message informs that the linker has modified the code for an ECALL instruction. That is that the linker has moved the ECALL instruction after the three following NOP instructions.

L1971: <Pattern> in function <function> at address <address> may be ECALL Pattern

[WARNING]

Description

The Linker has found a possible ECALL pattern at the given address. The Linker was not able to move this pattern.

Tips

The pattern may be produced by a data pattern. In this case check the code/data at the given address and map this message if this is ok.

L1972: <Pattern> in function <function> at address <address> looks like illegal ECALL

[ERROR]

Description

The Linker has found a possible ECALL pattern at the given address. The Linker was not able to move this pattern.

Tips

The pattern may be produced by a data pattern. In this case check the code/data at the given address and map this message if this is ok.

L1980: <Feature> not supported

[ERROR]

Description

The Linker does not support an used feature. This message is only used in rare circumstances, for example to show that some feature is not supported anymore (or not yet)

Tips

Check the documentation about this feature. Check why it was removed and if there are alternatives to use.

L1981: No copydown created for initialized object <Name>. Initialization data lost.

[WARNING]

Description

The named object is allocated in RAM and it is defined with some initialization values. But because no copy down information is allocated, the initialization data is lost.

Example

```
int i= 19;
int j;
```

When linking the code above with no startup code, then the linker does issue this warning for i as its initialization value 19 is not used.

Tips

- If you do not want this object to be initialized, change the source or ignore the warning.

L2000: Segment <Segmentname> (for variables) should not be al-

located in a READ_ONLY-section

[WARNING]

Description

Variables must be allocated in RAM. The section <Segmentname>, containing variables was mapped in the PLACEMENT definition list of the link parameter file to a section that was defined as read only in the SECTIONS definition list. This is illegal.

Example

```
LINK bankdemo.abs
NAMES ansib.lib startb.o bankdemo.o END
SECTIONS
  MY_RAM  = READ_WRITE  0x0800 TO 0x0BFF;
  MY_ROM  = READ_ONLY   0xC000 TO 0xCFFF;
  VPAGE   = READ_ONLY   0xD000 TO 0xFEFF;
  MY_PAGE = READ_ONLY 0x128000 TO 0x12AFFF;
PLACEMENT
  _PRESTART, STARTUP,
  ROM_VAR, STRINGS,
  NON_BANKED          INTO MY_ROM;
  DEFAULT_RAM         INTO MY_RAM;
  VPAGE_RAM           INTO VPAGE;
  MyPage,DEFAULT_ROM      INTO MY_PAGE;
END
STACKSIZE 0x50
```

Example

```
#pragma DATA_SEG SHORT VPAGE
  int x[4]; // 'x' is a variable, and can't therefore be
       // allocated in a read only segment
```

L2001: In link parameter file: segment <Segmentname> must always be present

[ERROR]

Description

Some segments are required to be always present (mapped in the PLACEMENT definition list to an identifier defined in the SECTIONS definition list).

Example

DEFAULT_RAM and DEFAULT_ROM have always to be defined.

Tips

Use a template link parameter file, for your target, where these segments are always defined. Modify this file for your application. This way you avoid to write the same default settings for every application again and you will not forget to define the sections that have always to be present.

L2002: Library file <Library> (in module <Module>) incorrect: "cause"

[ERROR]

Description

Object file is corrupt.

Example

"object tag incorrect" => The type tag of a linked object (VARIABLE, PROCEDURE,..) is incorrect.

Tips

Do compile your sources again. Contact support for help, if the error appears again.

L2003: Object file <Objfile> (<Cause>) incorrect

[ERROR]

Description

Object file is corrupt. (Equivalent message as L2002: Library file <Library> (in module <Module>) incorrect: "cause" for object files)

Tips

Do recompile the affected source file. Contact support for help, if the error appears again.

L2009: Out of allocation space in segment <segmentname> at address <address>

[ERROR]

Description

More address space allocated in segment <segmentname> than available. The address <address> given specifies the location, where the allocation failed.

L2008: Error in link parameter file

[ERROR]

Description

An error occurred while scanning the link parameter file. The message specifying the error was printed out as last message.

L2010: File not found: <Filename>

[ERROR]

Description

An input file (object file or absolute file) was not found.

Tips

Check your default.env path settings. Object files and absolute files opened for read are searched in the current directory or in the list of paths specified with the environment variables OBJPATH and GENPATH.

L2011: File <filename> is not a valid HIWARE object file, absolute file or library

[ERROR]

Description

The file <filename> is expected to be a HIWARE object file, absolute file or library, because a file before in the NAMES list was a HIWARE format file. The linker started therefore to link the application in the HIWARE absolute file format .

Tips

You may have wished to link the application as ELF/DWARF executable, but the fist object file in the NAMES list found was detected to be a file in HIWARE format. If you really intended to link an application in the HIWARE absolute format, replace the file <filename> by a valid HIWARE object file, absolute file or library.

L2014: User requested stop

[INFORMATION]

Description

The user has pressed the stop button in the toolbar. The linker stops execution as soon as possible.

L2015: Different type sizes in <ref_objfile> and <cur_objfile>

[WARNING]

Description

In the HIWARE format, the size of many basic types (short, int, long, float, double, long double, default data pointer and default function pointer) are encoded into the object file. This message is issued if the linker detects two object files with different sizes. This may be caused an explicit setting of the types in some files only. Also for the assembler, the sizes cannot be modified. The linker is using the type sizes of the first specified object file. For the remaining, it does only issue this warning, if the size does not match. The sizes are used for the layout of the startup structure, the zero out and for the copy down information.

Tips

- When the startup code object file is specified first, the startup structure sizes correspond to the startup code. Then differing information in other object files do not matter and this warning can be ignored.

L2051: Restriction: library file <Library> (in module <Module>): <Cause>

[ERROR]

Description

There are some memory restrictions in the linker. This can be happen by the following causes:

Example

- "too many objects" Too many objects allocated.

L2052: RESTRICTION: in object file <Objectfile>: <Cause>

[ERROR]

Description

Equivalent to message L2051: Restriction: library file <Library> (in module <Module>): <Cause>, but for object files.

L2053: Module <Modulename> imported (needed for module-initialization?), but not present in list of objectfiles

[WARNING]

Description

Only for linking MODULA-2. The module <modulename> is in the import list of another module but not present in the list of object files, specified in the NAMES section of the link parameter file.

L2054: The symbolfiles of module <Modulename> (used from <User1> and <User2>) have different keys

[ERROR]

Description

Only for linking MODULA-2. With the link parameter file command CHECKKEYS ON, all keys of equal named imported modules are compared. CHECKKEYS ON is set by default. To switch of this check, write CHECKKEYS OFF in the PRM file.

L2055: Function <functionname> (see link parameter file) not found

[ERROR]

Description

An interrupt vector was mapped to the function with name <functionname> in the link parameter file. But a function with this name was not found in the modules linked.

L2056: Vector address <address> must fit wordsize

[ERROR]

Description

An interrupt vector with word size is mapped to an odd address in the link parameter file.

L2057: Illegal file format (Reference to unknown object) in <objfile>

[ERROR]

Description

Older versions of HIWARE Compilers use -1 for unknown object. This leads to inconsistency with the linker. Later versions of compilers do avoid this. The error reported here is not a linker error, but a compiler error.

Tips

Do recompile your sources.

L2058: <objnum> referenced objects in <file>

[ERROR]

Description

Object file is corrupt: Too many referenced objects in file or the number of referenced objects is negative.

Tips

- Do recompile the affected source file.

L2059: Error in map of <absfile>

[ERROR]

Description

Absolute file as input for ROM library is corrupt (Its number of modules is invalid).

Tips

Decode the absolute file. If this works and the number of modules contained is correct, contact support otherwise do rebuild the absolute file. Contact its distributor support for help, if this is not possible (absolute file from other party).

L2060: Too many (<objnum>) objects in library <library>

[ERROR]

Description

Number of objects in library exceeds maximum limit. The actual value for the maximum depends on the linker version. The 32 Bit linker version allows more than 500'000'000 objects in one library. Old 16 bit linker versions did have a limit of 8000 objects.

Tips

Cause can be a corrupt library. Do divide your library in sub-libraries if the count is correct and this large.

L2061: <filename> followed by '-'/'+', but not a library or program module

[ERROR]

Description

The plus sign after a file name in the NAMES section disables smart linking for the specified file. A minus sign specified after an absolute file name takes it out from application startup.

L2062: <object> found twice with different size (in '<module1>'-

><objsize1> and in '<module2>'-><objsize2>)

[WARNING]

Description

Naming conflict or duplicated definition with different attributes in the application. Two objects where defined with the same name, but with different sizes.

L2063: <symbol> twice exported (module <module1> and module <module2>)

[ERROR]

Description

The object <symbol> has been implemented and exported from two different modules.

Tips

Review your module structure design. Remove one of the objects, if they refer to the same context. Rename one of the objects if both of them are used in different contexts.

L2064: Required system object <objectname> not found

[ERROR]

Description

An object absolutely required by the linker is missing.

Example

_Startup is such an object.

Tips

The entry point of the application must exist in order to link correctly. It's default name is _Startup. This name can be configured by the link parameter file entry INIT. E.g.

```
INIT MyEntryPoint
```

Probably you forgot to specify the startup module as one of the files in the NAMES section. _Startup is thought to be defined in the startup module. Another reason can be name mangling with C++: The names of functions are encoded with the types in the object file, e.g. void Startup(void) is encoded as Startup__Fv. Either use extern "C" for such cases or use the mangled name in the linker parameter file.

L2065: No module exports with name <objectname>

[ERROR]

Description

An object absolutely required by the linker is not exported.

Example

__Startup is such an object.

Tips

Probably you forgot to specify the startup module as one of the files in the NAMES section. __Startup is thought to be defined in the startup module.

L2066: Variable '_startupData' not found, linker prepares no startup

[WARNING]

Description

The _startupData is a structure (C-struct) containing all information read out from the Startup function as:

- Top level procedure of user program

Tips

- Probably you forgot to specify the startup module as one of the files in the NAMES section. __Startup is thought to be defined in the startup module.

L2067: Variable '_startupData' found, but not exported

[WARNING]

Description

The startup data has been found, but is not exported.

Tips

See L2064: Required system object <objectname> not found.

L2068: <objname> (in ENTRIES link parameter file) not found

[ERROR]

Description

Object name in the ENTRIES section was not found. In ENTRIES all objects are listed that are linked in any case (referenced or not by other objects). <objname> was not found in any module.

Tips

Check out, if the name in the ENTRIES section was written correctly.

L2069: The segment 'COPY' must not cross sections

[ERROR]

Description

The COPY segment must be placed in one section. This is not the case here.

L2070: The segment STRINGS crosses the page boundary

[ERROR]

Description

The HC16 does not allow, the STRINGS section to cross page boundary.

L2071: Fixup Error: Reference to non linked object (<objname>)

[ERROR]

Description

An object was referenced, but not linked. This error may be caused by a modified dependency with DEPENDENCY in the PRM file or by a wrong compiler/ assembler specified dependency.

Tips

Use DEPENDENCY ADDUSE instead of DEPENDENCY USES. If the compiler/ assembler did generate the missing dependencies, try to rebuild the application.

See also

Link Parameter File Command DEPENDENCY

L2072: 8 bit branch (from address <address>) out of range (-128 <= <offset> <= 127)

[ERROR]

Description

8 bit branch from address <address> out of range.

Tips

If the source file of this branch is an assembly file, take a look at the branch at address <address>. Rewrite to code correctly. Some compilers do assume that functions compiled in the same segment and defined close together get allocated in

the same order. When in the link parameter file PLACEMENT such a segment is splitted up into several sections, then larger gaps can be generated:

```
SECTIONS
 ROM1 = READ_ONLY 0x4000 TO 0x4FFF;
 ROM2 = READ_ONLY 0x8000 TO 0x8FFF;
PLACEMENT
 FUNCTIONS INTO ROM1, ROM2;
```

If this causes your problem, either recompile your sources with this optimization switched off (see the compiler manual for the correct option) or splitup the functions by hand into different segments, which are assigned to one section only.

If this causes your problem, either recompile your sources with this optimization switched off (see the compiler manual for the correct option) or splitup the functions by hand into different segments, which are assigned to one section only.

L2073: 11 bit branch out of range (-2048 <= <offset> <= 2047)

[ERROR]

Description

11 bit branch out of range.

Tips

If the source file of this branch is an assembly file, take a look at the branch at address <address>. Rewrite to code correctly. Some compilers do assume that functions compiled in the same segment and defined close together get allocated in the same order. When in the link parameter file PLACEMENT such a segment is splitted up into several sections, then larger gaps can be generated:

```
SECTIONS
 ROM1 = READ_ONLY 0x4000 TO 0x4FFF;
 ROM2 = READ_ONLY 0x8000 TO 0x8FFF;
PLACEMENT
 FUNCTIONS INTO ROM1, ROM2;
```

If this causes your problem, either recompile your sources with this optimization switched off (see the compiler manual for the correct option) or splitup the functions by hand into different segments, which are assigned to one section only.

If this causes your problem, either recompile your sources with this optimization switched off (see the compiler manual for the correct option) or splitup the functions by hand into different segments, which are assigned to one section only.

L2074: 16 bit branch out of range (-32768 <= <offset> <= 32767)

[ERROR]

Description

16 bit branch out of range.

Tips

If the source file of this branch is an assembly file, take a look at the branch at address <address>. Rewrite to code correctly. Some compilers do assume that functions compiled in the same segment and defined close together get allocated in the same order. When in the link parameter file PLACEMENT such a segment is splitted up into several sections, then larger gaps can be generated:

```
SECTIONS
 ROM1 = READ_ONLY 0x4000 TO 0x4FFF;
 ROM2 = READ_ONLY 0x8000 TO 0x8FFF;
PLACEMENT
 FUNCTIONS INTO ROM1, ROM2;
```

If this causes your problem, either recompile your sources with this optimization switched off (see the compiler manual for the correct option) or splitup the functions by hand into different segments, which are assigned to one section only.

If this causes your problem, either recompile your sources with this optimization switched off (see the compiler manual for the correct option) or splitup the functions by hand into different segments, which are assigned to one section only.

L2075: 8 bit index out of range (<index> for <objname>)

[ERROR]

Description

Offset to index register is out of range.

Tips

If the source file of this branch is an assembly file, take a look at the branch at address <address>. Rewrite to code correctly. Some compilers do assume that functions compiled in the same segment and defined close together get allocated in the same order. When in the link parameter file PLACEMENT such a segment is splitted up into several sections, then larger gaps can be generated:

```
SECTIONS
 ROM1 = READ_ONLY 0x4000 TO 0x4FFF;
 ROM2 = READ_ONLY 0x8000 TO 0x8FFF;
PLACEMENT
 FUNCTIONS INTO ROM1, ROM2;
```

If this causes your problem, either recompile your sources with this optimization switched off (see the compiler manual for the correct option) or splitup the functions by hand into different segments, which are assigned to one section only.

If this causes your problem, either recompile your sources with this optimization switched off (see the compiler manual for the correct option) or splitup the functions by hand into different segments, which are assigned to one section only.

L2076: Jump crossing page boundary

[ERROR]

Description

A jump is crossing page boundary.

Tips

If the source file of this branch is an assembly file, take a look at the branch at address <address>. Rewrite to code correctly. Some compilers do assume that functions compiled in the same segment and defined close together get allocated in the same order. When in the link parameter file PLACEMENT such a segment is splitted up into several sections, then larger gaps can be generated:

```
SECTIONS
 ROM1 = READ_ONLY 0x4000 TO 0x4FFF;
 ROM2 = READ_ONLY 0x8000 TO 0x8FFF;
PLACEMENT
 FUNCTIONS INTO ROM1, ROM2;
```

If this causes your problem, either recompile your sources with this optimization switched off (see the compiler manual for the correct option) or splitup the functions by hand into different segments, which are assigned to one section only.

If this causes your problem, either recompile your sources with this optimization switched off (see the compiler manual for the correct option) or splitup the functions by hand into different segments, which are assigned to one section only.

L2077: 16-bit index out of range (<index> for <objname>)

[ERROR]

Description

16 bit index out of range.

Tips

If the source file of this branch is an assembly file, take a look at the branch at address <address>. Rewrite to code correctly. Some compilers do assume that functions compiled in the same segment and defined close together get allocated in the same order. When in the link parameter file PLACEMENT such a segment is splitted up into several sections, then larger gaps can be generated:

```
SECTIONS
 ROM1 = READ_ONLY 0x4000 TO 0x4FFF;
 ROM2 = READ_ONLY 0x8000 TO 0x8FFF;
PLACEMENT
 FUNCTIONS INTO ROM1, ROM2;
```

If this causes your problem, either recompile your sources with this optimization switched off (see the compiler manual for the correct option) or splitup the functions by hand into different segments, which are assigned to one section only.

If this causes your problem, either recompile your sources with this optimization switched off (see the compiler manual for the correct option) or splitup the functions by hand into different segments, which are assigned to one section only.

L2078: 5 bit offset out of range (-16 <= <offset> <= 15)

[ERROR]

Description

5 bit offset out of range.

Tips

If the source file of this branch is an assembly file, take a look at the branch at address <address>. Rewrite to code correctly. Some compilers do assume that functions compiled in the same segment and defined close together get allocated in the same order. When in the link parameter file PLACEMENT such a segment is splitted up into several sections, then larger gaps can be generated:

```
SECTIONS
 ROM1 = READ_ONLY 0x4000 TO 0x4FFF;
 ROM2 = READ_ONLY 0x8000 TO 0x8FFF;
PLACEMENT
 FUNCTIONS INTO ROM1, ROM2;
```

If this causes your problem, either recompile your sources with this optimization switched off (see the compiler manual for the correct option) or splitup the functions by hand into different segments, which are assigned to one section only.

If this causes your problem, either recompile your sources with this optimization switched off (see the compiler manual for the correct option) or splitup the functions by hand into different segments, which are assigned to one section only.

L2079: 9 bit offset out of range (-256 <= <offset> <= 255) in <object> with offset <offset> to <object>

[ERROR]

Description

9 bit offset out of range.

Tips

If the source file of this branch is an assembly file, take a look at the branch at address <address>. Rewrite to code correctly. Some compilers do assume that functions compiled in the same segment and defined close together get allocated in

the same order. When in the link parameter file PLACEMENT such a segment is splitted up into several sections, then larger gaps can be generated:

```
SECTIONS
 ROM1 = READ_ONLY 0x4000 TO 0x4FFF;
 ROM2 = READ_ONLY 0x8000 TO 0x8FFF;
PLACEMENT
 FUNCTIONS INTO ROM1, ROM2;
```

If this causes your problem, either recompile your sources with this optimization switched off (see the compiler manual for the correct option) or split the functions by hand into different segments, which are assigned to one section only.

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L2080: 10 bit offset out of range (0 <= <offset> <= 1023)

[ERROR]

Description

10 bit offset out of range.

Tips

If the source file of this branch is an assembly file, take a look at the branch at address <address>. Rewrite to code correctly. Some compilers do assume that functions compiled in the same segment and defined close together get allocated in the same order. When in the link parameter file PLACEMENT such a segment is splitted up into several sections, then larger gaps can be generated:

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SECTIONS
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L2081: Illegal allocation of BIT segment ('<objname>':0x<address>..0x<endaddress> => 0x20..0x3F, 0x400..0x43F)

[ERROR]

Description

Illegal allocation of BIT segment.

L2082: 4 bit offset out of range (-7 <= <offset> <= 15)

[ERROR]

Description

4 bit offset out of range.

Tips

If the source file of this branch is an assembly file, take a look at the branch at address <address>. Rewrite to code correctly. Some compilers do assume that functions compiled in the same segment and defined close together get allocated in the same order. When in the link parameter file PLACEMENT such a segment is splitted up into several sections, then larger gaps can be generated:

```
SECTIONS
 ROM1 = READ_ONLY 0x4000 TO 0x4FFF;
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PLACEMENT
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L2083: 11 bit offset out of range (-2048 <= <offset> <= 2047)

[ERROR]

Description

11 bit offset out of range.

Tips

If the source file of this branch is an assembly file, take a look at the branch at address <address>. Rewrite to code correctly. Some compilers do assume that functions compiled in the same segment and defined close together get allocated in the same order. When in the link parameter file PLACEMENT such a segment is splitted up into several sections, then larger gaps can be generated:

```
SECTIONS
 ROM1 = READ_ONLY 0x4000 TO 0x4FFF;
 ROM2 = READ_ONLY 0x8000 TO 0x8FFF;
PLACEMENT
 FUNCTIONS INTO ROM1, ROM2;
```

If this causes your problem, either recompile your sources with this optimization switched off (see the compiler manual for the correct option) or splitup the functions by hand into different segments, which are assigned to one section only.

If this causes your problem, either recompile your sources with this optimization switched off (see the compiler manual for the correct option) or splitup the functions by hand into different segments, which are assigned to one section only.

L2084: Can't solve reference to object <name>

[ERROR]

Description

Illegal or incompatible object file format. The reference to object <name> can't be solved.

Tips

Recompile the sources. If the result remains the same, contact support for help.

L2085: Can't solve reference to internal object

[ERROR]

Description

Illegal or incompatible object file format. The reference to object <name> can't be solved.

Tips

Recompile the sources. If the result remains the same, contact support for help.

L2086: Cannot switch to segment <segName>. (Offset to big)

[ERROR]

Description

Can't switch to segment <segname>. The offset is too big.

L2087: Object file position error in <objname>

[ERROR]

Description

Object file is corrupt.

Tips

Recompile the sources. If the result remains the same, contact support for help.

L2088: Procedure <funcname> not correctly defined

[ERROR]

Description

The named function was not defined. This error message does occur for example in the case of an used undefined static function.

Tips

Check if this static function is defined.

L2089: Internal: Code size of <objname> incorrect (<data> <obj-size>)

[ERROR]

Description

Illegal object file format. The compiler or the assembler have produced a corrupt object file or the file has been corrupted after creation.

Tips

Do recompile your sources. If recompiling leads to the same results, contact support for help.

L2090: Internal: Failed to write procedures for <modulename>

[ERROR]

Description

Illegal object file format. The compiler or the assembler have produced a corrupt object file or the file has been corrupted after creation.

Tips

Do recompile your sources. If recompiling leads to the same results, contact support for help.

L2091: Data allocated in ROM can't exceed 32KByte

[ERROR]

Description

An object allocated in ROM is bigger that 32K. This is not allowed. The object won't be allocated.

L2092: Allocation of object <objname> failed

[ERROR]

Description

This error does occur when reserved linker segment names were used as identifier or when functions (code) should be placed into a non READ_ONLY segment.

Tips

Do not use reserved names for objects. Check that all you code is placed into READ_ONLY segments.

L2093: Variable <varname> (objectfile <objfile>) appears in module <module1> and in module <module2>

[ERROR]

Description

A variable is defined twice (placed at different locations) in different modules.

L2094: Object <varname> (objectfile <objfile>) appears in module <module1> and in module <module2>

[WARNING]

Description

An object is defined twice (placed at different locations) in different modules.

L2096: Overlap variable <Name> not allocated

[DISABLE]

Description

Variables in segment _OVERLAP are only allocated together with the defining function. This message is issued if all the accesses to some overlap variable are removed, but the variable is defined and should be linked because smart linking is switched off. The option -CAllocUnusedOverlap does change the default behavior so that such variables are allocated. Note: If any not allocated variable is referenced, the linker does issue L2071: Fixup Error: Reference to non linked object (<objname>).

See also

- L2071: Fixup Error: Reference to non linked object (<objname>)

L2097: Additional overlap variable <Name> allocated

[WARNING]

Description

Variables in segment _OVERLAP are only allocated together with the defining function. If a function does not refer to one of its local variables, but this variable is still defined in the object file, this message is issued when allocating this variable. Such an variable is not used, and, even worse, its space is not overlapped with any other variable. Additional overlap variables are only allocated when the option -CAllocUnusedOverlap is specified.

Tips

- Switch on SMART Linking when using overlapping.

See also

- Link Parameter File Command DEPENDENCY

L2098: The label <labelname> cannot be resolved because of a re-

cursion.

[ERROR]

Description

According to the input file depends the label on a recursive definition. For example label is defined as label_b plus some offset and label_b is defined as label a plus some offset.

Tips

- Check the label definition.

L2103: Linking succeeded. Executable is written to <absfile>

[DISABLE]

Description

Success message of the linker. In <absfile> the destination file of the link process (absolute file) is printed with full path. Note that this message is disabled by default. It is only visible if it is explicitly enabled by a command line option.

See also

Command line option -WmsgSi.

L2104: Linking failed

[ERROR]

Description

Fail message of the linker. The specified destination file (absolute file) of the link process is deleted.

L2150: Illegal fixup offset (low bits) in <object> with offset <offset>

to <object>

[ERROR]

Description

The linker cannot resolve the fixup/relocation for a relative 8bit fixup. For this relative fixup the offset has to be even, but it is not.

Tips

Contact support with your example. You may move this message to a warning so you could continue with linking, but code may not execute correctly at the location indicated in the message.

L2151: Fixup out of range (<low> <= <offset> <= <high>) in <object> with offset <offset> to <object>

[ERROR]

Description

The linker cannot resolve the fixup/relocation because the distance to the object is too far. A reason could be that you indicated e.g. that an object/segment is placed in a 8bit address area, but in the linker parameter file the object/segment is placed into a 16bit address area.

Tips

- Check if declaration for the compiler/assembler matches your memory map provided to the linker (parameter file).

L2201: Listing file could not be opened

[ERROR]

Description

The listing output file of the link process could not be opened..

L2202: File for output s could not be opened

[ERROR]

Description

The destination file of the link process (absolute file) could not be opened.

Tips

Check, if it is not opened for reading by any other process (Decoder, Debugger) or the if the destination folder or file is not marked as read only.

L2203: Listing of link process to <listfile>

[DISABLE]

Description

The listing file is printed with full path, if its creation succeeded.

L2204: Segment is not allocated to any section

[ERROR]

Description

A special segment ("_OVERLAP") required by the linker is not allocated to any section.

Example

At the current linker version no other segment than "_OVERLAP" causes this message.

L2205: ROM libraries cannot have a function main (<main>)

[ERROR]

Description

A main function was defined in the absolute file linked to the application as ROM library. This is not allowed as default setting.

L2206: ROM libraries cannot have an INIT function (<init>)

[WARNING]

Description

An init function was defined in the absolute file linked to the application as ROM library. This function can cause a conflict when linking ton an application with an init function with the same name.

L2207: <main> not found

[ERROR]

Description

The function main was not found in any of the linked modules.

L2208: No copydown created for initialized object <Name>. Initialization data lost.

[WARNING]

Description

The named object is allocated in RAM and it is defined with some initialization values. But because no copy down information is allocated, the initialization data is lost.

Example

```
int i= 19;
int j;
```

When linking the code above with no startup code, then the linker does issue this warning for i as its initialization value 19 is not used.

Tips

- If you do not want this object to be initialized, change the source or ignore the warning.

L2251: Link parameter file <prmfile> not found

[ERROR]

Description

The link parameter file (extension .PRM), the source file of the linker, was not found. The specified source file does not exist or the search paths are not correctly set.

Tips

Check your default.env path settings. Link parameter files are searched in the current directory or in the list of paths specified with the environment variable GENPATH.

L2252: Illegal syntax in link parameter file: <syntaxerror>

[ERROR]

Description

A syntax error occurred in the link parameter file. The detailed error cause is printed in <syntaxerror>.

Example

- "number too big"

Tips

The cause of the errors reported here are syntactically and therefore easily detected are with the given source position info.

L2253: <definition> not present in link parameter file

[ERROR]

Description

The definition of <definition> is not present in the link parameter file, but absolutely required by the link process.

Example

```
"NAMES" definition is not present in the link parameter
file"
```

Tips

- Use a template link parameter file, for your target, where all these definitions are always present. Modify this file for your application. This way you avoid to write the same default settings for every application again and you will not forget definitions that have always to be present.

L2254: <definition> is multiply defined in link parameter file

[ERROR]

Description

The definition of <definition> is allowed to be present only once but duplicated in the link parameter file.

Example

```
"PLACEMENT definition is duplicated in the link parameter
file"
```

L2257: Both stacktop and stacksize defined

[ERROR]

Description

You can only define STACKTOP or STACK size, because a specification of one of them defines the settings of the other.

L2258: No stack definition allowed in ROM libraries

[ERROR]

Description

No stack definition allowed in ROM libraries.

L2259: No main function allowed in ROM libraries

[ERROR]

Description

No main function allowed in ROM libraries.

L2300: Segment <segmentname> not found in any objectfile

[WARNING]

Description

A segment, declared in the link parameter file, was not found in any object file.

Tips

Check this name in the linker parameter file and in the sources. This message is issued to warn about possible spelling differences from a segment name in the source files and in the link parameter file. If the link parameter file is shared between different projects and some of them do not have this segment, you can disable this message.

L2301: Segment <segmentname> must always be present

[ERROR]

Description

Some segments are absolutely required by the linker. If they are not present an error is issued.

Example

"SSTACK" is such a segment if the linked file becomes an executable and not a ROM library.

L2303: Segment <seg1> has to be allocated into <seg2>

[ERROR]

Description

Segment <seg1> has to be allocated in <seg2>

Example

(For XA only): ROM_VAR has to be allocated in ROM section.

L2304: <segmentname> appears twice in the <deflist> definition list

[ERROR]

Description

The name <segmentname> appears twice in the definition list <deflist> of the link parameter file. <deflist> is either SECTIONS or PLACEMENTS.

Example

"MY_RAM appears twice in the SECTIONS definition list."

L2305: In link parameter file: The segment has the section type <type> (illegal)

[ERROR]

Description

The section type of segment is illegal.

L2306: Section <<seg1start>,<seg1end>> and Section <<seg2start>,<seg2end>> overlap

[ERROR]

Description

Segments are not allowed to overlap.

L2307: SSTACK cannot be allocated on more than one section

[ERROR]

Description

The stack has to be placed in one single section.

L2308: Size of Stack (STACKSIZE = 0x<stacksize>) exceeds size of segment SSTACK (=0x<segmentsize>)

[ERROR]

Description

The STACKSIZE definition defines the size of the stack, that has to be placed in SSTACK. Therefore STACKSIZE is not allowed to exceed the size of SSTACK.

L2309: STACKTOP-command specifies 0x<stacktop> which is not in SSTACK (0x<stackstart>..0x<stackend>)

[ERROR]

Description

The STACKTOP definition defines the top address of the stack, that has to be placed in SSTACK. Therefore STACKTOP is not allowed to be outsize of the SSTACK segment.

L2310: The STACKTOP definition is incompatible with SSTACK being part of a list of segments

[ERROR]

Description

The STACKTOP definition in the link parameter file conflicts with the definition of the stack segment SSTACK in the link parameter file.

Tips

Change one of the definitions in the link parameter file.

L2311: STACKTOP or STACKSIZE missed

[ERROR]

Description

No STACKTOP or STACKSIZE declared, so no stack defined.

L2312: Stack not initialized

[WARNING]

Description

If the stack is defined, it has to be initialized.

L2313: All <segtype>_BASED segments must fit in a range of 64

kBytes

[ERROR]

Description

Based segments must be smaller that 64K.

L2314: A <segtype>_BASED segment must not have an address less than <address>

[ERROR]

Description

Only for the HC16. Based segments must be smaller that 64K.

L2315: A <segtype>_BASED segment must not have an address bigger than <address>

[ERROR]

Description

Only for the HC16. Based segments must be smaller that 64K.

L2316: All SHORT <segtype>_BASED segments must fit in a range of <range> Bytes (<startadr> - <endadr> > 256 Bytes)

[ERROR]

Description

Only for the HC16. Based short segments must be smaller that 256 Bytes.

L2317: All non far segments have to be allocated on one single

page

[ERROR]

Description

Only far segments can be allocated on multiple pages. All others have to be allocated on a single page.

L2318: Cannot split _OVERLAP

[ERROR]

Description

The linker does not support to split the _OVERLAP segment into several areas in the HIWARE object file format. In the ELF object file format, this is supported.

Tips

- Check if you can use the ELF object file format. Most of the build tools do support it as well as the HIWARE object file format.

L2400: Memory model mismatch: <model1> (previous files) and model <model2> in module <objfile>

[ERROR]

Description

The memory model of an application to link has to be unique for all modules. If this error is moved to a warning or less, then the application is generated. However, depending on the compilation units, the generated application might not work as different memory models do usually have different calling conventions. Also other problems might occur. This message should only be moved by experienced users.

L2401: Target CPU mismatch: <cpu1> (previous files) and <cpu2>

in module <objfile>

[ERROR]

Description

The memory model of an application to link has to be unique for all modules. If this error is moved to a warning or less, then the application is generated. However, depending on the compilation units, the generated application might not work as different memory models do usually have different calling conventions. Also other problems might occur. This message should only be moved by experienced users.

L2402: Incompatible flags or compiler options: <flags>

[ERROR]

Description

The flags set in an object file are incompatible with these of proceeding object files or with compiler options. One case where this option is used are incompatible floating point options.

L2403: Incompatible flags or compiler options: <flags>

[WARNING]

Description

Same as L2402: Incompatible flags or compiler options: <flags>, but not an error, but a relocatable warning message. One case where this option is used are incompatible floating point options.

L2404: Unknown processor: <processor> in module <modulename>

[ERROR]

Description

The target processor id is not recognized by the linker. This may be caused by the support of a target by the compiler that is not yet supported by the linker version used, or the object file is corrupt. Another cause may be an internal error in the Linker.

Tips

If recompiling leads to the same results, contact support for help.

L2405: Illegal address range in link parameter file. In the <model> memory model data must fit into one page

[ERROR]

Description

Some memory models (SMALL, MEDIUM1) require the data segment to be allocated into one page.

L2406: More than one data page is used. Segment <segname> is in page 0

[WARNING]

Description

Only for the HC16. In the small memory model the data page must fit into page 0.

L2407: More than one data page is used in <memorymodel> memory model. The data page is defined by the placement of the stack

[WARNING]

Description

Some memory models (SMALL, MEDIUM) require the data page to be defined in the same placement as the stack.

L2408: Illegal address range in link parameter file. In <memorymodel> memory model the code page must be page zero

[ERROR]

Description

Some memory models (SMALL) require the code page to be on page 0.

L2409: Multiple links are illegal: <object1>(module <module1>) links to <link1>(module <toModule1>) and to <link2>(module <toModule2>)

[ERROR]

Description

Inconsistency in the handling of unresolved imports. The importing object <object1> in the module <module1> found the definition of an external candidate object twice. (The first exporter is the object <link1> in the module <toModule1> and the second exporter is the object <link2> in the module <toModule2>.

L2410: Unresolved external <object> (imported from <module>)

[ERROR]

Description

An external imported from module <module> could not be found in any object file.

L2412: Dependency '<object>' description: ''

[WARNING]

Description

This warning is issued if the linker cannot handle a part of a link parameter file command "DEPENDENCY". Usually some of the named objects cannot be found. The linker does not consider this <object> anymore for the dependency information.

Tips

Check the spelling of all names. See in the mapfile how C++ name-mangled objects are called.

See also

Link parameter file command DEPENDENCY

L2413: Align STACKSIZE from <oldSize> to <newSize>

[INFORMATION]

Description

The stack size is aligned to a new value. The actual alignment needed depends on the target processor.

Tips

Specify an aligned size in the PRM file, if your processor needs an aligned stack.

L2414: Stacksize not aligned. Is <oldsize>, expected to be aligned to <expectedsize>

[WARNING]

Description

The stack size is not aligned to an expected size. The actual alignment needed depends on the target processor.

Tips

Specify an aligned size in the PRM file, if your processor needs an aligned stack.

L2415: Illegal dependency of '<object>'

[ERROR]

Description

This error is only generated for illegal object files. Check the producing tool.

L2416: Illegal file name '<Filename>'

[ERROR]

Description

The specified filename is was not correctly terminated. This error may happen if a filename is specified with a single double quote.

Example

```
LINK "a.abs
...
```

Tips

Terminate the file name with a second double quote.

L2417: Object <objname> refers to non existing segment number <segnumber>

[ERROR]

Description

The specified object refers to a segment number which is not defined in the segment table of the object file. This error only occurs for illegal, corrupted object files.

Tips

Delete the object file, and rebuild it. If the error occurs again, contact the vendor of the object file producing tool. If this error is ignored, the default ROM/RAM segment is assumed.

L2418: Object <objname> allocated in segment <segname> is not allocated according to the segment attribute <attrname>

[WARNING]

Description

The linker has found an object, allocated in a segment with a special segment attribute, which was not allocated according to this attribute. This warning occurs when the source code attributes do not correspond to the memory area specified for the segment.

Example

Note: This example generates the warning only for target compilers supporting the SHORT segment modifier. C source file (test.c):

```
#pragma DATA_SEG SHORT SHORT_SEG
int i;
void main(void) {
 i=1;
}
```

PRM file (test.prm)

```
LINK test.abs
NAMES test.o END
SECTIONS
 MY_RAM = NO_INIT   0x180 TO 0x1ff;
 MY_ROM = READ_ONLY 0x1000 TO 0x1fff;
PLACEMENT
 DEFAULT_ROM INTO MY_ROM;
 DATA_SEG, _OVERLAP, DEFAULT_RAM INTO MY_RAM;
END
INIT main
```

Tips

Check your sources and your link parameter file if the handle the named object and segment correctly.

L4000: Could not open object file (<objFile>) in NAMES list

[ERROR]

Description

The linker could not open any object file in the NAMES list. This message prints out the name of the last file in the names list found (<objFile>).

Tips

Check your default.env path settings. Object files are searched in the current directory or in the list of paths specified with the environment variables OBJPATH and GENPATH.

L4001: Link parameter file <PRMFile> not found

[ERROR]

Description

The specified source file does not exist or the search paths are not correctly set.

Tips

Check your default.env path settings. Link parameter files are searched in the current directory or in the list of paths specified with the environment variable GENPATH.

L4002: Unable to determine object file format for <PRMFile>. NAMES section missing? Use -F option to specify format.

[ERROR]

Description

The linker was not able to determine the object file format. A possible cause is that no object files at all are linked.

Tips

The linker detects the object file format by checking the files in the NAMES sections of the prm file and all the files passed in with the -add option. Check if there are any object files present at all. Use the option -FE for the ELF object file format or -FH for the hiware object file format.

L4003: Linking <PRMFile> as HIWARE format link parameter file

[DISABLE]

Description

The linker detects the object file format to link by scanning the NAMES section for the first file that it can open to evaluate the file format. If the first file in the NAMES section, which can be opened by the linker is a HIWARE object file, this message is issued and the HIWARE object file format linker, a subprocess of the HIWARE Linker is started. Note that this message is disabled by default. It is only issued if the message is explicitly enabled on the command line.

See also

Command line option -WmsgSi.

L4004: Linking <PRMFile> as ELF/DWARF format link parameter file

[DISABLE]

Description

The linker detects the object file format to link by scanning the NAMES section for the first file that it can open to evaluate the file format. If the first file in the NAMES section, which can be opened by the linker is a ELF/DWARF object file, this message is issued and the ELF/DWARF object file format linker, a subprocess of the HIWARE Linker is started. Note that this message is disabled by default. It is only issued if the message is explicitly enabled on the command line.

See also

Command line option -WmsgSi.

L4005: Illegal file format of object file (<objFile>)

[ERROR]

Description

There is no object file in the NAMES list with a known file format or a object file specified with option -Add has a unknown file format.

Tips

Check your default.env path settings. Object files are searched in the current directory or in the list of paths specified with the environment variables OBJPATH and GENPATH. It may be that you have files of another development environment in your directories.

L4006: Failed to create temporary file

[ERROR]

Description

The linker creates a temporary file for the prescan of the link parameter file in the current directory. If this fails, the Linker can't continue.

Tips

Enable the read access to files for the Linker in the current directory.

L4007: Include file nesting to deep in link parameter file

[ERROR]

Description

Only an include file nesting of maximum depth 6 is allowed.

L4008: Include file <includefile> not found

[ERROR]

Description

The include file <includefile> was not found.

L4009: Command <Command> overwritten by option <Option>

[WARNING]

Description

This message is generated, when a command from the PRM file is overwritten by a command line option.

- <command name>: name of the command, which is overwritten by a linker option

In this case the command line option is stronger than the command specified in the PRM file. The commands, which may be overwritten by a command line option, are:

LINK, which may be overwritten by the option -O (definition of the output file name).MAPFILE, which may be overwritten by the option -M (enable generation

of the MAP file).INIT, which may be overwritten by the option -E (definition of the application entry point). When the LINK command is detected in the PRM file and the option -O is specified on the command line, following message is generated:

```
'Command LINK overwritten by option -O'
```

L4010: Burner file creation error ''

[ERROR]

Description

The built-in burner was not able to generate an output file because of the given reason.

Tips

The application (*.abs) is still generated correctly. You might use the external burner to produce the file.

L4011: Failed to generate distribution file because of <reason>

[DISABLE, INFORMATION, WARNING,ERROR]

Description

Failed to generate a distribution file because of the given reason <reason>.

See also

Option -Dist Section Automatic Distribution of Variables

L4012: Failed to generate distribution file because of distribution segment not found or not alone in placement

[ERROR]

Description

This message is generated, when the distribution segment doesn't exist in the placement of the PRM file or if it doesn't stay alone in the placement.

Example

If DISTRIBUTE is the distribution segment , it has to stay ALONE in the placement. Then it should look as follows:

```
PLACEMENT
 DISTRIBUTE DISTRIBUTE_INTO MY_ROM0, MY_ROM1;
```

See also

Option -Dist Section Automatic Distribution of Variables

L4013: Function <function> is not in the distribution segment

[DISABLE]

Description

If a function inside of the distribution segment is called from a outside one (the one mentioned in the message), it has to have a far calling convention. This has a negative influence of the optimization. This message is generated to have an overview from which outside functions incoming calls exist.

Tips

If it's possible, insert this functions in the distribution segment.

See also

- Option -Dist

L4014: The processor <processor> is not supported by the linker optimizer

[ERROR]

Description

This message is generated, when the processor is not supported by the linker optimizer.

Tips

If your target CPU has to be supported with this optimization, please check with support if this could be done with a new release.

L4015: Section <section> has no IBCC_NEAR or IBCC_FAR flag

[ERROR]

Description

This message is generated, when a section <section> which is in the distribution segment doesn't have an IBCC_NEAR (inter bank calling convention near) or an IBCC_FAR (inter bank calling convention far) Flag.

Example

Each section in the PLACEMENT list used for the distribution (DISTRIBUTE_INTO) has either to have the IBCC_NEAR or the IBCC_FAR flag.

```
SECTIONS
 MY_ROM0 = READ_ONLY IBCC_NEAR 0x005000 TO 0x00504F;
 MY_ROM1 = READ_ONLY IBCC_FAR 0x018000 TO 0x018050;
 MY_ROM2 = READ_ONLY IBCC_FAR 0x028000 TO 0x0280F0;
END
PLACEMENT
 DISTRIBUTE DISTRIBUTE_INTO MY_ROM0, MY_ROM1, MY_ROM2;
END
```

See also

- Option -Dist

L4016: No section in the segment has an IBCC_NEAR flag

[INFORMATION]

Description

This message is generated, when no section which is in the distribution segment has an IBCC_NEAR Flag (inter bank calling convention).

Tips

Check if you really don't want to have distributed functions in a near section. Placing functions in a near section may increase performance and could improve code density.

See also

- Option -Dist

L4017: Failed to generate distribution file because there are no functions in the distribution segment

[ERROR]

Description

This message is generated, when no functions are found in the code segment . is the name of the distribution segment, which contains the functions for the optimized distribution. For the Linker optimizer it is necessary to specify in the source files a command like: pragma CODE_SEG . All functions which follow this command are automatically distributed into this Segment.

Tips

- Check if your compiler supports the "#pragma CODE_SEG".

See also

- Option -Dist

L4018: The sections in the distribution segment have not enough memory for all functions

[ERROR]

Description

This message is generated, when the functions which were distributed into the special distribution segment have not enough space into the sections of it.

Tips

- Add more pages to the distribution segment or increase the size of these pages.

See also

- Option -Dist

L4019: Function <function name>=""> has a near flag and cannot be distributed

[ERROR]

Description

The linker optimizer doesn't support functions which are assigned in the source code with a near flag.

Example

MyFunction is distributed in the distribution segment "DISTRIBUTE" and has a near flag:

```
#pragma CODE_SEG DISTRIBUTE
void near MyFunction(void) {}
```

Tips

Avoid to use the near Flag

```
void near MyFunction(void) {}
```

See also

- Option -Dist

L4020: Not enough memory in the non banked sections of the distribution segment

[ERROR]

Description

While optimizing functions out of the distribution segment, the linker has not found enough memory in the non banked sections of the distribution segment. Only functions which have a near flag can be placed in a non banked section.

Tips

All near functions must have enough space in the near sections (sections with the IBCC_NEAR flag) of the distribution segment. If possible increase the size of the non banked sections of the distribution segment, otherwise remove some near functions from it.

See also

- Option -Dist

L4021: Incompatible derivative: <Deriv0> in previous files and <Deriv1> in current file

[WARNING]

Description

The two mentioned object files were compiled or assembled for different, incompatible derivatives of the same CPU family. Depending on which features of the two derivatives were used, the generated executable might not work for the one or the other derivative (or even for none of them).

Tips

- Recompile your sources, and use a common setting for all source files.

L4022: HexFile not found: <Filename>

[ERROR]

Description

The hexfile <Filename> to link with (specified with the HEXFILE command in the link parameter file) was not found. The specified hex file does not exist or the search paths are not correctly set.

Tips

Check your default.env path settings. Hex files are searched in the current directory or in the list of paths specified with the environment variable GENPATH.

L4023: Hexfile error '' in file '<Filename>'

[ERROR]

Description

The linker did find some problems with the hexfile <Filename>. Possible problems are a bad checksum, a bad length, a too large length (>256) or an otherwise corrupted file.

Tips

- Check if the file specified is really a hex file. If yes, create it and try again.

L4024: No information available for segment '<name>'.

[WARNING]

Description

A undefined symbol started with one of the linker defined prefixes "__SEG_START_", "__SEG_END_" or "__SEG_SIZE_" but the name of the following segment was not known. Therefore the linker does not know to which address this symbol should evaluate. To handle this case, the linker does issue this message and the linker is using the address 0 as address. However, the linking does not fail. Note: Recent linkers are also issuing L4024 for known sections which are

empty. Previous versions did silently show these sections to be at address 0 with a size of 0.

Example

```
extern char __SEG_START_UNKNOWN_SEGMENT[];
```

Tips

- Check the spelling.

L4025: This limited version allows only <num> <limitKind>

[ERROR]

Description

Depending on your license configuration, the linker may e.g. limited only to allow up to 4K C++ code. The limitation size you will see from the <num> field and the limitation kind (e.g. C++ code) you can see from the <limitKind> field. The limitations are also shown in the about box.

Tips

- Check if you are using a correct license configuration.

L4026: Incompatible compile-time options: different HCS12XE memory mappings found in object files

[WARNING]

Description

The HCS12XE specific mapping of different resources to the 0x4000 must be consistently configured for the complete application. This message is issued if different object files were compiled with different settings.

Tips

- Use the same options for all object files.

L4027: Incompatible compile-time options: different HCS12XE memory mappings found in object files

[WARNING]

Description

The HCS12XE specific mapping of different resources to the 0x4000 must be consistently configured for the complete application. This message is issued if a object file is using a different mapping than the one which was specified to the linker.

Tips

Use the same options for the linker as for the compiler and assembler.

L4028: Section '<SectionName>' has no DATA_NEAR or DATA_FAR flag

[ERROR]

Description

This message occurs for Memory Banker feature(data distribution of objects) if a segment is not specified with any access specifiers.

L4029: No objects in the distribution segment ''

[DISABLE]

Description

This message occurs if using MemoryBanker (automated distribution for code/data) and if nothing is placed in the specified distribution section.

Tips

- This message can be safely ignored, but can show that due to some pragma's are not placed in the distribution segment.

- When using MemoryBanker, avoid the usage of the DEFAULT segment. This will take objects out of the optimization set. Use #pragma push and #pragma pop instead.

L4030: Failed to generate data distribution file because of distribution segment '<SegmentName>' not found or not alone in placement.

[ERROR

Description

This message occurs for Memory Banker feature (Automatic data distribution) if the PLACEMENT section in PRM file does not have the information about the assignment of data distribute section/s to segments.

L4032: No section in the segment <SegmentName> has a DATA_NEAR flag

[INFORMATION]

Description

This error is thrown if Memory Banker option is ON and distribute section is placed in banked memory.

In placement section, distribute section should be assigned to atleast one segment that maps to non banked memory.

L4033: Not enough memory in the section of the distribution segment for object <ObjectName>

[ERROR

Description

The error is thrown if the object of distribute section is not allocated any memory due to insufficient memory space in distribute segments.L4100: Failed to convert address '<srcAddress>' of '<object>' because of '<Reason>'.

[WARNING]

Description

For the HCS12X, addresses in the external memory starting at global 0x140000'G are not mapped in the paged address space, and therefore taking the paged address of an object allocated in that range fails.

Tips

- Check that the correct address space is specified in the prm. For the S12X, when using global addresses, a 'G suffix is required.

L4101: Preprocessor failure because of '<Reason>'.

[ERROR]

Description

To support the C preprocessing of prm files, the linker itself does handle the line C preprocessor directive. With the line directive, it is possible to redirect error messages to another file. Note that the linker does not handle any other preprocessor directives. Instead, use the C compiler and emit a preprocessor listing which then contains the line directives so that errors are reported for the original not preprocessed source file.

Tips

Check the ANSI C compiler for a list of features.

L4102: Computation of total memory size per memory type (e.g. _SEG_TOTAL_RW) unavailable in Hiware format

[ERROR]

Description

This is only available with ELF format.

L4104: Library file '<FileName>' should be recompiled with option <Reason>

[INFORMATION]

Description

This message is related to Memory Banker feature and is emitted in first pass by linker. It gives information about the option with which the input library has to be recompiled and linked to application in the second pass.

L4105: Library file <Filename> not found

[ERROR]

Description

This error message occurs for option -ReadLibFile<filename> in second pass of Memory Banker when the specified file is not found.

L4106: Startup file '<FileName>' should be recompiled with option <Reason>

[INFORMATION]

Description

This message is related to Memory Banker feature and is emitted in first pass by linker. It gives information about the option with which the startup file shoulde be compiled and integrated to the application.

L4107: Linker implicitly allocates objects of '<section>' after section '<section>'.

[INFORMATION]

Description

There can be user defined sections not allocated to segments in PLACEMENT block of PRM file. Linker assigns objects of such section to DEFAULT segments. This message is issued for those type of sections. If DEFAULT_ROM and ROM_VAR sections are assigned to same segments in PLCAEMENT block of PRM,then user defined constant section(not allocated to segment in PRM) is placed after DEFAULT_ROM section. If they are assigned to disjoint segments then user defined constant section gets placed after ROM_VAR section.

Tips

Assign user defined section to segments in PLACEMENT block of PRM file.

L4108: Section '<SectionName>' is assigned to multiple segments or pages

[DISABLED]

Description

This message occurs if a section is assigned to multiple segments or pages.

L4109: Link from function <ObjectName> to <> is disables as it initiates indirect recursivity

[WARNING]

Description

This message occurs for functions that cause indirect recursitivity.

For example:

```
a() { b();}
B() {c(); }
C() { a();}
Link from c() to a() is removed during Stack Consumption
Computation.
```

Tips

```
The total stack effect of indirect recursion can be
explicitly added under STACK_CONSUMPTION directive.
Like,

STACK_CONSUMPTION

ROOT main

RECURSION_FACTOR a b c 20;

END

END
```

L4110: Maximum stack consumption computed for root <Object-Name> is <,> and this exceeds the stack size in input PRM file.

[WARNING]

Description

This message occurs when the linker calculated stack effect for the application is greater than the input stack size specified in the PRM file.

L4111: No input in PRM file for STACK_CONSUMPTION

[WARNING]

Description

This message occurs when there is no input in PRM file for STACK_CONSUMPTION directive but the -StackConsumption option is being passed to linker. Linker calculates stack effect for entries specified in VECTORS and ENTRIES directives of PRM file.

L4112: Function <ObjectName> specifid under STACK_CONSUMPTION entry of pRM file is not found

[ERROR]

Description

Linker builds an internal dependency graph of functions and stack effect calculation is done for this graph. The error is thrown if the function specified under STACK_CONSUMPTION entry is not found in this graph.

L4113: Stack size information for function <ObjectName> is not available Default stack size of this function is considered as zero

[WARNING]

Description

This message occurs while computing total stack effect of application.The stack size information of function is not passed by compiler.

Tips

The stack size of function can be explicitly specified with CONSUMPTION directive.

For example, an assembly function stack size information is not given by compiler. The same can be added in PRM file as below:

```
STACK_CONSUMPTION
CONSUMPTION foo 100;
END
```

L4114: Stack consumption option [<Command>] is diabled. Maximum stack usage for the application will not be computed.

[WARNING]

Description

This message occurs when the input PRM file has STACK_CONSUMPTION directive entries and the option -StackConsumption is not enabled. This option should be enabled for Stack Consumption Computation of application.

L4115: The nesting depth of the call graph exceeds <Reason>. Max-

imum stack usage for the application will not be computed.

[WARNING]

Description

The default nesting depth for Stack Consumption feature is specified as 256. The message occurs when the nesting depth of application exceeds this count.

Tips

The stack size information of a function including its successive callee stack size can be specified with CONSUMPTION directive in PRM file.

L4116: The indirect recursion depth exceeds <Reason>. Maximum stack usage display might be incorrect.

[WARNING]

Description

The nesting depth for recursive functions can be up to 256. The message when this count is exceeded.

Tips

The complete stack size information for recursion can be specified through CONSUMPTION directive.

L4117: Duplicate entry "ROOT <RootName>" in PRM file.

[WARNING]

Description

This message occurs when multiple ROOT entries of same name are specified under STACK_CONSUMPTION directive in PRM file.

L4118: Redundant Stack Consumption directives <DirectiveName> and <DirectiveName> specified for function <FunctionName> in

PRM file.

[WARNING]

Description

RECURSION_FACTOR and CONSUMPTION directives are both specified for a function in PRM file under STACK_CONSUMPTION entry. It is redundant and the maximum of them will add to stack effect calculation.

Burner Message List

The section describes all burner messages.

B1: Unknown Message Occurred

[FATAL]

Description

The application tried to issue an undefined message. This is an internal error. Report any occurrences to your distributor.

B2: Message Overflow, Skipping <kind> Messages

[DISABLE, INFORMATION, WARNING, ERROR]

Description

Indicates the application has reached the maximum allowed number of displayed messages as controlled by the burner options:

- -WmsgNi: Number of Information Messages
- -WmsgNw: Number of Warning Messages
- -WmsgNe: Number of Error Messages

Further options of this kind are not displayed.

TIP Use the options `-WmsgNi`, `-WmsgNw` and `-WmsgNe` to change the number of messages of whatever type the utility accepts.

B50: Input file '<file>' not found

[FATAL]

Description

Indicates the Application was unable to find a file needed for processing.

TIP Make sure the file really exits. If you are using a file for which the name contains spaces, you must place quotes around the filename.

B51: Cannot Open Statistic Log File <file>

[DISABLE, INFORMATION, WARNING, ERROR]

Description

Indicates that the application was unable to open a statistic output file, therefore no statistics were generated.

NOTE Not all tools support statistic log files. Even if a tool does not support it, the message still exists, but is never issued.

B52: Error in Command Line '<cmd>

[FATAL]

Description

Issued when an error occurs while processing the command line.

B53: Message <Id> is not used by this version. The mapping of this message is ignored.

[DISABLE, INFORMATION, WARNING, ERROR]

Description

The given message id was not recognized as known message. Usually this message is issued with the options -WmsgS[D|I|W|E]<num> which should map a specific message to a different message kind.

Example

-WmsgSD123456789

TIP There are various reasons why the tool would not recognize a certain message. Ensure that you are using the option with the right tool, say you do not disable linker messages in the compiler preferences. The message may have existed for an previous version of the tool but was removed for example because a limitation does no longer exist. The message was added in a more recent version and the used old version did not support it yet. The message did never exist. Maybe a typo?

B54: Option <Option> <Description>

[DISABLE, INFORMATION, WARNING, ERROR]

Description

This information is used to inform about special cases for options. One reason this message is used is for options which a previous version did support but this version does no longer support. The message itself contains a descriptive text how to handle this option now.

TIP Check the manual for all the current option. Check the release notes about the background of this change.

B56: Option value overriden for option <OptionName>. Old value '<OldValue>'. New value '<NewValue>

[DISABLE, INFORMATION, WARNING, ERROR]

Description

This message occurs when same option is specified more than once with same or different option values.

B64: Line Continuation Occurred in <FileName>

[DISABLE, INFORMATION, WARNING, ERROR]

Description

In an environment file, the character '\' at the end of a line is interpreted as line continuation. This line and the next one are interpreted as one line. Because the path separation character of MS-DOS is also '\', paths are often incorrectly written that end with '\'. Instead use a '.' after the last '\' in a path.

Example

Current `Default.env`:

```
...
LIBPATH=c:\Freescale\lib\
OBJPATH=c:\Freescale\work
...
```

Is interpreted as

```
...
LIBPATH=c:\Freescale\libOBJPATH=c:\Freescale\work
...
```

To fix this code, append a '.' at the end of '\'

```
...
LIBPATH=c:\Freescale\lib\.
OBJPATH=c:\Freescale\work\
...
```

NOTE Because this information occurs during the initialization phase of the application, the message prefix might not occur in the error message. It may appear as `64: Line Continuation occurred in <FileName>`.

B65: Environment Macro Expansion Error '<description>' for <variablename>

[DISABLE, INFORMATION, WARNING, ERROR]

Description

Indicates that a problem occurred during an environment variable macro substitution. Possible causes are that the named macro did not exist, or that some length limitation was reached. Recursive macros may also cause this message.

Example

Current variables:

```
...
LIBPATH=${LIBPATH}
...
```

TIP Check the definition of the environment variable.

B66: Search Path <Name> Does Not Exist

[DISABLE, INFORMATION, WARNING, ERROR]

Description

Indicates that the tool searched for a file or file path that was not found.

To resolve the error:

- Check the spelling of your paths.
- Update the paths when moving a project.
- Use relative paths in your environment variables.
- Make sure network drives are available.

B1000: Could Not Open '<FileType>' '<File>

[ERROR]

Description

Indicates that the specified file could not be opened.

This message is used for input and output files.

TIP For files to be generated, they must be modifiable and sufficient space must be available on the disk. Ensure that the file is not locked by another application and that the path exists.

B1001: Error in Input File Format

[ERROR]

Description

Indicates that an error occurred while reading the input file.

To resolve the error:

- Try to generate the input file again.
- Make sure you have enough free disk space.

B1002: Selected Communication Port is Busy

[ERROR]

Description

Indicates that the application cannot access the selected communication port.

To resolve the error:

- Find out if another application has locked the serial port.
- Make sure the correct serial port is specified.

B1003: Timeout or Failure for the Selected Communication

[ERROR]

Description:

Indicates that a timeout or general failure occurred on the selected communication port.

TIP Find out if another application has locked the serial port.

B1004: Error in Macro '<macro>' at Position <pos>: '<msg>'

[ERROR]

Description

Indicates that the Burner was unable to resolve a macro. A macro is surrounded by % characters (e.g. `%ABS_FILE%`).

To resolve the error:

- Make sure the macro is defined in the environment.
- Make sure the macro is passed on the command line using the `-Env` option.

B1005: Error in Command Line at Position <pos>: '<msg>'

[ERROR]

Description

Indicates that the command line scanner detected an invalid command line.

TIP Check the syntax of your command line.

B1006: '<msg>'

[ERROR]

Description

Indicates that a generic error occurred.

Libmaker Message List

The section describes all documented libmaker messages.

LM1: Unknown Message Occurred

Message Type

[FATAL]

Description

Indicates that the application tried to issue an undefined message. This is an internal error. Report any occurrences to your distributor.

LM2: Message Overflow, Skipping <kind> Messages

Message Type

[INFORMATION]

Description

Indicates that the application has displayed the maximum number of messages of the specific type, as specified by the options:

- -WmsgNi: Number of Information Messages
- -WmsgNw: Number of Warning Messages
- -WmsgNe: Number of Error Messages

Additional messages of this type that exceed the specified limit are not displayed.

TIP Use the options listed above to specify the number of messages that can be displayed.

LM50: Input File '<file>' Not Found

Message Type

[FATAL]

Description

The Application was not able to find a file needed for processing.

TIP Make sure the file really exits. If you are using a file with a name that contains spaces, you must put quotes around the file name.

LM51: Cannot Open Statistic Log File <file>

Message Type

[WARNING]

Description

Indicates that it was not possible to open a statistic output file, therefore no statistics were generated.

NOTE Not all tools support statistic log files. Even if a tool does not support it, the message still exists, but is never issued in this case.

LM52: Error in Command Line <cmd>

Message Type

[FATAL]

Description

Indicates that an error while processing the command line.

LM53: Message <Id> is not used by this version. The mapping of this message is ignored

[WARNING]

Description

The given message id was not recognized as known message. Usually this message is issued with the options -WmsgS[D|I|W|E]<Num> which should map a specific message to a different message kind.

Example

```
-WmsgSD123456789
```

TIP There are various reasons why the tool would not recognize a certain message. Ensure that you are using the option with the right tool, say you do not disable linker messages in the compiler preferences. The message may have existed for an previous version of the tool but was removed for example because a limitation does no longer exist. The message was added in a more recent version and the used old version did not support it yet. The message did never exist. Maybe a typo?

LM54: Option <cmd> :<Description>

[INFORMATION]

Description

This information is used to inform about special cases for options. One reason this message is used is for options which a previous version did support but this version does no longer support. The message itself contains a descriptive text how to handle this option now.

Tips

Check the manual for all the current option. Check the release notes about the background of this change.

LM56: Option value overriden for option <OptionName>. Old value '<OldValue>'. New value '<NewValue>'.

Message Type

[WARNING]

Description

This message occurs when same option is specified more than once with same or different option values.

LM64: Line Continuation Occurred in <FileName>

Message Type

[INFORMATION]

Description

In any environment file, the character '\' at the end of a line is interpreted as a line continuation character. Because the path separation character for MS-DOS is also '\', paths can be incorrectly written if they end with '\'. Use a '.' after the last '\' to distinguish a path from a line continuation character.

Example

Current `Default.env`:

```
...
LIBPATH=c:\freescale\lib\
OBJPATH=c:\freescale\work
...
```

Is interpreted as

```
...
LIBPATH=c:\freescale\libOBJPATH=c:\freescale\work
...
```

To fix it, append a '.' after the '\'

```
...
LIBPATH=c:\freescale\lib\.
OBJPATH=c:\freescale\work
...
```

NOTE Because this information occurs during the initialization phase of the application, the message prefix might not occur in the error message. The message may appear as `64: Line Continuation occurred in <FileName>`.

LM65: Environment Macro Expansion Message '<description>' for <variablename>

Message Type

[ERROR]

Description

Indicates that a problem occurred during an environment variable macro substitution. The named macro may not exist or some length limitation may have been reached. Also recursive macros may cause this message.

Example

Current variables:

```
...
LIBPATH=${LIBPATH}
...
```

TIP Check the definition of the environment variable.

LM66: Search Path <Name> Does Not Exist

Message Type

[INFORMATION]

Description

Indicates that the tool searched for a file that was not found, or that the specified path did not exist.

TIP Check the spelling of your paths. Update the paths when moving a project. Use relative paths.

Decoder Message List

This section lists all decoder messages.

D1: Unknown Message Occurred

[FATAL]

Description

Indicates the application tried to issue an undefined message. This is an internal error. Report this message to your distributor.

D2: Message Overflow, Skipping <kind> Messages

[DISABLE, INFORMATION, WARNING, ERROR]

Description

Indicates the application has issued the maximum number of message types specified with the options:

- -WmsgNi: Number of Information Messages
- -WmsgNw: Number of Warning Messages

- -WmsgNe: Number of Error Messages

Additional messages of this type are not displayed.

TIP Use the options listed above to change the number of messages to display.

D50: Input File '<file>' Not Found

```
[FATAL]
```

Description

Indicates the application was unable to find a file needed for processing.

TIP Make sure the file really exists. If you are using a file with a name that contains spaces, you must enclose the file name in quotes.

D51: Cannot Open Statistic Log File <file>

```
[DISABLE, INFORMATION, WARNING, ERROR]
```

Description

Indicates the application was unable to open a statistic output file, therefore no statistics are generated.

NOTE Not all tools support statistic log files. Even if a tool does not support it, the message still exists, but is not issued in this case.

D52: Error in Command Line <cmd>

```
[FATAL]
```

Description

Indicates an error occurred while processing the command line.

D53: Message <Id> is not used by this version. The mapping of this message is ignored

[WARNING]

Description

The given message id was not recognized as known message. Usually this message is issued with the options -WmsgS[D|I|W|E]<Num> which should map a specific message to a different message kind.

Example

```
-WmsgSD123456789
```

TIP There are various reasons why the tool would not recognize a certain message. Ensure that you are using the option with the right tool, say you do not disable linker messages in the compiler preferences. The message may have existed for an previous version of the tool but was removed for example because a limitation does no longer exist. The message was added in a more recent version and the used old version did not support it yet. The message did never exist. Maybe a typo?

D54: Option <cmd> <description>

[INFORMATION]

Description

This information is used to inform about special cases for options. One reason this message is used is for options which a previous version did support but this version does no longer support. The message itself contains a descriptive text how to handle this option now.

Tips

Check the manual for all the current option. Check the release notes about the background of this change.

D56: Option value overriden for option <OptionName>. Old value '<OldValue>'. New value '<NewValue>'.

[DISABLE, INFORMATION, WARNING, ERROR]

Description

This message occurs when same option is specified more than once with same or different option values.

D64: Line Continuation Occurred in <FileName>

[DISABLE, INFORMATION, WARNING, ERROR]

Description

In any environment file, the character '\' at the end of a line is interpreted as line continuation. This line and the next one are handled as one line. Because the path separation character of MS-DOS is also '\', paths that end with '\' are often incorrectly written. Instead, use a '.' after the last '\' unless you really want a line continuation.

Example

Current `Default.env`:

```
...
LIBPATH=c:\freescale\lib\
OBJPATH=c:\freescale\work
...
```

This is identical to:

```
...
LIBPATH=c:\freescale\libOBJPATH=c:\freescale\work
...
```

To fix it, append a '.' after the '\'

```
...
LIBPATH=c:\freescale\lib\.
OBJPATH=c:\freescale\work
...
```

D65: Environment Macro Expansion Message '<description>' for <variablename>

```
[DISABLE, INFORMATION, WARNING, ERROR]
```

Description

Indicates a problem occurred during an environment variable macro substitution. Possible causes are that the named macro did not exist or a length limitation was reached. Also, recursive macros may cause this message.

Example

Current variables:

```
...
LIBPATH=${LIBPATH}
...
```

TIP Check the definition of the environment variable.

D66: Search Path <Name> Does Not Exist

```
[DISABLE, INFORMATION, WARNING, ERROR]
```

Description

Indicates that the tool looked for a file that was not found, or a path name that does not exist.

TIP Check the accuracy of your paths. Update the paths when moving a project. Use relative paths.

D1000: Bad Hex Input File <Description>

```
[DISABLE, INFORMATION, WARNING, ERROR]
```

Description

Indicates that the decoder detected incorrect entries in the file while decoding an S-Record or an Intel Hex file. The content of `<Description>` gives more detail.

TIP Check the descriptive text to ensure that the correct file was passed to the decoder.

D1001: Because Current Processor is Unknown, No Disassembly is Generated. Use -proc.

`[DISABLE, INFORMATION, WARNING, ERROR]`

Description

While decoding n S-Record or an Intel Hex file, the decoder needs to know about the processor used to decode the file with disassembly information. This is needed because these formats do not contain information about the processor.

TIP Use the `-Proc` option (see -Proc: Set Processor (Decoder)) to specify the processor.

D1002: Memory allocation failed. Possible reasons: corrupt input file or not enough memory available

[FATAL]

Description

During processing the input file, the decoder was not able to allocate enough memory to process it.

Tips

Check if your input file is a legal file (and not corrupted). Try to extend the memory available to the decoder utility.

D1003: An invalid checksum has been found

[WARNING]

Description

While decoding a Motorola S-Record, the decoder has found that the checksum is wrong.

Tips

Verify if the S-Record file is corrupted. It may be that the tool generated the S-Record was not calculating the checksum correctly.

D1004: File IO Error for file <Filename>

[ERROR]

Description

There was an unexpected error returned from the file system. The error could have happened because of a read, write, seek or any other file system operation. However this error is not returned for "normal" error cases like non existing files or files with unexpected content.

Tips

Possible causes are that the file was on a removable storage and this storage was detached while being accesses, network failures for networked files, bad disks or others. Check if this problem persists with a local file. Also try to copy the file and use its copy, this will detect cases in which another application is currently locking the file.

Makefile Messages

This section lists and describes error messages that can appear when:

- Maker detects an error in the makefile
- A called application detects an error that Maker catches

M1: Unknown Message Occurred

Message Type

[FATAL]

Description

Maker tried to send an undefined message. This internal error should not occur. Report it to your distributor.

M2: Message Overflow, Skipping <kind> Messages

Message Type

[INFORMATION]

Description

The tool displays the number of messages of the specific kind as controlled with the options.

- -WmsgNi: Number of Information Messages
- -WmsgNw: Number of Warning Messages
- -WmsgNe: Number of Error Messages

Maker does not display further options of this kind.

TIP Use the options `-WmsgNi`, `-WmsgNw` and `-WmsgNe` to change the number of messages.

M50: Input File '<file>' Not Found

Message Type

[FATAL]

Description

The Application did not find a file needed for processing.

TIP Make sure the file really exists. If using a file name containing spaces, enclose the file name in quotes.

M51: Cannot Open Statistic Log File <file>

Message Type

[WARNING]

Description

Maker could not open a statistic output file, therefore it generated no statistics.

NOTE If a tool does not support statistical log files, the message still exists but Maker does not issue it.

M52: Error in command line <cmd>

[FATAL]

Description

In case there is an error while processing the command line, this message is issued.

M53: Message <Id> is not used by this version. The mapping of this message is ignored.

[WARNING]

Description

The given message id was not recognized as known message. Usually this message is issued with the options -WmsgS[D|I|W|E]<Num> which should map a specific message to a different message kind.

Example

```
-WmsgSD123456789
```

TIP There are various reasons why the tool would not recognize a certain message. Ensure that you are using the option with the right tool, say you do not disable linker messages in the compiler preferences. The message may have existed for an previous version of the tool but was removed for example because a limitation does no longer exist. The message was added in a more recent version and the used old version did not support it yet. The message did never exist. Maybe a typo?

M54: Option <Option> .

[INFORMATION]

Description

This information is used to inform about special cases for options. One reason this message is used is for options which a previous version did support but this version does no longer support. The message itself contains a descriptive text how to handle this option now.

Tips

Check the manual for all the current option. Check the release notes about the background of this change.

M56: Option value overriden for option <OptionName>. Old value '<OldValue>'. New value '<NewValue>'.

[WARNING]

Description

This message occurs when same option is specified more than once with same or different option values.

M64: Line Continuation Occurred in <FileName>

Message Type

[INFORMATION]

Description

In any environment file, the backslash character (\) at the end of a line denotes a line continuation. Maker handles this line and the next one as a single line. Because the backslash is also the path-separation character in MS-DOS, paths often incorrectly end in '\'. Use a period (.) after the last backslash unless you really want a line continuation.

Example

```
Current Default.env:
...
LIBPATH=c:\freescale\lib\
OBJPATH=c:\freescale\work
...
which Maker interprets as:
...
LIBPATH=c:\freescale\libOBJPATH=c:\freescale\work
...
```

TIP Append a period (.) behind the backslash (\).

```
...
LIBPATH=c:\freescale\lib\.
OBJPATH=c:\freescale\work
...
```

NOTE Because this information occurs during the Maker's initialization phase, the `M` may not occur in the error message but may appear as `64: Line Continuation occurred in <FileName>`.

M65: Environment Macro Expansion Error '<description>' for <variablename>

Message Type

[INFORMATION]

Description

Indicates that a problem occurred during an environment-variable macro substitution. Possible causes are that the named macro did not exist or some length limitation occurred. Recursive macros may also cause this message.

Example

```
Current Default.env:
...
LIBPATH=${LIBPATH}
...
```

TIP Check the definition of the environment variable.

M66: Search Path <Name> Does Not Exist

Message Type

[INFORMATION]

Description

Indicates that the tool was unable to find a file. The search failed because the tool was searching for a non-existent path.

To resolve the error:

- Check the spelling of your paths.
- Update the paths when moving a project.
- Use relative paths in your environment variables.
- Make sure network drives are available.

M5000: User Requested Stop

Message Type

[ERROR]

Description

The user clicks the **Stops the current make process** icon. A message dialog prompts you to continue or interrupt the current make process.

M5001: Error in Command Line

Message Type

[ERROR]

Description

Maker detected a syntax error in the command line. Maker scans only the tokens that start with a dash (-) (which signals options) but leaves the other names in command line unscanned. Because Maker assumes that these tokens represent filenames, it answers only option errors with this message. It prints M5019 for other syntactical errors.

Example

```
maker -Y
## Y is an illegal option
```

TIP Call Maker with the `-h` argument for a list of options.

M5002: Can't Return to <makefile> at End of Include File

Message Type

[ERROR]

Description

The makefile executed before opening the include file and Maker cannot reopen it again.

TIP Make sure the makefile exists.

M5003: Illegal Dependency

Message Type

[ERROR]

Description

Only identifiers or filenames can reside in the dependency list. Maker reports other tokens as invalid.

Example

```
makeall:
 inout.o message.o main.o (*)
```

TIP Name your targets with identifiers.

M5004: Illegal Macro Reference

Message Type

[ERROR]

Description

You used a name for a macro that is not an identifier. You must name all your macros with identifiers.

Example

```
makeall:
  cc src.c $(***)
```

M5005: Macro Substitution Too Complex

Message Type

[ERROR]

Description

Maker cannot resolve the macro in a table overflow.

TIP Organize your makefile structure. Use template makefiles called from Maker with command-line macros as arguments.

M5006: Macro Reference Not Closed

Message Type

[ERROR]

Description

Macro has no right brace to close the macro.

Example

```
makeall:
  cc src.c $(MYMAC
```

TIP Add a right brace.

M5007: Unknown Macro: <macroname>

Message Type

[ERROR]

Description

Maker did not recognize `<macroname>` as a declared macro.

M5008: Macro Definition or Command Line Too Long

Message Type

[ERROR]

Description

Maker cannot read a line in the makefile because it is too long.

M5009: Illegal Include Directive

Message Type

[ERROR]

Description

The include directive has too many arguments.

Example (invalid)

```
INCLUDE macros.inc utils.inc
```

To resolve the error, Divide the include into multiple includes:

```
INCLUDE macros.inc
INCLUDE utils.inc
```

M5010: Illegal Line

Message Type

[ERROR]

Description

Maker encountered a syntax error in the makefile. The line starts with an invalid token sequence.

Example (invalid)

```
makeAll: Compile Link
echo "-- all done   ## command has to start with spaces
```

M5011: Illegal Suffix for Inference Rule

Message Type

[ERROR]

Description

The rule has incorrect syntax.

Example (correct)

```
.c.o :
  $(CC) $(CFLAGS) $*.c
```

M5012: Include File Not Found: <includefile>

Message Type

[WARNING]

Description

The filename given as an argument of the `INCLUDE` command does not specify an existing file.

TIP Verify the accuracy of the path settings in your `default.env` file; verify that the environment variable `DefaultDir` in the File `MCUTOOLS.INI` did not set the default directory.

M5013: Include File Too Long: <includefile>

Message Type

[ERROR]

Description

Maker cannot include the specified file because it is too big.

TIP Divide your included file into several smaller files.

M5014: Circular Macro Substitution in <macroname>

Message Type

[ERROR]

Description

Maker detected a circular reference in the macro substitution.

M5015: Colon (:) Expected

Message Type

[ERROR]

Description

Always mark a target declaration with a colon after the target identifier, followed by the dependencies.

M5016: Filename After INCLUDE Expected

Message Type

[ERROR]

Description

Maker detected a token after the `INCLUDE` command that is not a filename which conforms to a Maker identifier.

TIP Do not use non-alphanumeric characters in filenames, even if the operating system allows them.

M5017: Circular Include, File <includefile>

Message Type

[ERROR]

Description

Maker does not allow circular include references in a makefile.

Example

```
.mak file includes A.inc. A.inc includes B.inc. B.inc
includes C.inc. C.inc includes A.inc
```

M5018: Entry Doesn't Start at Column 0

Message Type

[ERROR]

Description

Entries (Identifier: dependencies.) must start at the first column of a line.

M5019: No Makefile Found

Message Type

[ERROR]

Description

The makefile specified in the argument list does not exist.

TIP Verify the accuracy of the path settings in your `default.env` file; also verify that the default directory, set by the `DefaultDir` environment variable in the `MCUTOOLS.INI` file, is not set.

M5020: Fatal Error During Initialization

Message Type

[ERROR]

Description

The Maker initialization procedure failed.

TIP Restore a previously functional configuration.

M5021: Nothing to Make: No Target Found

Message Type

[ERROR]

Description

The Maker did not specify a target.

M5022: Don't Know How to Make <target>

Message Type

[ERROR]

Description

The target-dependency list contains an identifier that does not exist as a file and does not reside in the target list of the makefile.

TIP This message sometimes appears even if target or file dependencies exist. Maker dependency resolutions do not always find all targets, especially when you work with multiply layered rules. For this reason, structure the makefile another way and check the settings in your `default.env` file.

M5023: Circular Dependencies Between <target1> and <target2>

Message Type

[ERROR]

Description

`<target1>` is in the transitive closure of circular dependencies. For example, build `<target1> <target1>`. `<target2>` is the last target handled before Maker detects the circular dependencies.

Example

```
XX:   AA BB
AA:   FF EE
BB:   DD
DD:   XX
EE:
FF:
## XX is dependent (transitive closure) on
AA,BB,FF,EE,DD,XX
```

M5024: Illegal Option

Message Type

[ERROR]

Description

The option specified in the command line has an incorrect format.

Example

```
Maker test.mak -DCC+\HC12\CHC08.EXE
```

instead of

```
Maker test.mak -DCC=\HC12\CHC08.EXE
```

TIP With `-h`, Maker prints all available options with the expected argument list.

M5027: Making Target <target>

Message Type

[INFORMATION]

Description

Maker currently builds the specified target.

TIP The two special targets `BEFORE` and `AFTER` execute just before and after the top target. Use them for initiations and cleanup.

M5028: Command Line Too Long: <commandline>

Message Type

[ERROR]

Description

The command line passed to Maker is too long for Maker.

M5029: Illegal Target Name: <targetname>

Message Type

[ERROR]

Description

You specified an invalid name as the target, which can happen when using multiple command-line arguments. Maker takes the first argument as a make file name and all remaining arguments as target names. If some target names are invalid, this message appears. If you ignore this message with the message move options, then Maker ignores the invalid target name.

Exec Process Messages

This section explains messages that can appear when a command in a target's build-command list fails.

M5100: Command Line Too Long for Exec

Message Type

[ERROR]

Description

The length of a command in the target's command list in the makefile is too long to execute.

M5101: Two File Names Expected

Message Type

[ERROR]

Description

Some Maker commands (such as `Copy` or `Ren`) need two filenames as arguments. This error message occurs when the command did not contain two filenames.

M5102: Input File Not Found

Message Type

[ERROR]

Description

A built-in file command required to open a source file for reading was unable to find that source file.

M5103: Output File Not Opened

Message Type

[ERROR]

Description

A built-in file command required to open or create a destination file for writing failed to open or create that destination file.

TIP Check the settings in your `default.env` file.

M5104: Error While Copying

Message Type

[ERROR]

Description

While copying one file, another failed in the block-copy loop. Maker opened the file but the blockwise write operation failed.

TIP Check the attributes of the destination file.

M5105: Renaming Failed

Message Type

[ERROR]

Description

Maker failed to rename a file.

Potential causes are:

- Inappropriate filenames as arguments
- The source file does not exist, or another process is using it
- The destination file name is already in use.

TIP Check the file (including its attributes) to rename the file.

M5106: File Name Expected

Message Type

[ERROR]

Description

Maker expects an argument of a built-in command to specify an existing file, but it has an illegal format for a file name.

TIP Use only names and extensions allowed for C-identifiers, even if your operating system permits more character types for filenames.

M5107: File Does Not Exist

Message Type

[ERROR]

Description

Maker expects a built-in command argument to specify an existing file, but the file does not exist.

TIP Check the settings in your `default.env` file.

M5108: Called Application Detected an Error

Message Type

[ERROR]

Description

The application that Maker called detected an error not reported in detail in its error output, or Maker did not find the error output.

TIP Use a file named `EDOUT`, or another file that you specify using the environment variable `ERRORFILE`, in your `default.env` file. Maker prints the lines in this file starting with `ERROR`, `FATAL`, `WARNING` or `INFORMATION` if enabled in the Maker.

M5109: Echo <commandline>

Message Type

[INFORMATION]

Description

This message appears when Maker calls an application. The entire macro-expanded command line displays.

M5110: Called Application Caused a System Error

Message Type

[ERROR]

Description

The program that Maker executed exited with an operating-system error.

M5111: Change Directory (cd) Failed

Message Type

[ERROR]

Description

The built-in `cd` command was unable to change the directory.

TIP Make sure the specified directory exists. Check your working directory when using relative paths.

M5112: Called Application: <error>

Message Type

[ERROR]

Description

The called application detected an error and wrote it to the error-output file. Maker prints the error message if you enable the message type in Maker.

Example

```
ERROR M5112: called application detected an error: "ERROR
C1005: Illegal storage class!"
```

The string quoted is the called program's message.

TIP Try to run the application manually with the specified arguments. You can reclassify the called program's message class to `ERROR`, `WARNING`, or `INFORMATION`; you can also disable it.

M5113: Called Application: <warning>

Message Type

[WARNING]

Description

The called application issued a warning and wrote it to the error output file. Maker prints the warning message if you enable its message type in Maker.

Example

```
WARNING M5113: called application: "WARNING C1038:
Cannot be friend of myself"
```

The string quoted is the called program's message. If you classify M5113 as an error, Maker prints message as:

```
ERROR M5113: called application: "WARNING C1038: Cannot
be friend of myself"
```

TIP Try to run the application manually with the specified arguments. You can reclassify the called program's message class to `ERROR`, `WARNING`, or `INFORMATION`; you can also disable it.

M5114: Called Application: <information>

Message Type

[INFORMATION]

Description

The called application issued information and wrote it to its error output file. Maker prints the information message in Maker.

Example

```
INFORMATION M5114: called application: "INFORMATION
C1390: Implicit virtual function"
```

The string quoted is the called program's message.

TIP Try to run the application manually with the specified arguments. You can reclassify the called program's message class to `ERROR`, `WARNING`, or `INFORMATION`; you can also disable it.

M5115: Called Application: <fatal>

Message Type

[ERROR]

Description

The called application detected a fatal error and wrote the message to its error output file. Maker prints the fatal warning message if you enabled that message type in Maker.

Example

```
ERROR M5115: called application: "FATAL C1403: Out of
memory"
```

The string quoted is the called program's message.

TIP Try to run the application manually with the specified arguments. You can reclassify the called program's message class to `ERROR`, `WARNING`, or `INFORMATION`; you can also disable it.

M5116: Could Not Delete File

Message Type

[WARNING]

Description

The built-in `del` command was unable to delete the specified argument file.

TIP Make sure that the file exists and that its attributes allow Maker to delete it.

M5117: Path Was Not Found

Message Type

[ERROR]

Description

Maker was unable to restore an old directory that changed with the built-in command `cd` after the end of the command-list scope.

TIP Make sure the old directory exists. It must exist to use `cd`.

M5118: Could Not Create Process: <diagnostic>

Message Type

[ERROR]

Description

The operating system issues this message when the called process cannot run. The detailed message resides in `<diagnostic>`.

M5119: Exec <commandline>

Message Type

[INFORMATION]

Description

Maker issues this message after it calls an application. The entire macro-expanded command line displays.

M5120: Running Version with Limited Number of Execution Calls. Number of Allowed Execution Calls Exceeded

Message Type

[FATAL]

Description

This message does not appear when you have a fully registered version of Maker. A non-registered demonstration version has processing limitations. The demonstration version has a limit of five command calls. If you exceed this limit in one run, M5120 appears and the make process stops.

M5121: The Files <file1> and <file2> Are Not Identical

Message Type

[INFORMATION]

Description

An `fc` or `fctext` built-in command detected that two files are not identical.

M5122: The Files <file1> and <file2> Are Identical

Message Type

[INFORMATION]

Description

A `fc` or `fctext` built-in command detected that two files are identical.

M5153: Processing Make Files Under Win32s Is Not Supported by the Maker

Message Type

[FATAL]

Description

Maker cannot synchronize the execution of commands with its own processing under Win32s and cannot run under Win32s. This error occurs because a 32-bit application running under Win32s with the 32-bit API cannot detect a completed called application. The Maker issues this message if you try to run a makefile under Win32s and stops execution.

Modula-2 Maker Messages

This section explains messages that can appear when the build process for Modula-2 fails.

M5700: Environment Variable COMP Not Set

Message Type

[ERROR]

Description

The `COMP` environment variable defines the Modula-2 compiler. When you do not set this variable, the Modula-2 Maker can run only in silent mode (option `-s`).

M5701: Environment Variable LINK Not Set

Message Type

[ERROR]

Description

The `LINK` environment variable defines the linker. When you do not set this variable, the Maker can run only in silent (option `-s`) or in compile-only mode (option `-c`).

M5702: Neither Source Nor Symbol File Found: <source file>

Message Type

[ERROR]

Description

The compiler found neither the object file nor the source file, and was unable to build the target.

TIP Check the settings in your `default.env` file.

M5703: Circular Imports in Definition Modules

Message Type

[ERROR]

Description

The transitive closure of a module's import list includes the module itself (a circular dependency list).

TIP Layer your application and put basic types included from different layers into separate modules.

M5704: Can't Recompile <source file> (No Source Found)

Message Type

[ERROR]

Description

The compiler was unable to find the specified source file.

TIP Determine whether the source file exists in a location other than expected. Also check the settings in your `default.env` file.

M5705: No Make File Generated (Top Module Not Found)

Message Type

[WARNING]

Description

The compiler was unable to write the makefile for the Modula-2 project because you did not specify the top target.

TIP Check the settings in your `default.env` file.

M5706: Couldn't Open the Listing File <list file>

Message Type

[WARNING]

Description

A file error occurred upon opening or closing the listing file for Modula-2 Make.

TIP Check the settings in your `default.env` file.

M5708: Couldn't Open the Makefile

Message Type

[ERROR]

Description

The makefile does not exist, or the make process was unable to open it for reading.

TIP The default extension for Modula-2 makefiles is `.MOD`.

TIP Check the settings in your `default.env` file.

M5761: Wrote Makefile <makefile>

Message Type

[INFORMATION]

Description

Maker prints this information if no error occurred and the Modula-2 Maker succeeded in creating the makefile.

M5763: Compilation Sequence

Message Type

[INFORMATION]

Description

Announces the print listing to the Maker standard output instead of to a file listing.

D

Tool Commands

SmartLinker Commands

This section describes each SmartLinker parameter command. Each command description includes the following:

- **Syntax**: Description of the command syntax.
- **Description**: Detailed description of the command.
- **Example**: Example of how to use the command.

Some commands are available only in ELF/DWARF format, and some commands only in Freescale object file format. This is indicated with the object file format in parenthesis (ELF) or (Freescale).

If a command is available only for a specific language, it is also indicated. For example, **M2** denotes that the feature is available only for Modula-2 linker parameter files.

Additionally, it is also noted if the behavior of a command is different for Freescale and ELF/DWARF formats.

AUTO_LOAD: Load Imported Modules (Freescale, M2)

Syntax

```
AUTOLOAD ON | OFF
```

Description:

The optional `AUTO_LOAD` command affects linking only when there are Modula-2 modules present. When `AUTO_LOAD` is switched `ON`, the linker automatically loads and processes all modules imported in some Modula-2 modules. It is not necessary to enumerate all object files of Modula-2 applications. The linker assumes that the object file name of a Modula-2 module is the same as the module name with the `.o` extension. Modules automatically loaded by the linker (i.e. imported in a Modula-2 Module present in the `NAMES` list) must not appear in the `NAMES` list. The default setting is ON.

You must switch `AUTO_LOAD OFF` when linking with a ROM library. If switched ON, the linker automatically loads the missing object files, and disregards the objects in the ROM library.

NOTE You must also switch `AUTO_LOAD OFF` if the object file names are not the same as the module names, because this prevents the linker from finding the object files.

Example:

```
AUTOLOAD ON
```

CHECKSUM: Checksum Computation (ELF)

Syntax

```
Checksum= CHECKSUM {ChecksumEntry} END.
ChecksumEntry= CHECKSUM_ENTRY
     ChecksumMethod
     [INIT Number]
     [POLY Number]
     OF MemoryArea
     OF MemoryArea
     OF MemoryArea
     ...
     ..
     INTO MemoryArea
     [UNDEFINED Number]
   END.
ChecksumMethod= METHOD_CRC_CCITT | METHOD_CRC8
| METHOD_CRC16 | METHOD_CRC32
| METHOD_ADD [SIZE <Size>] | METHOD_XOR.
```

Description:

This command instructs the linker to compute `checksum` over some memory areas. All necessary information for this is specified in this structure.

NOTE The specified `OF MemoryArea` usually also has its separate `SEGMENTS` entry. Use the `FILL` directive to fill all gaps and ensure a predictable result.

Listing D.1 Example

```
SEGMENTS
MY_ROM = READ_ONLY   0xE020 TO 0xFEFF FILL 0xFF;
....
END
CHECKSUM
  CHECKSUM_ENTRY METHOD_CRC_CCITT
    OF READ_ONLY 0xE020 TO 0xEEFF
    OF READ_ONLY 0xEF00 TO 0xFEFF
    INTO    READ_ONLY   0xE010 SIZE 2
    UNDEFINED 0xff
  END
END
```

The checksum computes only over areas with `READ_ONLY` and `CODE` qualifiers. Checksum computations support the following methods:

- `METHOD_XOR` – XORs the elements of the memory areas together. The size of the `INTO_AREA` defines the element size.
- `METHOD_ADD` – Adds the elements of the memory areas together. The optional `SIZE` argument defines the element size. If you do not specify the `SIZE` option, the linker uses the size of the `INTO_AREA` instead.
- `METHOD_CRC_CCITT` – Computes a 16-bit cyclic redundancy check (CRC) checksum according to CRC CCITT over all bytes in the areas. The `INTO_AREA` size must be 2 bytes.
- `METHOD_CRC16` – Computes a 16-bit CRC checksum according to the commonly used CRC 16 over all bytes in the areas. The `INTO_AREA` size must be 2 bytes.
- `METHOD_CRC32` – Computes a 32-bit CRC checksum according to the commonly used CRC 32 over all bytes in the areas. The `INTO_AREA` size must be 4 bytes.

The linker uses the optional `[INIT Number]` entry as the initial value in checksum computation. If it is not specified, the linker uses the default value of `0xffffffff` for CRC checksums and 0 for addition and XOR.

The optional `[POLY Number]` entry allows you to specify alternative polynomials for the CRC checksum computation.

`OF MemoryArea`: The area for which to compute the checksum.

`INTO MemoryArea`: The area into which to store the computed checksum. This area must be distinct from any other placement in the `prm` file and from the `OF MemoryArea`.

The linker uses the optional `[UNDEFINED Number]` value when no memory is available at certain places. Use the `FILL` directive to prevent this linker behavior (for an example see above).

Example 1

```
CHECKSUM
    CHECKSUM_ENTRY
        METHOD_CRC_CCITT
        OF READ_ONLY 0xE020 TO 0xEEFF
        OF READ_ONLY 0xEF00 TO 0xFEFF
        INTO    READ_ONLY   0xE010 SIZE 2
        UNDEFINED 0xff
    END
END
```

This entry causes the computation of a checksum of areas 0xE020 to 0xEEFF and 0xEF00 to 0xFEFF, and stores the checksum value at address 0xE010.

The linker calculates the checksum according to the CRC CCITT.

Example 2

Assume the following memory content:

```
0x1000 02 02 03 04
```

Then the XOR 1-byte checksum from 0x1000 to 0x1003 is `0x07 (=0x02^0x02^0x03^0x04).`

NOTE `METHOD_XOR` is the fastest computation method; `METHOD_ADD` is the next fastest computation method. However, for both `METHOD_XOR` and `METHOD_ADD`, multiple regular 1-bit changes can cancel each other out. The CRC methods avoid this weakness. For example, if you clear both 0x1000 and 0x1001, then the XOR checksum does not change. Similar cases exist for ADD checksum as well.

NOTE `METHOD_XOR` and `METHOD_ADD` also support using larger element sizes to compute the checksum.

By default, the linker uses the size of `INTO MemoryArea` as the element size. However for `METHOD_ADD` you can explicitly specify the size (in bytes) as less than the `INTO MemoryArea` size.

With an element size of 2, the checksum of the example is 0x0506 (`= 0x0202 ^ 0x0304`).

NOTE Larger element sizes allow faster computation of the checksums on 16- or 32-bit machines.

The `OF MemoryArea` size and address must be multiples of the element size.

CRC-based methods compute the checksum values in bytes.

Often, the actual size of the area to be checked is not known in advance.

Depending on how much C source code the compiler generates, the placements may be relatively full.

NOTE This method does not support varying element sizes. Instead, fill unused areas in the placement with the `FILL` directive to a known value. This increases overhead as the checksum computes these fill areas as well.

CHECKKEYS: Check Module Keys (Freescale, M2)

Syntax

```
CHECKKEYS ON | OFF
```

Description

If the optional `CHECKKEYS` command is switched `ON` (default), the linker compares module keys of the Modula-2 modules in the application and issues an error message if it detects an inconsistency (symbol file newer than the object file). `CHECKKEYS OFF` turns off this module key check.

Example

```
CHECKKEYS ON
```

DATA: Specify the RAM Start (Freescale)

Syntax

```
DATA Address
```

Description

NOTE Older linker parameter files support this command. This command will not be supported in future releases.

Use this command to specify the default ROM start address. The specified address must be in hexadecimal notation. The linker translates this command internally as:

```
DATA 0x????' => 'DEFAULT_RAM INTO READ_WRITE 0x???? TO
0x????
```

The unknown end address of `DEFAULT_RAM` causes the linker to specify or attempt to find out the end address itself.

Example

```
START 0x1000
```

DEPENDENCY: Dependency Control

Syntax

```
DEPENDENCY {Dependency} END.
Dependency = ROOT {ObjName} END
| ObjName USES {ObjName} END
| ObjName ADDUSE {ObjName} END
| ObjName DELUSE {ObjName} END.
```

Description

The DEPENDENCY keyword allows the modification of automatically-detected dependency information.

Use this command to add new roots (`ROOT` keyword) and overwrite (`USES`), extend (`ADDUSE`), or remove (`DELUSE`) existing dependencies.

The dependency information serves two purposes:

- Smart Linking – Links only the objects that depend on roots.
- Overlapping local variables and parameters – Some small 8-bit processors use global memory instead of stack space to allocate local variables and parameters. The linker uses the dependency information to allocate local variables of different functions to the same addresses, provided the functions are never active simultaneously.

ROOT Keyword

Use the `ROOT` keyword to specify a group of root objects.

A `ROOT` entry with a single object functions the same as using the object in an `ENTRIES` section (see ENTRIES: List of Objects to Link with Application). A `ROOT` entry with several objects functions the same as using the object in an `OVERLAP_GROUP` entry (see OVERLAP_GROUP: Application Uses Overlapping (ELF)). If you use several objects in one root group, only one object of the group is active at a time. Use this information to improved variable overlap allocation. The linker allocates function variables of the same group in the same area. To avoid this, either use several ROOT blocks or add the objects in the ENTRIES section.

Example: Overlapped Allocation of Variables (Not Applicable for all Targets)

Listing D.2 C source

```
void main(void) { int i; ....}
void interrupt int1(void) { int j; ... }
void interrupt int2(void) { int k; ... }
prm file:
...DEPENDENCY
  ROOT main END
  ROOT int1 int2 END
END
```

In this example, the linker allocates the variables of the function `main` and all its dependents first, then allocates the variables of `int1` and `int2` into the same area. This means `j` and `k` may overlap.

USES Keyword

The `USES` keyword defines all dependencies for a single object. Only the given dependencies are used. Any unlisted dependencies are ignored. If a needed dependency is not specified after the `USES`, the linker issues error messages.

Example: Overlapped Allocation of Variables (Not Applicable for all Targets)

Listing D.3 C Source

```
void f(void(* fct)(void)) { int i; ... fct();...}
void g(void) { int j;... }
void h(void) { int k;... }
void main(void) { f(g); f(h); }
```

Listing D.4 prm File

```
DEPENDENCY
  f USES g h END
END
```

This USES statement assures that the variable i of f does not overlap any of the variables of g or h.

NOTE The automatic detection does not work for functions called by a function pointer initialized outside of the function, as in this case.

The USES keyword hides any compiler-specified dependencies. If the code of f (not shown above) calls any additional functions, USES generates errors. It is usually better to use ADDUSE than USES.

ADDUSE Keyword

Use the ADDUSE keyword to add additional dependencies to those that are automatically detected. Use ADDUSE to ensure that no dependencies are lost. Generated application code may use more memory, but considers all known dependencies.

Example: Overlapped Allocation of Variables (Not Applicable for all Targets)

Listing D.5 C Source

```
void f(void(* fct)(void)) { int i; ... fct();...}
void g(void) { int j;... }
void h(void) { int k;... }
void main(void) { f(g); f(h); }
```

Listing D.6 prm File

```
DEPENDENCY
  f ADDUSE g h END
END
```

This code adds only new dependencies.

For smart linking, automatic detection covers almost all cases. You only need to link additional depending objects if objects are accessed by a fixed address.

Example: (Smart Linking)

Listing D.7 C Code

```
int i @ 0x8000;
void main(void) {
  *(int*)0x8000 = 3;
}
```

To tell the linker to link `i` as well as `main`, add the following line to the link parameter file:

```
DEPENDENCY main ADDUSE i END
```

DELUSE Keyword

Use the `DELUSE` keyword to remove single dependencies from the set of automatically-detected dependencies.

To get a list of all automatically-detected dependencies, comment out any `DEPENDECY` blocks in the prm file, switch on map file generation and look at the `OBJECT-DEPENDENCIES SECTION` in the generated map file.

Automatic dependency generation can generate unnecessary dependencies because some runtime behavior is not taken into account.

Example:

Listing D.8 C Source

```
void MainWaitLoop(void) { int i; for (;;) { ... } }
void _Startup(void) { int j; InitAll();
 MainWaitLoop(void); }
```

Listing D.9 prm File

```
DEPENDENCY
  _Startup DELUSE MainWaitLoop END
  ROOT _Startup MainWaitLoop END
END
```

Because `MainWaitLoop` takes no parameters and never returns, the linker can allocate the local variable `i` overlapped with `_Startup`. The `ROOT` directive specifies that the locals of the two functions can be allocated at the same addresses.

Overlapping of Local Variables and Parameters

The most common application of the `DEPENDENCY` command is for overlapping.

See Also:

OVERLAP_GROUP: Application Uses Overlapping (ELF)

ENTRIES: List of Objects to Link with Application

Syntax (ELF):

```
ENTRIES
   [FileName " :"](*|objName)
   {[FileName ":"](*|objName)}
END
```

Syntax (Freescale):

```
ENTRIES objName {objName} END
```

Description

Use the `ENTRIES` block to specify a list of objects that must always be linked with the application, even when they are never referenced. The specified objects are used as additional entry point in the application. The linker links all objects referenced within these objects with the application.

The optional `ENTRIES` block cannot be specified more than once in a prm file.

The following table describes the supported notations.

Table D.1 Notations and Descriptions

Notation	Description
`<Object Name>`	Links the specified global object with the application.
`<File Name>:<Object Name>` (ELF)	Links the specified local object defined in the specified binary file with the application.
`<File Name>:*` (ELF)	Links all objects defined within the specified file with the application.
`*` (ELF)	Links all objects with the application. This switches OFF smart linking for the application.

ELF-Specific Issues

If a file name specified in the `ENTRIES` block is not present in the `NAMES` block, the linker inserts the file name in the list of binary files building the application.

Listing D.10 Example

```
NAMES
  startup.o
END

ENTRIES
  fibo.o:*
END
```

In this example, the linker builds the application from the files `fibo.o` and `startup.o`.

File names specified in the `ENTRIES` block may also be present in the `NAMES` block.

Listing D.11 Example

```
NAMES
  fibo.o startup.o
END

ENTRIES
  fibo.o:*
END
```

In this example, the linker builds the application from the files `fibo.o` and `startup.o`. The file `fibo.o` specified in the `NAMES` block is the same file specified in the `ENTRIES` block.

NOTE We strongly recommend that you avoid switching smart linking OFF when the ANSI library is linked with the application. The ANSI library contains the implementation of all runtime functions and ANSI-standard functions. This generates a large amount of code not needed by the application.

HEXFILE: Link Hex File with Application

Syntax

```
HEXFILE <fileName> [OFFSET <hexNumber>]
```

Arguments

`<fileName>`: Any valid file name. The linker searches for this file in the current directory first, and then in the directories specified in the `GENPATH` environment variable.

`<hexNumber>`: If specified, adds this number to the address found in each record of the hex file. The result is the address to which the linker copies the data bytes.

Description

Use this command to link an S-Record or Intel Hex file with the application.

```
HEXFILE fiboram.s1 OFFSET 0xFFFF9800 /* 0x800 - 0x7000 */
```

The above code adds the optional offset specified in the `HEXFILE` command to each record in the Freescale S-record file, and encodes the code at address 0x7000 at address 0x800. The offset 0xFFFF9800 used above is the unsigned representation of -0x68000. To calculate it, use a hex-capable calculator and subtract 0x7000 from 0x800.

NOTE In the Freescale format, the linker does not perform any checking to avoid overwriting any portion of normal linked code by data from hex files.

Example

```
HEXFILE fiboram.s1 OFFSET 0xFFFF9800 /* 0x800 - 0x7000 */
```

INIT: Specify Application Init Point

Syntax

```
INIT  FuncName
```

Description

This command defines the initialization entry point for the application. The `INIT` command is mandatory for assembly application and optional otherwise. It cannot be specified more than once in the prm file.

When you specify the `INIT` command in the prm file, the linker uses the specified function as application entry point. This is either the main routine or a startup routine calling the main routine.

When `INIT` is not specified in the prm file, the linker looks for a function named `_Startup` and uses it as the application entry point.

Example

```
INIT MyGlobStart /* Specify a global variable as
application          entry point.*/
```

ELF Specific issues:

You can specify any static or global function as entry point.

ELF Specific Example:

```
INIT myFile.o:myLocStart /* Specify a local variable
as application entry point.*/
```

Do not use this command for ROM libraries. Specifying an `INIT` command in a ROM library prm file generates a warning.

LINK: Specify Name of Output File

Syntax

```
LINK <NameOfABSFile> ['AS ROM_LIB']
```

Description

The LINK command defines the name of the file generated by the link session. This command is mandatory and can only be specified once in a prm file.

After a successful link session the linker creates the file NameOfABSFile. If you defined the ABSPATH environment variable (see ABSPATH: Absolute Path), the linker generates the absolute file in the first directory listed there. Otherwise, the linker writes the file to the directory in which the parameter file was found. If a file with this name already exists, it is overwritten.

A successful linking session also creates a map file with the same base name as NameOfABSFile and with extension .map. If you defined the TEXTPATH environment variable (see TEXTPATH: Text Path), the linker generates the .map file in the first directory listed there. Otherwise, the linker writes the file to the directory where the parameter file was found. If a file with this name already exists, it is overwritten.

If you include AS ROM_LIB after the name of the absolute file, the linker generates a ROM library instead of an absolute file (see ROM Libraries). A ROM library is an absolute file which cannot be executed alone.

Prm files require the LINK command. If you omit the LINK command, the SmartLinker generates an error message unless you specify the -O option on the command line (see -O: Define Absolute File Name (SmartLinker)).

NOTE If you start the linker from the CodeWarrior IDE, the linker automatically adds the -O option. If you specify the -O option on the command line, it has higher priority than the LINK command.

Listing D.12 Example

```
LINK fibo.abs

NAMES  fibo.o startup.o END
SECTIONS
    MY_RAM = READ_WRITE 0x1000 TO 0x18FF;
    MY_ROM = READ_ONLY  0x8000 TO 0x8FFF;
    MY_STK = READ_WRITE 0x1900 TO 0x1FFF;
PLACEMENT
    DEFAULT_ROM   INTO  MY_ROM;
    DEFAULT_RAM   INTO  MY_RAM;
    SSTACK        INTO  MY_STK;
END
VECTOR ADDRESS 0xFFFE _Startup /* set reset vector */
```

In this case, the linker generates fibo.ABS and fibo.map after successfully linking from the previous prm file.

MAIN: Name of Application Root Function

Syntax

```
MAIN FuncName
```

Description

The optional `MAIN` command cannot be specified more than once in the prm file. This command defines the root function for an ANSI-C application (the function invoked at the end of the startup function).

When you do not specify `MAIN` in the prm file, the linker looks for a function named `main` to use as the application root.

Example

```
MAIN MyGlobMain /* Specify a global variable as
application root.*/
```

ELF-Specific issues:

You can specify any static or global function as application root function.

ELF-Specific Example:

```
MAINmyFile.o:myLocMain/*Specifyalocalvariableas
application root.*/
```

This command is not required for ROM libraries. Specifying the `MAIN` command in a ROM Libraries prm file generates a warning.

MAPFILE: Configure Map File Content

Syntax (ELF):

```
MAPFILE (ALL|NONE|TARGET|FILE|STARTUP_STRUCT|SEC_ALLOC|
OBJ_ALLOC|SORTED_OBJECT_LIST|OBJ_DEP|OBJ_UNUSED|
COPYDOWN|OVERLAP_TREE|STATISTIC|MODULE_STATISTIC)
[,{(ALL|NONE|TARGET|FILE|STARTUP_STRUCT|SEC_ALLOC|OBJ_A
LLOC
|OBJ_DEP|OBJ_UNUSED|COPYDOWN|OVERLAP_TREE|STATISTIC|MOD
```

```
ULE_STATISTIC)}]
```

Syntax (Freescale):

```
MAPFILE (ON|OFF)
```

Description

Use this optional command to control `.map` file generation. The default condition activates the command `MAPFILE ALL`, indicating that a map file must be created, containing all linking time information.

Table D.2 and Table D.3 describe the available map file specifiers.

Table D.2 Map File Specifiers and Descriptions (ELF Specific)

Specifier	Description
ALL	Generates a map file containing all available information
COPYDOWN	Writes information about the initialization value for objects allocated in RAM to the map file (COPYDOWN section)
FILE	Includes information about the files building the application in the map file (FILE section)
NONE	Generates no map file
OBJ_ALLOC	Includes information about the allocated objects in the map file (OBJECT ALLOCATION section)
SORTED_OBJECT_LIST	Generates a list of all allocated objects, sorted by address, and includes it in the map file (OBJECT LIST SORTED BY ADDRESS section)
OBJ_UNUSED	Includes a list of all unused objects in the map file (`UNUSED OBJECTS` section)
OBJ_DEP	Includes a list of dependencies between the objects in the application in the map file (`OBJECT DEPENDENCY` section)
DEPENDENCY_TREE	Shows the allocation of overlapped variables (`DEPENDENCY TREE` section)
SEC_ALLOC	Includes information about the sections used in the application in the map file (`SECTION ALLOCATION` section)
STARTUP_STRUCT	Includes information about the startup structure in the map file (`STARTUP` section).

Table D.2 Map File Specifiers and Descriptions (ELF Specific) (*continued*)

Specifier	Description
MODULE_STATISTIC	Includes information about how much ROM/RAM specific modules (compilation units) use.
STATISTIC	Includes statistic information about the link session in the map file (`STATISTICS` section)
TARGET	Includes information about the target processor and memory model in the map file (`TARGET` section)

See The Map File for detailed descriptions of information generated by each specifier.

ELF-Specific Issues:

Specifying `ALL` in the `MAPFILE` command includes all available sections in the map file.

Example

The following commands are all equivalent. Each of these commands generates a map file containing all the possible information about the linking session.

```
MAPFILE ALL
MAPFILE TARGET, ALL
MAPFILE TARGET, ALL, FILE, STATISTIC
```

Specifying `NONE` in the `MAPFILE` command prevents the linker from generating the map file.

Example

The following commands are all equivalents. No map file is generated.

```
MAPFILE NONE
MAPFILE TARGET, NONE
MAPFILE TARGET, NONE, FILE, STATISTIC
```

Freescale-Specific Issues:

For compatibility with old-style Freescale-format prm files, the `MAPFILE` command supports the following arguments:

- `MAPFILE OFF` is equivalent to `MAPFILE NONE`
- `MAPFILE ON` is equivalent to `MAPFILE ALL`

Table D.3 Map File Specifiers and Descriptions (Freescale Specific)

Specifier	Description
OFF	Generates no map file
ON	Generates a map file containing all information available

NAMES: List Files Building the Application

Syntax

```
NAMES <FileName>['+'|'-'] {<FileName>['+'|'-']} END
```

Description

The NAMES block contains a list of binary files building the application. This block is mandatory and can only be specified once in a prm file.

The linker reads all files given between NAMES and END. The linker searches for the files first in the project directory, then in the directories specified in the OBJPATH environment variable (see OBJPATH: Object File Path) and finally in the directories specified in the GENPATH environment variable (see GENPATH: Define Paths to Search for Input Files). The files may be either object files, absolute or ROM Library files, or libraries.

You may specify additional files by using the -Add option (see -Add: Additional Object/Library File). The linker links object files specified with the -Add option before linking the files mentioned in the NAMES block.

The SmartLinker links only the referenced objects (variables and functions) to the application. You can specify any number of files in the NAMES block, however the application contains only the functions and variables really used.

The plus sign after a file name (e.g. <FileName>+) switches smart linking OFF for the specified file. This links all the objects defined in this file, even unused objects, with the application.

Specifying a minus sign after an absolute file name (e.g. <FileName>-) tells the linker not to use the absolute file in the application startup, that is, the linker does not initialize global variables defined in the absolute file during application startup (see Using ROM Libraries).

Do not include a space or spaces between the file name and the plus or minus sign.

Example

```
LINK fibo.abs

NAMES  fibo.o startup.o END
SEGMENTS
    MY_RAM = READ_WRITE 0x1000 TO 0x18FF;
    MY_ROM = READ_ONLY  0x8000 TO 0x8FFF;
    MY_STK = READ_WRITE 0x1900 TO 0x1FFF;
PLACEMENT
    DEFAULT_ROM   INTO  MY_ROM;
    DEFAULT_RAM   INTO  MY_RAM;
    SSTACK        INTO  MY_STK;
END
VECTOR ADDRESS 0xFFFE _Startup /* set reset vector */
```

In this example, the linker builds the application `fibo` from the files `fibo.o` and `startup.o`.

OVERLAP_GROUP: Application Uses Overlapping (ELF)

Syntax

```
OVERLAP_GROUP {<Objects>} END
```

Description

Use the `OVERLAP_GROUP` only for overlapping locals. See also Overlapping Locals.

In some cases the linker cannot detect that functions have no dependencies, and does not overlap local variables which might benefit from overlapping. Use `OVERLAP_GROUP` block to specify a group of functions which do not overlap.

`OVERLAP_GROUP` is only available in the ELF object file format. However, you can achieve the same functionality with the `DEPENDENCY` command (see DEPENDENCY: Dependency Control, ROOT Keyword) available in the Freescale format.

Example:

Assume the default implementations of the C startup routines:

- `_Startup`: the main entry point of the application. It calls first `Init` and then uses `_startupData` to call `main`.
- `Init`: Uses the information in `_startupData` to generate the zero out
- `_startupData`: The linker fills this data-structure with information, such as the address of the `main` function and identity of areas to be handled by `zero out` in `Init`.
- `main`: The main startup point of C code

The following dependencies exist between these objects:

- `_Startup` depends on `_startupData` and `Init`
- `Init` depends on `_startupData`
- `_startupData` depends on `main`.

Assume the following entry in the prm file:

```
/* _Startup is a group of its own */
OVERLAP_GROUP _Startup END
```

When investigating `_Startup`, linker does not know that `Init` does not call `main`. According to the dependency information, it might call `main`, so the linker does not overlap the variables of `Init` and `main`.

But in this case, the linker builds the following `OVERLAP_GROUP`:

```
/* Overlap the variables of main and the variables of
_Startup */
OVERLAP_GROUP main _Startup END
```

This way, the linker overlaps the variables of `Init` and `main` because the linker allocates `main` first and then allocates `_Startup`.

For the HC05 with the usual startup code, this entry saves eight bytes in the `OVERLAP_GROUP` segment. To modify the usual startup code so that `_Startup` and `main` do not overlap, insert `OVERLAP_GROUP _Startup END` into the prm file.

NOTE You can configure the names of the `_Startup` function, `main` and `_startupData` to a non-default name in the prm file.

Example:

Assume that a processor has two interrupt priorities: Interrupt 1 priorities and Interrupt 0 priorities.

Assume the two functions `IntPrio1A` and `IntPrio1B` handle interrupt 1 priority requests.

Assume the two functions `IntPrio0A` and `IntPrio0B` handle the interrupt 0 priority requests.

Since two functions on the same priority level can never be active at the same time, use two `OVERLAP_GROUP`s to overlap the functions of the same level.

```
OVERLAP_GROUP IntPrio1A IntPrio1B END
OVERLAP_GROUP IntPrio0A IntPrio0B END
```

See also

DEPENDENCY: Dependency Control

PLACEMENT: Place Sections into Segments

Syntax (ELF)

```
PLACEMENT
SectionName{,sectionName} (INTO | DISTRIBUTE_INTO)
SegSpec{,SegSpec};
{SectionName{,sectionName} (INTO | DISTRIBUTE_INTO)
SegSpec{,SegSpec};}
END
```

Description

The `PLACEMENT` block is mandatory in a prm file and it cannot be specified more than once.

Each placement statement between the `PLACEMENT` and `END`, defines:

- (ELF) A relation between logical sections and physical memory ranges, called segments.
- (Freescale) A relation between logical segments and physical memory ranges called sections. Standard terminology for Freescale uses a `SECTIONS` block, rather than a `SEGMENTS` block; the ELF linker accepts this syntax.

Example (ELF)

```
SEGMENTS
  ROM_1  = READ_ONLY 0x800 TO 0xAFF;
  ROM_2  = READ_ONLY 0xB00 TO 0xCFF;
END
PLACEMENT
  DEFAULT_ROM INTO ROM_1, ROM_2;
END
```

In this example, the linker allocates the objects from `DEFAULT_ROM` section in `ROM_1` segment first. As soon as the `ROM_1` segment is full, allocation continues in section `ROM_2`.

You can split a statement inside of the `PLACEMENT` block over several lines. The statement terminates as soon as the linker detects a semicolon.

Always define the `SEGMENTS` block before defining the `PLACEMENT` block, because segments referenced in the `PLACEMENT` block must be defined in the `SEGMENTS` block.

Some restrictions apply on the commands specified in the `PLACEMENT` block:

- When you specify the `.copy` section in the `PLACEMENT` block, specify it as the last section in the section list.
- When you specify the `.stack` section in the `PLACEMENT` block, the prm file requires an additional `STACKSIZE` command if the stack is not the single section specified in the placement statement.
- Always specify the predefined sections `.text` and `.data` in the `PLACEMENT` block. These files retrieve the default placement for code or variable sections. The linker allocates all code or constant sections not appearing in the `PLACEMENT` block into the same segment list as the `.text` section. The linker allocates all variable sections not appearing in the `PLACEMENT` block into the same segment list as the `.data` section.

Example (Freescale)

```
SECTIONS
  ROM_1  = READ_ONLY 0x800 TO 0xAFF;
PLACEMENT
  DEFAULT_ROM, ROM_VAR INTO ROM_1;
END
```

In this example, the linker allocates the objects from `DEFAULT_ROM` segment first and then allocates the objects from the `ROM_VAR` segment.

Object allocation starts with the first section in the list; the linker allocates objects to the first memory range in the list as long as available memory can accommodate the object. If a section is full (i.e., the next object to be allocated is too large for the available space in the section), allocation continues with the next section in the list.

PRESTART: Application Prestart Code (Freescale)

Syntax

```
PRESTART (["+"] HexDigit {HexDigit} | OFF)
```

Description

This optional command allows the modification of the default `init` code generated by the linker at the very beginning of the application. Normally this code looks like:

```
DisableInterrupts.
On some processor, setup page registers
JMP StartupRoutine ("_Startup" by default)
```

Use the `PRESTART` command to replace all code before `JMP` by the code given by the Hex numbers following the keyword. If you add + after `PRESTART`, the linker inserts the code just before `JMP` but does not replace the standard code sequence.

NOTE Do not write a sequence of hexadecimal numbers in C (or Modula-2) format after the `PRESTART` command. Write an even number of hexadecimal digits. Example: `PRESTART + 4E714E71`

`PRESTART OFF` turns off prestart code completely, i.e., the first instruction executed is the first instruction of the startup routine.

Example

```
PRESTART OFF
```

SECTIONS: Define Memory Map (Freescale)

Syntax

```
SECTIONS {(READ_ONLY|READ_WRITE|NO_INIT|PAGED)
   <startAddr> (TO <endAddr> | SIZE <size>)}
```

Description

Specify the optional SECTIONS block in the prm file only once. Follow the SECTIONS block immediately by the PLACEMENT block.

The SECTIONS command allows you to assign meaningful names to address ranges. Subsequently you can use these names in PLACEMENT statements, thus increasing the readability of the parameter file.

Each address range you define is associated with one of the following:

- Qualifier (see Qualifier Handling)
- Start and end address
- Start address and a size

NOTE The ELF linker accepts SECTION syntax as an alias for SEGMENTS syntax.

Section Qualifier

The following qualifiers are available for sections:

- READ_ONLY: used for address ranges which are initialized at program load time. The application (*.abs) contains content only for this qualifier.
- READ_WRITE: used for address ranges initialized by the startup code at runtime. The linker initializes memory area defined with this qualifier with 0 at application startup. Information about READ_WRITE section initialization is stored in a READ_ONLY section.
- NO_INIT: used for address ranges where read/write accesses are allowed. The linker does not initialize memory area defined with this qualifier at application startup. This is useful if your target has a battery-buffered RAM or to speed up application startup.
- PAGED: used for address ranges where read/write accesses are allowed. The linker does not initialize memory area defined with this qualifier at application startup. Additionally, the linker does not control overlap between segments defined with the PAGED qualifier. When you use overlapped segments, it is your responsibility to select the correct page before accessing the data allocated on a page.

Table D.4 Section Qualifiers

Qualifier	Initialized Variables	Non-Initialized Variables	Constants	Code
READ_ONLY	Not applicable (1)	Not applicable (1)	Content written to target address	Content written to target address
READ_WRITE	Content written into copy down area, along with information defining startup location. Area contained in zero out information (3, 4)	Area contained in zero out information (4)	Content written into copy down area, along with information defining startup location. Area contained in zero out information (3, 4)	Not applicable (1, 2)
NO_INIT	Not applicable (1)	Handled as allocated. Nothing generated.	Not applicable (1)	Not applicable (1)
PAGED	Not applicable (1)	Handled as allocated. Nothing generated.	Not applicable (1)	Not applicable (1)

- These cases are unintended, although the linker allows some of them. If allowed, the qualifier controls what is written into the application.
- To allocate code in a RAM area, declare the area as READ_ONLY.
- Initialized objects and constants in READ_WRITE sections also need RAM memory and space in the copy down area. The copy down contains the information about object initialization in the startup code.
- The zero out information defines which areas to initialize with 0 at startup. Because the zero out contains only an address and a size per area, it is usually much smaller than a copy down area, which also contains the (non-zero) content of the objects to be initialized.

Example

```
SECTIONS
  ROM   = READ_ONLY  0x1000 SIZE 0x2000;
  CLOCK = NO_INIT    0xFF00 TO   0xFFFF;
```

```
  RAM   = READ_WRITE 0x3000 TO   0x3EFF;
  Page0 = PAGED      0x4000 TO   0x4FFF;
  Page1 = PAGED      0x4000 TO   0x4FFF;
END
```

In this example:

- The ROM section is a `READ_ONLY` memory area. It starts at address 0x1000 and its size is 0x2000 bytes (from address 0x1000 to 0x2FFF).
- The RAM section is a `READ_WRITE` memory area. It starts at address 0x3000 and ends at 0x3FFF (size = 0x1000 bytes). Application startup allocates all variables in this segment with 0.
- The CLOCK section is a `READ_WRITE` memory area. It starts at address 0xFF00 and ends at 0xFFFF (size = 100 bytes). Variables allocated in this segment are not initialized at application startup.
- The `Page0` and `Page1` sections are `READ_WRITE` memory areas. These are overlapping segments. It is your responsibility to select the correct page before accessing any data allocated in one of these segments. Variables allocated in this segment are not be initialized at application startup.

SEGMENTS: Define Memory Map (ELF)

Syntax

```
SEGMENTS {(READ_ONLY|READ_WRITE|NO_INIT|PAGED)
          <startAddr> (TO <endAddr> | SIZE <size>)
          [RELOCATE_TO Address]
          [ALIGN <alignmentRule>]
          [FILL <fillPattern>]
          {(DO_OPTIMIZE_CONSTS | DO_NOT_OPTIMIZE_CONSTS)
            { CODE | DATA }
          }
         }
END
```

Description

The optional `SEGMENTS` block cannot be specified more than once in a prm file.

Use the SEGMENTS command to assign meaningful names to address ranges. You can then use these names in subsequent PLACEMENT statements, thus increasing the readability of the parameter file.

Each address range you define is associated with:

- A qualifier.
- A start and end address or a start address and a size.
- An optional relocation rule
- An optional alignment rule
- An optional fill pattern.
- Optional constant optimization with Common Code commands.

Segment Qualifier

The following qualifiers are available for segments:

- READ_ONLY: used for address ranges which are initialized at program load time.
- READ_WRITE: used for address ranges which are initialized by the startup code at runtime. The linker initializes memory area defined with this qualifier with 0 at application startup.
- NO_INIT: used for address ranges where read/write accesses are allowed. The linker does not initialize memory area defined with this qualifier at application startup. This may be useful if your target has a battery-buffered RAM or to speed up application startup.
- PAGED: used for address range where read/write accesses are allowed. The linker does not initialize memory area defined with this qualifier at application startup. Additionally, the linker does not control overlap between segments defined with the PAGED qualifier. When using overlapped segments, it is your responsibility to select the correct page before accessing the allocated data.

Qualifier Handling

Table D.5 Qualifier Handling

Qualifier	Initialized Variables	Non-Initialized Variables	Constants	Code
READ_ONLY	Not applicable (1)	Not applicable (1)	Content written to target address	Content written to target address
READ_WRITE	Content written into copy down area, along with startup location information. Area contained in zero out information (3, 4)	Area contained in zero out information (4)	Content written into copy down area, along with startup location information. Area contained in zero out information (3, 4)	Not applicable (1, 2)
NO_INIT	Not applicable (1)	Handled as allocated. Nothing generated.	Not applicable (1)	Not applicable (1)
PAGED	Not applicable (1)	Handled as allocated. Nothing generated.	Not applicable (1)	Not applicable (1)

- These cases are unintended, although the linker allows some of them. If allowed, the qualifier controls what is written into the application.
- To allocate code in a RAM area, declare this area as READ_ONLY.
- Initialized objects and constants in READ_WRITE sections need RAM memory and space in the copy down area. The copy down contains the information about object initialization process in the startup code.
- The zero out information identifies areas to initialize with 0 at startup. Because the zero out contains only an address and a size per area, it is usually much smaller than a copy down area, which also contains the (non-zero) content of the objects to be initialized.

Example

```
SEGMENTS
  ROM   = READ_ONLY  0x1000 SIZE 0x2000;
  CLOCK = NO_INIT    0xFF00 TO   0xFFFF;
  RAM   = READ_WRITE 0x3000 TO   0x3EFF;
  Page0 = PAGED      0x4000 TO   0x4FFF;
  Page1 = PAGED      0x4000 TO   0x4FFF;
END
```

In this example:

- The `ROM` segment is a `READ_ONLY` memory area. It starts at address 0x1000 and its size is 0x2000 bytes (from address 0x1000 to 0x2FFF).
- The `RAM` segment is a `READ_WRITE` memory area. It starts at address 0x3000 and ends at 0x3FFF (size = 0x1000 bytes). This example initializes all variables allocated in this segment with 0 at application startup.
- The `CLOCK` segment is a `READ_WRITE` memory area. It starts at address 0xFF00 and ends at 0xFFFF (size = 100 bytes). Variables allocated in this segment are not initialized at application startup.
- The `Page0` and `Page1` segments are `READ_WRITE` memory areas. These are overlapping segments. It is your responsibility to select the correct page before accessing any data allocated in one of these segments. The linker does not initialize variables allocated in this segment at application startup.

Defining a Relocation Rule

Use the relocation rule if a segment is moved to a different location at runtime. With the relocation rule, you instruct the linker to use different runtime addresses for all objects in a segment.

This is useful when at runtime the code is copied and executed at a different address than the linked location. One example is a Flash programmer which must run out of RAM. Another example is a boot loader, which moves the actual application to a different address before running it.

Specify a relocation rule as follows:

```
RELOCATE_TO Address
```

Use `<Address>` to specify the runtime address of the object.

Example

```
SEGMENTS
```

```
    CODE_RELOC  = READ_ONLY 0x8000 TO 0x8FFF RELOCATE_TO
0x1000;
...
END
```

In this example, references to functions in CODE_RELOC use addresses from 0x1000 to 0x1FFF area, but the code is programmed from 0x8000 to 0x8FFF.

With RELOCATE_TO, you can execute code at an address different from where it was allocated. The code need not be position independent (PIC), however, non-PIC code may not run at its allocation address, as all references in the code refer to the RELOCATE_TO address.

NOTE Usually the RELOCATE_TO address is in RAM. The linker does not check for overlaps in the RELOCATE_TO address area. Set up the prm file so that no overlapping is possible.

Defining an Alignment Rule

You can associate an alignment rule with each segment in the application. Use this feature when specific alignment rules are expected on a certain memory range.

Specify an alignment rule as follows:

```
ALIGN [<defaultAlignment>] [{'['(<Number>|
    <Number> 'TO' <Number>|
    ('<' | '>' | '<=' | '>=')<Number>)']:'<alignment>}]
```

Use the defaultAlignment argument to specify the alignment factor for objects not matching any condition in the following alignment list. If you do not specify an alignment list, the default alignment factor applies to all objects allocated in the segment. The default alignment factor is optional.

The following listing shows an example.

```
SEGMENTS
    RAM_1   = READ_WRITE 0x800 TO 0x8FF
              ALIGN 2 [1:1];
    RAM_2   = READ_WRITE 0x900 TO 0x9FF
              ALIGN [2 TO 3:2] [>= 4:4];
    RAM_3   = READ_WRITE 0xA00 TO 0xAFF
              ALIGN 1 [>=2:2];
END
```

In this example:

- RAM_1 segment: Aligns all objects of size equal to 1 byte on 1-byte boundaries. Aligns all other objects on 2-byte boundaries.
- RAM_2 segment: Aligns all objects of size equal to 2 or 3 bytes on 2-byte boundaries. Aligns all objects of size greater than or equal to 4 bytes on 4-byte boundaries. Objects of size equal to 1 byte follow the default processor alignment rule.
- RAM_3 segment: Aligns all objects of size greater than or equal to 2 bytes on 2-byte boundaries. Aligns all other objects on 1-byte boundaries.

Alignment rules that apply during object allocation are described in the alignment chapter.

Defining a Fill Pattern

You can associate a fill pattern with each segment in the application. This can be useful for automatically initializing uninitialized variables in the segments with a predefined pattern.

Specify a fill pattern as follows:

```
FILL <HexByte> {<HexByte>}
```

NOTE Any segment defined with the FILL command in the SEGMENTS portion of the prm file fills only if the segment is also used in the PLACEMENT section of the prm file. If necessary, add a dummy entry to the PLACEMENT section.

The following listing shows an example.

```
SEGMENTS
    RAM_1  = READ_WRITE 0x800 TO 0x8FF
             FILL 0xAA 0x55;
END
PLACEMENT
    DUMMY  INTO RAM_1
END
```

This example initializes uninitialized objects and filling bytes with the pattern 0xAA55.

If the size of an object to initialize is greater than the size of the specified pattern, the pattern repeats as many time as necessary to fill the objects. In this example, an object with a size of 4 bytes initializes with 0xAA55AA55.

If the size of an object to initialize is less than the size of the specified pattern, the pattern truncates to match the size of the object. In this example, an object with a size of 1 byte initializes with 0xAA.

When the value specified in an element of a fill pattern does not fit into a byte, it truncates to a byte value.

The following listing shows as example.

```
SEGMENTS
    RAM_1   = READ_WRITE 0x800 TO 0x8FF
              FILL 0xAA55;
END
```

This example initializes uninitialized objects and filling bytes with the pattern 0x55. The specified fill pattern truncates to a 1-byte value.

Fill patterns are useful for assigning an initial value to the padding bytes inserted between two objects during object allocation. This allows marking from the unused position with a specific marker and detecting them inside of the application.

For example, you can initialize an unused position inside a section of code with the hexadecimal code for the NOP instruction.

Optimizing Constants with Common Code

You can allocate constants having the same byte pattern to the same addresses. The most common usage is to allocate some string in another string.

Example

```
const char* hwstr="Hello World";
const char* wstr= "World";
```

The string `Hello World` contains the string `World` exactly. When the constants are optimized, `wstr` points to `hwstr+6`.

In the Freescale format, the linker only optimizes strings. In the ELF format, all constant objects, including strings, constants and code, can be optimized.

For all segments you can specify whether to optimize code or data (only constants and strings). If nothing is specified, `-Cocc` controls the default (see -Cocc: Optimize Common Code (ELF)).

Examples

Listing D.13 C-Source File

```
void print1(void) {
  printf("Hello");
}
void print2(void) {
  printf("Hello");
```

```
}
```

Listing D.14 Prm File

```
SECTIONS
    ...
    MY_ROM = READ_ONLY 0x9000 TO 0xFEFF DO_OVERLAP_CONSTS CODE DATA;
END
```

If you optimize data only, the string `Hello` appears once in the ROM-image. Optimizing both code and data allocates the `print1` and `print2` functions at the same address. However, if you optimize code only (this is not the case here), then `print1` and `print2` are not optimized because they use different instances of the string `Hello`.

If you optimize code only, the linker issues the warning:

```
L1951: Function print1 is allocated inside of print2 with
offset 0. Debugging may be affected.
```

The linker issues this warning because the debugger cannot distinguish between `print1` and `print2`, so the wrong function might display while debugging. This does not, however, affect the runtime behavior.

The linker detects certain branch distance optimizations done by the compiler because of the special fixups used. If the linker detects this type of optimization, neither the caller and the callee are moved into other functions. However, other functions can still be moved into them.

NOTE Switching off the compiler optimizations can produce smaller applications, if the compiler optimizations prevent linker optimizations.

In C++, several language constructs result in identical functions in different compilation units. Different instances of the same template may have identical code. Compiler-generated functions, and inline functions not actually inlined, are defined in every compilation unit. Finally, constants defined in header files are static in C++, so they are also contained once in every object file.

STACKSIZE: Define Stack Size

Syntax

```
STACKSIZE Number
```

Description

The STACKSIZE command is optional in a prm file and it cannot be specified more than once. Additionally, you cannot specify both STACKTOP and STACKSIZE commands in the same prm file (see STACKTOP: Define Stack Pointer Initial Value).

The STACKSIZE command defines the size requested for the stack. We recommend using this command if you do not care where the stack is allocated but only how large it is.

When the stack is defined using a STACKSIZE command alone, the stack is placed next to the section .data.

NOTE In the Freescale object file format allows the synonym STACK instead of STACKSIZE. This is for compatibility only, and may be removed in a future version.

Example

```
SECTIONS
  MY_RAM = READ_WRITE 0xA00 TO 0xAFF;
  MY_ROM = READ_ONLY  0x800 TO 0x9FF;
PLACEMENT
  DEFAULT_ROM INTO MY_ROM;
  DEFAULT_RAM INTO MY_RAM;
END
STACKSIZE 0x60
```

In this example, if the section .data is 4 bytes wide (from address 0xA00 to 0xA03), the section .stack is allocated next to it, from address 0xA63 down to address 0xA04. The stack initial value is set to 0xA62.

When the stack is defined through a STACKSIZE command associated with the placement of the .stack section, the stack is supposed to start at the segment start address incremented by the specified value and is defined down to the start address of the segment, where .stack has been placed.

Example

```
SECTIONS
  MY_STK = NO_INIT    0xB00 TO 0xBFF;
  MY_RAM = READ_WRITE 0xA00 TO 0xAFF;
  MY_ROM = READ_ONLY  0x800 TO 0x9FF;
PLACEMENT
  DEFAULT_ROM INTO MY_ROM;
  DEFAULT_RAM INTO MY_RAM;
  SSTACK      INTO MY_STK;
END
STACKSIZE 0x60
```

This example allocates the SSTACK section from address 0xB5F down to address 0xB00. The initial stack value is set to 0xB5E.

STACKTOP: Define Stack Pointer Initial Value

Syntax

```
STACKTOP Number
```

Description

The optional STACKTOP command cannot be specified more than once in a prm file. Additionally, you cannot specify both STACKTOP and STACKSIZE (see STACKSIZE: Define Stack Size) in a prm file.

The STACKTOP command defines the initial value for the stack pointer.

Example

Define STACKTOP as:

```
STACKTOP 0xBFF
```

This initializes the stack pointer with 0xBFF at application startup.

Defining the stack using a STACKTOP command alone affects the default stack size. Stack size depends on the processor and is big enough to store the target processor PC.

Defining the stack using a `STACKTOP` command associated with the placement of the `.stack` section starts the stack at the specified address, and includes the start address of the segment where `.stack` is placed.

Example

```
SEGMENTS
  MY_STK = NO_INIT    0xB00 TO 0xBFF;
  MY_RAM = READ_WRITE 0xA00 TO 0xAFF;
  MY_ROM = READ_ONLY  0x800 TO 0x9FF;
END
PLACEMENT
  DEFAULT_ROM   INTO MY_ROM;
  DEFAULT_RAM   INTO MY_RAM;
  SSTACK        INTO MY_STK;
END
STACKTOP 0xB7E
```

This example defines the stack pointer from address 0xB7E to address 0xB00.

START: Specify the ROM Start (Freescale)

Syntax

```
START Address
```

Description

NOTE This command supports old-style linker parameter files. Future releases may not support this command.

Use this command to specify start location of the default ROM. `Address` must be in hexadecimal notation. Internally this command translates into:

```
START 0x????' => 'DEFAULT_ROM INTO READ_ONLY 0x???? TO
0x????
```

Because the end address of `DEFAULT_ROM` is unknown, the linker attempts to specify/find the end address itself.

NOTE An error message during linking stating that `START` is undefined indicates that no visible application entry point exists for the linker (e.g., the `main` routine is defined as static).

Example

```
START 0x1000
```

VECTOR: Initialize Vector Table

Syntax

```
VECTOR (InitByAddr | InitByNumber)
```

Description

The `VECTOR` command is optional in a prm file and can be specified more than once.

A vector is a small piece of memory, having the size of a function address. This command allows you to initialize the processor's vectors while downloading the absolute file.

A `VECTOR` command consists of a vector location part (containing the location of the vector) and a vector target part (containing the value to store in the vector).

You can specify the vector location part:

- Through a vector number. Vector number-to-address mapping is target specific.
  - For targets with vectors starting at 0, this command allocates the vector at `<Number> * <Size of a Function Pointer>`.
  - For targets with vectors located from 0xFFFE and allocated downwards, `VECTOR 0` maps to 0xFFFE. Generally the address is `0xFFFE-<Number> * 2`.
  - For HC08/RS08, `VECTOR` numbers automatically map to vector locations natural for this target.
- Through a vector address. In this case, specify the `ADDRESS` keyword in the vector command.

You can specify the vector target part:

- As a function name
- As an absolute address.

Example

```
VECTOR ADDRESS 0xFFFE _Startup
VECTOR ADDRESS 0xFFFC 0xA00
VECTOR 0 _Startup
VECTOR 1 0xA00
```

If the size of a function pointer is coded on two bytes, then this example:

- Initializes the vector located at address 0xFFFE with the address of the function `_Startup`.
- Initializes the vector located at address 0xFFFC with the absolute address 0xA00.

The address of vector numbers is target specific.

- For an HC08:
  - Vector number 0 is located at address 0xFFFE.
  - Vector number 1 is located at address 0xFFFC.

You can specify an additional offset when the vector target is a function name. This initializes the vector with the address of the object + the specified offset.

Example

```
VECTOR ADDRESS 0xFFFE CommonISR OFFSET 0x10
```

This example initializes the vector located at address 0xFFFE with the address of the function `CommonISR + 0x10 Byte`. If `CommonISR` starts at address 0x800, this initializes the vector with 0x810.

This notation is very useful for common interrupt handlers.

All objects specified in a `VECTOR` command are entry points in the application. They are always linked with the application, as well as the objects they refer to.

Batch Burner Commands

This section describes valid parameter values that can be used in commands. For more details about commands, refer to the file `FIBO.BBL`, which shows how to write a script.

Following commands are available:

- baudRate: Baudrate for Serial Communication
- busWidth: Data Bus Width
- CLOSE: Close Open File or Communication Port
- dataBit: Number of Data Bits

baudRate: Baudrate for Serial Communication

Syntax

```
baudRate assign <baud>
```

Arguments

<baud>: valid baudrate.

Default

```
baudrate = 9600
```

Description

Sets the transmission speed. This parameter must not be used when the burner output is redirected to a file. Valid identifier values are 300, 600, 1200, 2400, 4800, 9600, 19200 or 38400 (default is 9600).

Use this command only if output is sent to a communication port.

Example

```
baudRate = 19200
```

See also

- dataBit: Number of Data Bits
- parity: Set Communication Parity
- header: Header File for PROM Burner
- OPENCOM: Open Output Communication Port

busWidth: Data Bus Width

Syntax

```
busWidth assign ( 1 | 2 | 4 )
```

Arguments

A bus width of 1, 2 or 4

Default

```
busWidth = 1
```

Description

Most EPROMs are 1 byte wide. To burn an application into EPROMs, you need 1, 2 or 4 EPROMs depending on the width of the data bus of the target system used. The Burner program allows you to select the data bus width using the identifier `busWidth`. Only 1, 2 and 4 are valid values for the parameter `busWidth` (the default is 1).

Example

```
busWidth = 4
```

CLOSE: Close Open File or Communication Port

Syntax

```
CLOSE
```

Arguments

None

Default

None

Description

Use `CLOSE` to close a file opened by OPENFILE: Open Output File or COM port opened with OPENCOM: Open Output Communication Port.

Example

```
CLOSE
```

See also

- OPENFILE: Open Output File
- OPENCOM: Open Output Communication Port

dataBit: Number of Data Bits

Syntax

```
dataBit assign ( 7 | 8 )
```

Arguments

7 or 8 data bits.

Default

```
dataBit = 8
```

Description

Sets the number of data bits. This parameter must not be used when the burner output is redirected to a file. Valid identifier values are 7 or 8 (default is 8).

Use this command only if the output is sent to a communication port.

Example

```
dataBit = 7
```

See also

- baudRate: Baudrate for Serial Communication
- parity: Set Communication Parity
- header: Header File for PROM Burner
- OPENCOM: Open Output Communication Port

destination: Destination Offset

Syntax

```
destination assign <offset>
```

Arguments

`<offset>`: offset to be added

Default

```
destination = 0
```

Description

Use this command to add an additional offset to the address field of an S-Record or a Intel Hex Record.

Example

```
destination = 0x2000
```

See also

- len: Length to be Copied
- origin: EEPROM Start Address

DO: For Loop Statement List

Syntax

```
"FOR" Ident Assign SimpleExpr
"TO" SimpleExpr "DO" StatementList "END"
```

Arguments

None

Default

None

Description

This command starts the FOR statement list. As `ident` only `i` may be used, and the burner replaces each occurrence of `#` in the loop with the actual value of `i`.

Example

```
FOR i=0 TO 10 DO
  ECHO "#"
END
```

See also

- FOR: For Loop
- TO: For Loop End Condition
- END: For Loop End or If End

ECHO: Echo String onto Output Window

Syntax

```
ECHO [<string>]
```

Arguments

`<string>`: a string written to the output window

Default

None

Description

With this command you can write a string to the output window. If you do not specify a string, the burner writes an empty line.

Example

```
ECHO
ECHO "hello world!"
```

ELSE: Else Part of If Condition

Syntax

```
IF RelExpr THEN StatementList
[ ELSE StatementList] END
```

Arguments

None

Default

None

Description

This command starts the optional `ELSE` part of an `IF` conditional section.

Example

```
FOR i=0 TO 10 DO
  IF i==7 THEN
    ECHO "i is 7"
  ELSE
    ECHO "#"
  END
END
```

See also

- END: For Loop End or If End
- IF: If Condition
- THEN: Statementlist for If Condition

END: For Loop End or If End

Syntax

```
FOR Ident Assign SimpleExpr
TO SimpleExpr DO StatementList END
```

or

```
IF RelExpr THEN StatementList
[ ELSE StatementList] END
```

Arguments

None

Default

None

Description

This command ends either a `FOR` loop or `IF` condition.

Example

```
FOR i=0 TO 10 DO
  IF i==7 THEN
    ECHO "i is 7"
  END
  ECHO "#"
END
```

See also

- IF: If Condition
- THEN: Statementlist for If Condition

- ELSE: Else Part of If Condition
- TO: For Loop End Condition
- DO: For Loop Statement List
- FOR: For Loop

FOR: For Loop

Syntax

```
FOR Ident Assign SimpleExpr
TO SimpleExpr DO StatementList END
```

Arguments

None

Default

None

Description

This command starts a `FOR` loop.

Example

```
FOR i=0 TO 10 DO
  IF i==7 THEN
    ECHO "i is 7"
  END
  ECHO "#"
END
```

See also

- TO: For Loop End Condition
- DO: For Loop Statement List
- END: For Loop End or If End

format: Output Format

Syntax

```
format assign ( freescale | intel | binary )
```

Arguments

Format, either Freescale S, Intel Hex or Binary.

Default

```
format = freescale
```

Description

The Burner supports three different data transfer formats: S-Records, Intel Hex-Format and binary format. With the binary format the output destination must be a file. Valid identifiers are: Freescale, intel, binary (the default is Freescale)

Example

```
format = binary
```

header: Header File for PROM Burner

Syntax

```
header assign <fileName>
```

Arguments

`<fileName>`: header file to be sent to serial port

Default:

```
header =
```

Description

Specifies an initialization file for the PROM burner. Do not use this parameter when the burner output is redirected to a file. This file is sent byte by byte (binary) without modification to the PROM burner before anything else is sent.

This command is only used if the output is sent to a communication port.

Example

```
header = "myheader.txt"
```

See also

- baudRate: Baudrate for Serial Communication
- parity: Set Communication Parity
- header: Header File for PROM Burner
- dataBit: Number of Data Bits
- OPENCOM: Open Output Communication Port

IF: If Condition

Syntax

```
IF RelExpr THEN StatementList
[ ELSE StatementList] END
```

Arguments

None

Default

None

Description

This command starts an `IF` conditional section.

Example

```
FOR i=0 TO 10 DO
  IF i==7 THEN
    ECHO "i is 7"
  END
  ECHO "#"
END
```

See also

- END: For Loop End or If End

- THEN: Statementlist for If Condition
- ELSE: Else Part of If Condition

---

len: Length to be Copied

Syntax

```
len assign <number>
```

Arguments

`<number>`: length to be copied.

Default

```
len = 0x10000
```

Description

Range of program code to be copied. You can also specify length using the ANSI-C or Modula-2 notation for hexadecimal constants (default is 0x10000).

Example

If an application is linked between address $3000 and $4000 and the EEPROM start address is $2000 (origin), then `len` must be set to $2000. The code is stored at address $1000 relative to the EEPROM start address.

If the EPROM start address is $3000 (origin) then `len` must be set to $1000. The code is stored at the beginning of the EEPROM.

Example

```
len = 0x2000
```

See also

- destination: Destination Offset
- origin: EEPROM Start Address

OPENCOM: Open Output Communication Port

Syntax

```
OPENCOM <port>
```

Arguments

`<port>`: valid COM port number (1, 2, 3, 4).

Default

None

Description

With this command, the Burner sends the output to the specified communication port. To close the port opened, use CLOSE: Close Open File or Communication Port.

Example

```
OPENCOM 2
```

See also

- baudRate: Baudrate for Serial Communication
- parity: Set Communication Parity
- header: Header File for PROM Burner
- dataBit: Number of Data Bits
- OPENFILE: Open Output File
- CLOSE: Close Open File or Communication Port

OPENFILE: Open Output File

Syntax

```
OPENFILE <file>
```

Arguments

`<file>`: valid file name.

Default

None

Description

With this command, the Burner sends the output to the specified file. To close the file, use CLOSE: Close Open File or Communication Port command.

Example

```
OPENFILE "myFile.s19"
```

See also

- OPENCOM: Open Output Communication Port
- CLOSE: Close Open File or Communication Port

---

origin: EEPROM Start Address

Syntax

```
origin assign <address>
```

Arguments

<address>: start address.

Default

```
origin = 0
```

Description

Initialized with the EPROM start address in the target system. You can specify the start address using ANSI C or Modula-2 notation for hexadecimal constants (default is 0).

Example:

```
origin = 0xC000
```

See also

- len: Length to be Copied
- destination: Destination Offset

parity: Set Communication Parity

Syntax

```
parity assign ( none | even | odd )
```

Arguments

parity none, even or odd.

Default

```
parity = none
```

Description

Sets the parity used for transfer. Do not use this parameter when the burner output is redirected to a file. Valid identifier values are none, odd, and even (default is none).

Use this command only if the output is sent to a communication port.

Example

```
parity = even
```

See also

- baudRate: Baudrate for Serial Communication
- dataBit: Number of Data Bits
- header: Header File for PROM Burner
- OPENCOM: Open Output Communication Port

SENDBYTE: Transfer Bytes

Syntax

```
SENDBYTE <number> <file>
```

Arguments

`<number>`: valid byte number (1, 2, 3, 4)

`<file>`: valid source file name.

Default

None

Description

This command starts the transfer.

If the data format is binary, the destination must be a file. The size of the file is the size specified by `len` divided by the `busWidth`. All undefined bytes are initialized with $FF or with the value specified by undefByte: Fill Byte for Binary Files.

If a data bus width of 1 byte is selected, the following command must be used to transfer the code:

```
SENDBYTE 1 "InFile.abs"
```

If the data bus is 2 bytes wide, the code is split into two parts; the command `SENDBYTE 1 "InFile.abs"` transfers the even part of the code (corresponding to D8 to D15) while the command `SENDBYTE 2 "InFile.abs"` transfers the odd part, which corresponds to the LSB (D0 to D7).

If the data bus is 4 bytes wide, the command `SENDBYTE 1 "InFile.abs"` transfers the MSB (D24 to D31), while the command `SENDBYTE 4 "InFile.abs"` sends the LSB (D0 to D7).

If using 16-bit EPROMs, you must use the commands `SENDWORD 1 "InFile.abs"` and `SENDWORD 2 "InFile.abs"`. If necessary, high and low byte can be swapped by initializing `swapBytes` with `yes`.

Example

```
SENDBYTE 1 "myApp.abs"
```

See also

- busWidth: Data Bus Width
- SENDWORD: Transfer Word

SENDWORD: Transfer Word

Syntax

```
SENDWORD <number> <file>
```

Arguments

`<number>`: valid word number (1, 2)

`<file>`: valid source file name.

Default

None

Description

This command starts the transfer.

If the data format is binary, the destination must be a file. The size of the file is the size specified by `len` divided by the `busWidth`. All undefined bytes are initialized with $FF or value specified by undefByte: Fill Byte for Binary Files.

If a data bus width of 1 byte is selected, the following command must be used to transfer the code:

```
SENDBYTE 1 "InFile.abs"
```

If the data bus is 2 bytes wide, the code is split into two parts; the command `SENDBYTE 1 "InFile.abs"` transfers the even part of the code (corresponding to D8 to D15) while the command `SENDBYTE 2 "InFile.abs"` transfers the odd part, which corresponds to the LSB (D0 to D7).

If the data bus is 4 bytes wide, the command `SENDBYTE 1 "InFile.abs"` transfers the MSB (D24 to D31), while the command `SENDBYTE 4 "InFile.abs"` sends the LSB (D0 to D7).

Using 16-bit EPROMs, the commands `SENDWORD 1 "InFile.abs"` and `SENDWORD 2 "InFile.abs"` must be used. If necessary, the high and low byte can be swapped by initializing swapBytes with yes.

Example

```
SENDWORD 1 "myApp.abs"
```

See also

- SENDBYTE: Transfer Bytes
- busWidth: Data Bus Width

SLINELEN: SRecord Line Length

Syntax

```
SLINELEN assign <number>
```

Arguments

<number>: valid line length (1, 2,)

Default

<number> == 32

Description

This command configures how many bytes written are on a single SRECORD line. This command only effects SRECORD file generation.

Example

With SLINELEN 16, the burner generates:

```
S113200000000000010100000000000000000000CA
S113201000088002082080000000001020408106B
```

With SLINELEN 8, the burner generates:

```
S10B2000000000001010000D2
S10B2008000000000000000CC
S10B2010000880020820800092
S10B201800000001020408109D
```

See also

- format: Output Format

SRECORD: S-Record Type

Syntax

SRECORD= (Sx | S1 | S2 | S3)

Arguments

Sx : Automatic choose between S1, S2 or S3 records

S1 : use S1 records

S2 : use S2 records

S3 : use S3 records

Default

```
SRECORD=Sx
```

Description

This command is for S-Record output format.

Normally the Burner chooses the matching S-Record type depending on the addresses used. However, with this option a certain type may be forced because the PROM burner only supports one type.

If Sx is active, the burner is in automatic mode:

if the highest address is >= 0x1000000, then S3 records are used,

if the highest address is >= 0x10000, then S2 records are used,

otherwise S1 records are used.

Example

```
SRECORD=S2
```

See also

- format: Output Format

swapByte: Swap Bytes

Syntax

```
swapByte assign ( on | off )
```

Arguments

`on` : enables byte swapping

`off` : disables byte swapping

Default

```
swapByte = off
```

Description

If necessary, the high and low byte can be exchanged when 16-bit or 32-bit EPROMs are used.

Example

```
swapByte = on
```

See also

- busWidth: Data Bus Width

THEN: Statementlist for If Condition

Syntax

```
IF RelExpr THEN StatementList
[ ELSE StatementList] END
```

Arguments

None

Default

None

Description

This command starts an IF conditional section.

Example

```
FOR i=0 TO 10 DO
  IF i==7 THEN
    ECHO "i is 7"
  END
  ECHO "#"
END
```

See also

- END: For Loop End or If End
- IF: If Condition
- ELSE: Else Part of If Condition

TO: For Loop End Condition

Syntax

```
FOR Ident Assign SimpleExpr
TO SimpleExpr DO StatementList END
```

Arguments

None

Default

None

Description

Specifies the `FOR` loop end condition. As `ident`, only `i` may be used, and each occurrence of `#` in the loop is replaced with the actual value of `i`.

Example

```
FOR i=0 TO 10 DO
  ECHO "#"
END
```

See also

- FOR: For Loop
- DO: For Loop Statement List
- END: For Loop End or If End

undefByte: Fill Byte for Binary Files

Syntax

```
undefByte assign <number>
```

Arguments

`<number>`: 8bit number

Default

```
undefByte = 0xFF
```

Description

This command assigns the default fill byte to undefined bytes in binary output files.

This command is only used for binary files.

Example

```
undefByte = 0x33
```

See also

- format: Output Format

PAUSE: Wait until Key Pressed

Syntax

```
PAUSE [<string>]
```

Arguments

`<string>`: a string written to output window

Default

None

Description

This command causes the batch burner language program to wait until a key is pressed. An optional message text may be specified. For Windows, a dialog box appears:

Figure D.1 Burner Pause Dialog Box

Example

```
PAUSE "please press a key."
```

E

EBNF Notation

This chapter gives a brief overview of the Extended Backus–Naur Form (EBNF) notation, which is frequently used in this manual to describe file formats and syntax rules.

Introduction to EBNF

EBNF is frequently used in this reference manual to describe file formats and syntax rules. Therefore a short introduction to EBNF is given here.

EBNF Example

```
ProcDecl     =  PROCEDURE "(" ArgList ")".
ArgList      =  Expression {"," Expression}.
Expression   =  Term ("*"|"/") Term.
Term         =  Factor AddOp Factor.
AddOp        =  "+"|"-".
Factor       =  (["-"] Number)|"(" Expression ")".
```

The EBNF language is a formalism that can be used to express the syntax of context-free languages. An EBNF grammar is a set of rules called *productions* of the form:

```
LeftHandSide = RightHandSide.
```

The left-hand side is a so-called non-terminal symbol, the right-hand side describes its composition.

EBNF consists of the following symbols:

- Terminal symbols (terminals for short) are the basic symbols which form the language described. In above example, the word `PROCEDURE` is a terminal. Punctuation symbols of the language described (not of EBNF itself) are quoted (they are terminals, too), while other terminal symbols are printed in **boldface**.
- Non-terminal symbols (non-terminals) are syntactic variables and must be defined in a production, i.e. they must appear on the left-hand side of a production somewhere. In the above example, there are many non-terminals, e.g. `ArgList` or `AddOp`.
- The vertical bar "|" denotes an alternative, i.e. either the left or the right side of the bar can appear in the language described, but one of them must. The third production

above means “an expression is a term followed by either a ‟*” or a ‟/” followed by another term”.

Parts of an EBNF production enclosed by ‟[” and ‟]” are optional. They may appear exactly once in the language, or they may be skipped. The minus sign in the last production above is optional, both −7 and 7 are allowed.

- The repetition is another useful construct. Any part of a production enclosed by ‟{” and ‟}” may appear any number of times in the language described (including zero, i.e. it may also be skipped). ArgList above is an example: an argument list is a single expression or a list of any number of expressions separated by commas. (Note that the syntax in the example does not allow empty argument lists)
- For better readability, normal parentheses may be used for grouping EBNF expressions, as is done in the last production of the example. Note the difference between the first and the second left bracket: the first one is part of EBNF itself, the second one is a terminal symbol (it is quoted) and therefore may appear in the language described.
- A production is always terminated by a period.

EBNF Syntax

We can now give the definition of EBNF in EBNF itself:

```
Production      =  NonTerminal "=" Expression ".".
Expression      =  Term {"|" Term}.
Term            =  Factor {Factor}.
Factor          =  NonTerminal
                   | Terminal
                   | "(" Expression ")"
                   | "[" Expression "]"
                   | "{" Expression "}".
Terminal        =  Identifier | “"“ <any char> “"“.
NonTerminal     =  Identifier.
```

The identifier for a non-terminal can be any name you like, terminal symbols are either identifiers appearing in the language described or any character sequence that is quoted.

Extensions

In addition to this standard definition of EBNF, we use the following notational conventions:

- The counting repetition: Anything enclosed by “{“ and “}” and followed by a superscripted expression *x* must appear exactly *x* times. *x* may also be a non-terminal. In the following example, exactly four stars are allowed:

```
Stars = {"*"}4.
```

- The size in bytes. Any identifier immediately followed by a number *n* in square brackets (“[” and “]”) may be assumed to be a binary number with the most significant byte stored first, having exactly *n* bytes. Example:

```
Struct=RefNo FilePos[4].
```

- In some examples, we enclose text by "<" and ">". This text is a meta–literal, i.e. whatever the text says may be inserted in place of the text. (cf. <any char> in the above example, where any character can be inserted).

Index

C

D

E

F

G

H

I

L

M

N

O

P

Q

R

S

T

U

V

W

X

Y