

ARM[®] Compiler toolchain v5.02 for μVision

Linker Reference



ARM Compiler toolchain v5.02 for μ Vision

Linker Reference

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Release Information

The following changes have been made to this book.

Change History

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Chapter 1

Conventions and feedback

The following describes the typographical conventions and how to give feedback:

Typographical conventions

The following typographical conventions are used:

`monospace` Denotes text that can be entered at the keyboard, such as commands, file and program names, and source code.

`monospace` Denotes a permitted abbreviation for a command or option. The underlined text can be entered instead of the full command or option name.

`monospace` *italic*

Denotes arguments to commands and functions where the argument is to be replaced by a specific value.

`monospace` **bold**

Denotes language keywords when used outside example code.

italic Highlights important notes, introduces special terminology, denotes internal cross-references, and citations.

bold Highlights interface elements, such as menu names. Also used for emphasis in descriptive lists, where appropriate, and for ARM® processor signal names.

Feedback on this product

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- your name and company

- the serial number of the product
- details of the release you are using
- details of the platform you are using, such as the hardware platform, operating system type and version
- a small standalone sample of code that reproduces the problem
- a clear explanation of what you expected to happen, and what actually happened
- the commands you used, including any command-line options
- sample output illustrating the problem
- the version string of the tools, including the version number and build numbers.

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- if viewing a PDF version of a document, the page numbers to which your comments apply
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Other information

- ARM Product Manuals, http://www.keil.com/support/man_arm.htm
- Keil Support Knowledgebase, <http://www.keil.com/support/knowledgebase.asp>
- Keil Product Support, <http://www.keil.com/support/>
- ARM Glossary, <http://infocenter.arm.com/help/topic/com.arm.doc.aeg0014-/index.html>.

Chapter 2

Linker command-line options

The following topics describe the command-line options supported by the linker, `armlink`:

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2.1 --any_contingency

This option permits extra space in any execution regions containing .ANY sections for linker-generated content such as veneers and alignment padding. Two percent of the space is reserved for veneers.

When a region is about to overflow because of potential padding, arm1ink lowers the priority of the .ANY selector.

This option is off by default. That is, arm1ink does not attempt to calculate padding and strictly follows the .ANY priorities.

Use this option with the --scatter option.

2.1.1 See also

Tasks

Using the Linker:

- [Placing unassigned sections with the .ANY module selector on page 8-23.](#)

Concepts

- [Behavior when .ANY sections overflow because of linker-generated content on page 4-29.](#)

Reference

- [--any_placement=algorithm on page 2-6](#)
- [--any_sort_order=order on page 2-8](#)
- [--info=topic\[,topic,...\] on page 2-58](#)
- [--scatter=filename on page 2-109](#)
- [Syntax of an input section description on page 4-23.](#)

2.2 --any_placement=*algorithm*

Controls the placement of sections that are placed using the .ANY module selector.

2.2.1 Syntax

--any_placement=*algorithm*

where *algorithm* is one of the following:

- | | |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| best_fit | Place the section in the execution region that currently has the least free space but is also sufficient to contain the section. |
| first_fit | Place the section in the first execution region that has sufficient space. The execution regions are examined in the order they are defined in the scatter file. |
| next_fit | Place the section using the following rules: <ul style="list-style-type: none"> • place in the current execution region if there is sufficient free space • place in the next execution region only if there is insufficient space in the current region • never place a section in a previous execution region. |
| worst_fit | Place the section in the execution region that currently has the most free space. |

Use this option with the --scatter option.

2.2.2 Usage

The placement algorithms interact with scatter files and --any_contingency as follows:

Interaction with normal scatter-loading rules

Scatter-loading with or without .ANY assigns a section to the most specific selector. All algorithms continue to assign to the most specific selector in preference to .ANY priority or size considerations.

Interaction with .ANY priority

Priority is considered after assignment to the most specific selector in all algorithms.

worst_fit and best_fit consider priority before their individual placement criteria. For example, you might have .ANY1 and .ANY2 selectors, with the .ANY1 region having the most free space. When using worst_fit the section is assigned to .ANY2 because it has higher priority. Only if the priorities are equal does the algorithm come into play.

first_fit considers the most specific selector first, then priority. It does not introduce any more placement rules.

next_fit also does not introduce any more placement rules. If a region is marked full during next_fit, that region cannot be considered again regardless of priority.

Interaction with --any_contingency

The priority of a .ANY selector is reduced to 0 if the region might overflow because of linker-generated content. This is enabled and disabled independently of the sorting and placement algorithms.

armlink calculates a worst-case contingency for each section.

For `worst_fit`, `best_fit`, and `first_fit`, when a region is about to overflow because of the contingency, `armlink` lowers the priority of the related `.ANY` selector.

For `next_fit`, when a possible overflow is detected, `armlink` marks that section as `FULL` and does not consider it again. This stays consistent with the rule that when a section is full it can never be revisited.

2.2.3 Default

The default option is `worst_fit`.

2.2.4 See also

Tasks

Using the Linker:

- [Placing unassigned sections with the `.ANY` module selector on page 8-23.](#)

Concepts

- [Behavior when `.ANY` sections overflow because of linker-generated content on page 4-29](#)

Using the Linker:

- [Examples of using placement algorithms for `.ANY` sections on page 8-26](#)
- [Example of `next_fit` algorithm showing behavior of full regions, selectors, and priority on page 8-28.](#)

Reference

- [--any_contingency on page 2-5](#)
- [--any_sort_order=order on page 2-8](#)
- [--info=topic\[,topic,...\] on page 2-58](#)
- [--scatter=filename on page 2-109](#)
- [Syntax of an input section description on page 4-23.](#)

2.3 --any_sort_order=*order*

Controls the sort order of input sections that are placed using the .ANY module selector.

2.3.1 Syntax

--any_sort_order=*order*

where *order* is one of the following:

descending_size

Sort input sections in descending size order.

cmdline

Sort input sections by command-line index.

By default, sections that have the same properties are resolved using the creation index. You can use the --tiebreaker command-line option to resolve sections by the order they appear on the linker command-line.

Use this option with the --scatter option.

2.3.2 Usage

The sorting governs the order that sections are processed during .ANY assignment. Normal scatter-loading rules, for example R0 before RW, are obeyed after the sections are assigned to regions.

2.3.3 Default

The default option is descending_size.

2.3.4 See also

Tasks

Using the Linker:

- [Placing unassigned sections with the .ANY module selector on page 8-23.](#)

Concepts

Using the Linker:

- [Examples of using sorting algorithms for .ANY sections on page 8-30.](#)

Reference

- [--any_contingency on page 2-5](#)
- [--any_placement=algorithm on page 2-6](#)
- [--info=topic\[,topic,...\] on page 2-58](#)
- [--scatter=filename on page 2-109](#)
- [--tiebreaker=option on page 2-131](#)
- [Syntax of an input section description on page 4-23.](#)

2.4 --api, --no_api

Enables and disables API section sorting. API sections are the sections that are called the most within a region. In large region mode these sections are extracted from the region and then inserted closest to the hotspots of the calling sections. This minimises the number of veneers generated.

2.4.1 Default

The default is `--no_api`. The linker automatically switches to `--api` if at least one execution region contains more code than the smallest inter-section branch. The smallest inter-section branch depends on the code in the region and the target processor:

32Mb	Execution region contains only ARM.
16Mb	Execution region contains Thumb, 32-bit Thumb is supported.
4Mb	Execution region contains Thumb, no 32-bit Thumb support.

2.4.2 See also

Concepts

Using the Linker:

- [Overview of veneers on page 4-26.](#)

Reference

- [--largeregions, --no_largeregions on page 2-70.](#)

2.5 --arm_only

This option enables the linker to target the ARM instruction set only. If the linker detects any objects requiring Thumb® state, an error is generated.

2.5.1 See also

Reference

Compiler Reference:

- [--arm](#) on page 3-14
- [--arm_only](#) on page 3-15
- [--thumb](#) on page 3-160.

Assembler Reference:

- [--arm](#) on page 2-9
- [--arm_only](#) on page 2-10
- [--thumb](#) on page 2-74.

2.6 --autoat, --no_autoat

This option controls the automatic assignment of `__at` sections to execution regions. `__at` sections are sections that must be placed at a specific address.

2.6.1 Usage

If enabled, the linker automatically selects an execution region for each `__at` section. If a suitable execution region does not exist, the linker creates a load region and an execution region to contain the `__at` section.

If disabled, the standard scatter-loading section selection rules apply.

2.6.2 Default

The default is `--autoat`.

2.6.3 Restrictions

You cannot use `__at` section placement with position independent execution regions.

If you use `__at` sections with overlays, you cannot use `--autoat` to place those sections. You must specify the names of `__at` sections in a scatter file manually, and specify the `--no_autoat` option.

2.6.4 See also

Concepts

Using the Linker:

- [Using `__at` sections to place sections at a specific address](#) on page 8-35
- [Automatic placement of `__at` sections](#) on page 8-37
- [Manual placement of `__at` sections](#) on page 8-39.

Reference

- [Chapter 4 Formal syntax of the scatter file.](#)

2.7 --be8

This option specifies ARMv6 Byte Invariant Addressing big-endian mode.

This is the default Byte Addressing mode for ARMv6 and later big-endian images. It means that the linker reverses the endianness of the instructions to give little-endian code and big-endian data for input objects that have been compiled or assembled as big-endian.

Byte Invariant Addressing mode is only available on ARM processors that support ARMv6 and above.

2.7.1 See also

Other information

- ARM Architecture Reference Manuals,
<http://infocenter.arm.com/help/topic/com.arm.doc.subset.arch.reference>.

2.8 --be32

This option specifies legacy Word Invariant Addressing big-endian mode, that is, identical to big-endian images prior to ARMv6. This produces big-endian code and data.

Word Invariant Addressing mode is the default mode for all pre-ARMv6 big-endian images.

2.8.1 See also

Other information

- ARM Architecture Reference Manuals,
<http://infocenter.arm.com/help/topic/com.arm.doc.subset.arch.reference/index.html>.

2.9 --bestdebug, --no_bestdebug

This option selects between linking for smallest code/data size or best debug illusion. Input objects might contain common data (COMDAT) groups, but these might not be identical across all input objects because of differences such as objects compiled with different optimization levels.

2.9.1 Default

The default is `--no_bestdebug`. This ensures that the code and data of the final image are the same regardless of whether you compile for debug or not. The smallest COMDAT groups are selected when linking, at the expense of a possibly slightly poorer debug illusion.

2.9.2 Usage

Use `--bestdebug` to select COMDAT groups with the best debug view. Be aware that the code and data of the final image might not be the same when building with or without debug.

2.9.3 Example

For two objects compiled with different optimization levels:

```
armcc -c -O2 file1.c
armcc -c -O0 file2.c
armlink --bestdebug file1.o file2.o -o image.axf
```

2.9.4 See also

Concepts

Using the Linker:

- [Elimination of common debug sections on page 5-2](#)
- [Elimination of common groups or sections on page 5-3](#)
- [Elimination of unused sections on page 5-4](#)
- [Elimination of unused virtual functions on page 5-6.](#)

2.10 --branchnop, --no_branchnop

This option causes the linker to replace any branch with a relocation that resolves to the next instruction with a NOP. This is the default behavior. However, there are cases where you might want to disable the option, for example, when performing verification or pipeline flushes.

2.10.1 Default

The default is --branchnop.

Use --no_branchnop to disable this behavior.

2.10.2 See also

Concepts

Using the Linker:

- [Handling branches that optimize to a NOP on page 5-21.](#)

Reference

- [--inline, --no_inline on page 2-63](#)
- [--tailreorder, --no_tailreorder on page 2-129.](#)

2.11 --callgraph, --no-callgraph

This option creates a file containing a static callgraph of functions. The callgraph gives definition and reference information for all functions in the image.

Note

If you use the `--partial` option to create a partially linked object, then no callgraph file is created.

2.11.1 Usage

The callgraph file:

- is saved in the same directory as the generated image.
- has the same name as the linked image. Use the `--callgraph_file=filename` option to specify a different callgraph filename.
- has a default output format of HTML. Use the `--callgraph_output=fmt` option to control the output format.

Note

If the linker is to calculate the function stack usage, any functions defined in the assembler files must have the appropriate:

- `PROC` and `ENDP` directives
 - `FRAME PUSH` and `FRAME POP` directives.
-

For each function `func` the linker lists the:

- processor state for which the function is compiled (ARM or Thumb)
- set of functions that call `func`
- set of functions that are called by `func`
- number of times the address of `func` is used in the image.

In addition, the callgraph identifies functions that are:

- called through interworking veneers
- defined outside the image
- permitted to remain undefined (weak references)
- called through a *Procedure Linkage Table* (PLT)
- not called but still exist in the image.

The static callgraph also gives information about stack usage. It lists the:

- size of the stack frame used by each function
- maximum size of the stack used by the function over any call sequence, that is, over any acyclic chain of function calls.

If there is a cycle, or if the linker detects a function with no stack size information in the call chain, + Unknown is added to the stack usage. A reason is added to indicate why stack usage is unknown.

The linker reports missing stack frame information if there is no debug frame information for the function.

For indirect functions, the linker cannot reliably determine which function made the indirect call. This might affect how the maximum stack usage is calculated for a call chain. The linker lists all function pointers used in the image.

Use frame directives in assembly language code to describe how your code uses the stack. These directives ensure that debug frame information is present for debuggers to perform stack unwinding or profiling.

2.11.2 Default

The default is `--no_callgraph`.

2.11.3 See also

Reference

- [--callgraph_file=filename](#) on page 2-18
- [--callgraph_output=fmt](#) on page 2-19
- [--cgfile=type](#) on page 2-20
- [--cgsymbol=type](#) on page 2-21
- [--cgundefined=type](#) on page 2-22
- [Chapter 4 Formal syntax of the scatter file.](#)

Assembler Reference:

- [FRAME POP](#) on page 5-42
- [FRAME PUSH](#) on page 5-43
- [FUNCTION or PROC](#) on page 5-52
- [ENDFUNC or ENDP](#) on page 5-34.

2.12 `--callgraph_file=filename`

This option controls the output filename of the callgraph.

2.12.1 Syntax

`--callgraph_file=filename`

where *filename* is the callgraph filename.

The default filename is the same as the linked image.

2.12.2 See also

Reference

- [--callgraph, --no_callgraph](#) on page 2-16
- [--callgraph_output=fmt](#) on page 2-19
- [--cgfile=type](#) on page 2-20
- [--cgsymbol=type](#) on page 2-21
- [--cgundefined=type](#) on page 2-22
- [--output=filename](#) on page 2-89
- [Chapter 4 Formal syntax of the scatter file.](#)

2.13 --callgraph_output=*fmt*

This option controls the output format of the callgraph.

2.13.1 Syntax

`--callgraph_output=fmt`

Where *fmt* can be one of the following:

html	Outputs the callgraph in HTML format.
text	Outputs the callgraph in plain text format.

2.13.2 Default

The default is `--callgraph_output=html`.

2.13.3 See also

Reference

- [--callgraph, --no_callgraph](#) on page 2-16
- [--callgraph_file=filename](#) on page 2-18
- [--cgfile=type](#) on page 2-20
- [--cgsymbol=type](#) on page 2-21
- [--cgundefined=type](#) on page 2-22
- [Chapter 4 Formal syntax of the scatter file.](#)

2.14 --cgfile=type

This option controls what files are used to obtain the symbols to be included in the callgraph.

2.14.1 Syntax

`--cgfile=type`

where *type* can be one of the following:

<code>all</code>	Includes symbols from all files.
<code>user</code>	Includes only symbols from user defined objects and libraries.
<code>system</code>	Includes only symbols from system libraries.

2.14.2 Default

The default is `--cgfile=all`.

2.14.3 See also

Reference

- [--callgraph, --no_callgraph](#) on page 2-16
- [--callgraph_file=filename](#) on page 2-18
- [--callgraph_output=fmt](#) on page 2-19
- [--cgsymbol=type](#) on page 2-21
- [--cgundefined=type](#) on page 2-22
- [Chapter 4 Formal syntax of the scatter file.](#)

2.15 --cgsymbol=*type*

This option controls what symbols are included in the callgraph.

2.15.1 Syntax

--cgsymbol=*type*

Where *type* can be one of the following:

all	Includes both local and global symbols.
locals	Includes only local symbols.
globals	Includes only global symbols.

2.15.2 Default

The default is --cgsymbol=all.

2.15.3 See also

Reference

- [--callgraph, --no_callgraph](#) on page 2-16
- [--callgraph_file=filename](#) on page 2-18
- [--callgraph_output=fmt](#) on page 2-19
- [--cgfile=type](#) on page 2-20
- [--cgundefined=type](#) on page 2-22
- [Chapter 4 Formal syntax of the scatter file.](#)

2.16 --cgundefined=*type*

This option controls what undefined references are included in the callgraph.

2.16.1 Syntax

`--cgundefined=type`

Where *type* can be one of the following:

<code>all</code>	Includes both function entries and calls to undefined weak references.
<code>entries</code>	Includes function entries for undefined weak references.
<code>calls</code>	Includes calls to undefined weak references.
<code>none</code>	Omits all undefined weak references from the output.

2.16.2 Default

The default is `--cgundefined=all`.

2.16.3 See also

Reference

- [--callgraph, --no_callgraph](#) on page 2-16
- [--callgraph_file=filename](#) on page 2-18
- [--callgraph_output=fmt](#) on page 2-19
- [--cgfile=type](#) on page 2-20
- [--cgsymbol=type](#) on page 2-21
- [Chapter 4 Formal syntax of the scatter file.](#)

2.17 --combreloc, --no_combreloc

This option enables or disables the linker reordering of the dynamic relocations so that a dynamic loader can process them more efficiently. `--combreloc` is the more efficient option.

2.17.1 Default

The default is `--combreloc`.

2.18 --comment_section, --no_comment_section

This option controls the inclusion of a comment section `.comment` in the final image.

Use `--no_comment_section` to strip the text in the `.comment` section, to help reduce the image size.

Note

You can also use the `--filtercomment` option to merge comments.

2.18.1 Default

The default is `--comment_section`.

2.18.2 See also

Concepts

- [--filtercomment, --no_filtercomment](#) on page 2-51

Using the Linker:

- [About merging comment sections](#) on page 5-24.

2.19 --compress_debug, --no_compress_debug

This option causes the linker to compress `.debug_*` sections, if it is sensible to do so. This removes some redundancy and reduces debug table size. Using `--compress_debug` can significantly increase the time required to link an image. Debug compression can only be performed on DWARF3 debug data, not DWARF2.

2.19.1 Default

The default is `--no_compress_debug`.

2.19.2 See also

Other information

- *The DWARF Debugging Standard*, <http://dwarfstd.org/>

2.20 --cppinit, --no_cppinit

This option enables the linker to use alternative C++ libraries with a different initialization symbol if required.

2.20.1 Syntax

`--cppinit=symbol`

If `--cppinit=symbol` is not specified then the default symbol `__cpp_initialize__aeabi_` is assumed.

`--no_cppinit` does not take a *symbol* argument.

2.20.2 Effect

The linker adds a non-weak reference to *symbol* if any static constructor or destructor sections are detected.

For `--cppinit=__cpp_initialize__aeabi_`, the linker processes `R_ARM_TARGET1` relocations as `R_ARM_REL32`, because this is required by the `__cpp_initialize__aeabi_` function. In all other cases `R_ARM_TARGET1` relocations are processed as `R_ARM_ABS32`.

2.20.3 See also

Concepts

Using ARM C and C++ Libraries and Floating-Point Support:

- [Initialization of the execution environment and execution of the application on page 2-55](#)
- [C++ initialization, construction and destruction on page 2-56.](#)

Reference

- [--ref_cpp_init, --no_ref_cpp_init on page 2-99.](#)

2.21 --cpu=list

This option lists the supported architecture and processor names that you can use with `--cpu=name`.

2.21.1 See also

Reference

- [--cpu=name](#) on page 2-28.

2.22 --cpu=name

This option enables the linker to determine the target ARM processor or architecture. It has the same format as the option supported by the compiler.

2.22.1 Syntax

--cpu=name

Where *name* is the name of an ARM processor or architecture. For details, see the description of --cpu=name compiler option.

2.22.2 Usage

The link phase fails if any of the component object files rely on features that are incompatible with the selected processor. The linker also uses this option to optimize the choice of system libraries and any veneers that need to be generated when building the final image. The default is to select a CPU that is compatible with all of the component object files. That is, to select the most up-to-date architecture among all input objects.

————— Note —————

If the --cpu option has a built-in *floating-point unit* (FPU) then the linker implies --fpu=built-in_fpu. For example, --cpu=cortex-m3 implies --fpu=softvfp.

2.22.3 See also

Concepts

Using the Compiler:

- [Types of floating-point linkage on page 5-65](#)
- [Compiler options for floating-point linkage and computations on page 5-66.](#)

Reference

- [--cpu=list on page 2-27](#)
- [--fpu=list on page 2-55](#)
- [--fpu=name on page 2-56.](#)

Using the Compiler:

- [Floating-point linkage and computational requirements of compiler options on page 5-68](#)
- [Processors and their implicit Floating-Point Units \(FPUs\) on page 5-70.](#)

Compiler Reference:

- [--cpu=list on page 3-32](#)
- [--cpu=name on page 3-33](#)
- [--fpu=list on page 3-74](#)
- [--fpu=name on page 3-75.](#)

2.23 --crosser_veneershare, --no_crosser_veneershare

Enables or disables veneer sharing across execution regions.

The default is `--crosser_veneershare`, and enables veneer sharing across execution regions.

`--no_crosser_veneershare` prohibits veneer sharing across execution regions.

2.23.1 See also

Reference

- [--veneershare, --no_veneershare on page 2-140](#).

2.24 --datacompressor=*opt*

This option enables you to specify one of the supplied algorithms for RW data compression. If you do not specify a data compression algorithm, the linker chooses the most appropriate one for you automatically. In general, it is not necessary to override this choice.

2.24.1 Syntax

--datacompressor=*opt*

Where *opt* is one of the following:

on	Enables RW data compression to minimize ROM size.
off	Disables RW data compression.
list	Lists the data compressors available to the linker.
<i>id</i>	<i>id</i> is a data compression algorithm:

Table 2-1 Data compressor algorithms

id	Compression algorithm
0	run-length encoding
1	run-length encoding, with LZ77 on small-repeats
2	complex LZ77 compression

Specifying a compressor adds a decompressor to the code area. If the final image does not have compressed data, the decompressor is not added.

2.24.2 Default

The default is --datacompressor=on.

2.24.3 See also

Concepts

Using the Linker:

- [Optimization with RW data compression on page 5-13](#)
- [How the linker chooses a compressor on page 5-14](#)
- [How compression is applied on page 5-16](#)
- [Working with RW data compression on page 5-17.](#)

2.25 --debug, --no_debug

This option controls the generation of debug information in the output file. Debug information includes debug input sections and the symbol/string table.

2.25.1 Default

The default is --debug.

2.25.2 Usage

Use --no_debug to exclude debug information from the output file. The resulting ELF image is smaller, but you cannot debug it at source level. The linker discards any debug input section it finds in the input objects and library members, and does not include the symbol and string table in the image. This only affects the image size as loaded into the debugger. It has no effect on the size of any resulting binary image that is downloaded to the target.

If you are using --partial the linker creates a partially-linked object without any debug data.

Note

Do not use --no_debug if a fromelf --fieldoffsets step is required. If your image is produced without debug information, fromelf cannot:

- translate the image into other file formats
 - produce a meaningful disassembly listing.
-

2.25.3 See also

Reference

Using the fromelf Image Converter:

- [--fieldoffsets on page 4-28.](#)

2.26 --diag_error=tag[,tag,...]

This option sets diagnostic messages that have a specific tag to error severity.

2.26.1 Syntax

`--diag_error=tag[,tag,...]`

Where *tag* can be:

- a diagnostic message number to set to error severity
- warning, to treat all warnings as errors.

2.26.2 See also

Reference

- [--diag_remark=tag\[,tag,...\]](#) on page 2-33
- [--diag_style=arm|ide|gnu](#) on page 2-34
- [--diag_suppress=tag\[,tag,...\]](#) on page 2-35
- [--diag_warning=tag\[,tag,...\]](#) on page 2-36
- [--errors=filename](#) on page 2-45
- [--remarks](#) on page 2-101
- [--strict](#) on page 2-119.

2.27 `--diag_remark=tag[,tag,...]`

This option sets diagnostic messages that have a specific tag to remark severity.

You can use the `--remarks` option to display these messages.

2.27.1 Syntax

`--diag_remark=tag[,tag,...]`

Where *tag* is a comma-separated list of diagnostic message numbers.

2.27.2 See also

Reference

- [`--diag_error=tag\[,tag,...\]` on page 2-32](#)
- [`--diag_style=arm|ide|gnu` on page 2-34](#)
- [`--diag_suppress=tag\[,tag,...\]` on page 2-35](#)
- [`--diag_warning=tag\[,tag,...\]` on page 2-36](#)
- [`--errors=filename` on page 2-45](#)
- [`--remarks` on page 2-101](#)
- [`--strict` on page 2-119.](#)

2.28 `--diag_style=arm|ide|gnu`

This option changes the formatting of warning and error messages.

2.28.1 Default

The default is `--diag_style=arm`.

2.28.2 Usage

`--diag_style=gnu` matches the format reported by the GNU Compiler, gcc.

`--diag_style=ide` matches the format reported by Microsoft Visual Studio.

2.28.3 See also

Reference

- [`--diag_error=tag\[,tag,...\]` on page 2-32](#)
- [`--diag_remark=tag\[,tag,...\]` on page 2-33](#)
- [`--diag_suppress=tag\[,tag,...\]` on page 2-35](#)
- [`--diag_warning=tag\[,tag,...\]` on page 2-36](#)
- [`--errors=filename` on page 2-45](#)
- [`--remarks` on page 2-101](#)
- [`--strict` on page 2-119.](#)

2.29 `--diag_suppress=tag[,tag,...]`

This option suppresses all diagnostic messages that have a specific tag.

2.29.1 Syntax

`--diag_suppress=tag[,tag,...]`

Where *tag* can be:

- a diagnostic message number to be suppressed
- `error`, to suppress all errors that can be downgraded
- `warning`, to suppress all warnings.

2.29.2 Example

To suppress the warning messages that have numbers L6314W and L6305W, use the following command:

```
armlink --diag_suppress=L6314,L6305 ...
```

2.29.3 See also

Reference

- [--diag_error=tag\[,tag,...\]](#) on page 2-32
- [--diag_remark=tag\[,tag,...\]](#) on page 2-33
- [--diag_style=arm|ide|gnu](#) on page 2-34
- [--diag_warning=tag\[,tag,...\]](#) on page 2-36
- [--errors=filename](#) on page 2-45
- [--remarks](#) on page 2-101
- [--strict](#) on page 2-119.

2.30 --diag_warning=tag[,tag,...]

This option sets diagnostic messages that have a specific tag to warning severity.

2.30.1 Syntax

`--diag_warning=tag[,tag,...]`

Where *tag* can be:

- a diagnostic message number to set to warning severity
- `error`, to set all errors that can be downgraded to warnings.

2.30.2 See also

Reference

- [--diag_error=tag\[,tag,...\]](#) on page 2-32
- [--diag_remark=tag\[,tag,...\]](#) on page 2-33
- [--diag_style=arm|ide|gnu](#) on page 2-34
- [--diag_suppress=tag\[,tag,...\]](#) on page 2-35
- [--errors=filename](#) on page 2-45
- [--remarks](#) on page 2-101
- [--strict](#) on page 2-119.

2.31 --eager_load_debug, --no_eager_load_debug

The `--no_eager_load_debug` option causes the linker to remove debug section data from memory after object loading. This lowers the peak memory usage of the linker at the expense of some linker performance, because much of the debug data has to be loaded again when the final image is written.

Using `--no_eager_load_debug` option does not affect the debug data that is written into the ELF file.

The default is `--eager_load_debug`.

Note

The resulting image or object built without debug information might differ by a small number of bytes. This is because the `.comment` section contains the linker command line used, where the options have differed from the default (the default is `--eager_debug_load`). Therefore `--no_eager_load_debug` images are a little larger and contain Program Header and possibly a Section Header a small number of bytes later. Use `--no_comment_section` to eliminate this difference.

2.31.1 See also

Reference

- [--comment_section, --no_comment_section](#) on page 2-24.

2.32 --edit=*file_list*

This option enables you to specify steering files containing commands to edit the symbol tables in the output binary. You can specify commands in a steering file to:

- Hide global symbols. Use this option to hide specific global symbols in object files. The hidden symbols are not publicly visible.
- Rename global symbols. Use this option to resolve symbol naming conflicts.

2.32.1 Syntax

```
--edit=file_list
```

Where *file_list* can be more than one steering file separated by a comma. Do not include a space after the comma.

2.32.2 Example

```
--edit=file1 --edit=file2 --edit=file3  
--edit=file1,file2,file3
```

2.32.3 See also

Concepts

Using the Linker:

- [Hiding and renaming global symbols with a steering file on page 7-27.](#)

Reference

- [Chapter 3 Linker steering file command reference.](#)

2.33 --emit_debug_overlay_relocs

Outputs only relocations of debug sections with respect to overlaid program sections to aid an overlay-aware debugger.

2.33.1 See also

Reference

- [--emit_debug_overlay_section](#) on page 2-40
- [--emit_non_debug_relocs](#) on page 2-41
- [--emit_relocs](#) on page 2-42.

Other information

- *ABI for the ARM Architecture: Support for Debugging Overlaid Programs*,
<http://infocenter.arm.com/help/topic/com.arm.doc.ih0049-/index.html>.

2.34 --emit_debug_overlay_section

In a relocatable file, a debug section refers to a location in a program section by way of a relocated location. A reference from a debug section to a location in a program section has the following format:

`<debug_section_index, debug_section_offset>, <program_section_index, program_section_offset>`

During static linking the pair of *program* values is reduced to single value, the execution address. This is ambiguous in the presence of overlaid sections.

To resolve this ambiguity, use this option to output a `.ARM.debug_overlay` section of type `SHT_ARM_DEBUG_OVERLAY = SHT_LOUSER + 4` containing a table of entries as follows:

`debug_section_offset, debug_section_index, program_section_index`

2.34.1 See also

Reference

- [--emit_debug_overlay_relocs](#) on page 2-39
- [--emit_relocs](#) on page 2-42.

Other information

- *ABI for the ARM Architecture: Support for Debugging Overlaid Programs*, <http://infocenter.arm.com/help/topic/com.arm.doc.ih0049-/index.html>.

2.35 --emit_non_debug_relocs

Retains only relocations from non-debug sections in an executable file.

2.35.1 See also

Reference

- [--emit_relocs](#) on page 2-42.

2.36 --emit_relocs

Retains all relocations in the executable file. This results in larger executable files.

This is equivalent to the GNU ld --emit-relocs option.

2.36.1 See also

Reference

- [--emit_debug_overlay_relocs](#) on page 2-39
- [--emit_non_debug_relocs](#) on page 2-41.

Other information

- *ABI for the ARM Architecture: Support for Debugging Overlaid Programs*,
<http://infocenter.arm.com/help/topic/com.arm.doc.ih0049-/index.html>.

2.37 --entry=*location*

This option specifies the unique initial entry point of the image.

2.37.1 Syntax

`--entry=location`

Where *location* is one of the following:

entry_address

A numerical value, for example: `--entry=0x0`

symbol

Specifies an image entry point as the address of *symbol*, for example:
`--entry=reset_handler`

offset+object(section)

Specifies an image entry point as an *offset* inside a *section* within a particular *object*, for example: `--entry=8+startup.o(startupseg)`

There must be no spaces within the argument to `--entry`. The input section and object names are matched without case-sensitivity. You can use the following simplified notation:

- `object(section)`, if offset is zero.
- `object`, if there is only one input section. `armlink` generates an error message if there is more than one code input section in object.

Note

If the entry address of your image is in Thumb state, then the least significant bit of the address must be set to 1. The linker does this automatically if you specify a symbol. For example, if the entry code starts at address `0x8000` in Thumb state you must use `--entry=0x8001`.

Note

If you use `--ltcg`, then only `--entry=symbol` can be used.

2.37.2 Usage

The image can contain multiple entry points. Multiple entry points might be specified with the `ENTRY` directive in assembler source files. In such cases, a unique initial entry point must be specified for an image, otherwise the error `L6305E` is generated. The initial entry point specified with the `--entry` option is stored in the executable file header for use by the loader. There can be only one occurrence of this option on the command line. A debugger typically uses this entry address to initialize the *Program Counter* (PC) when an image is loaded. The initial entry point must meet the following conditions:

- the image entry point must lie within an execution region
- the execution region must be non-overlay, and must be a root execution region (load address == execution address).

2.37.3 See also

Concepts

Using the Linker:

- [About link-time code generation on page 5-11.](#)

Reference

- [--ltdg on page 2-81](#)
- [--startup=symbol, --no_startup on page 2-118.](#)

Assembler Reference:

- [ENTRY on page 5-35.](#)

2.38 `--errors=filename`

This option redirects the diagnostics from the standard error stream to *filename*.

The specified file is created at the start of the link stage. If a file of the same name already exists, it is overwritten.

If *filename* is specified without path information, it is created in the current directory.

2.38.1 See also

Reference

- [--diag_error=tag\[,tag,...\]](#) on page 2-32
- [--diag_remark=tag\[,tag,...\]](#) on page 2-33
- [--diag_style=arm|ide|gnu](#) on page 2-34
- [--diag_suppress=tag\[,tag,...\]](#) on page 2-35
- [--diag_warning=tag\[,tag,...\]](#) on page 2-36.

2.39 --exceptions, --no_exceptions

This option controls the generation of exception tables in the final image.

2.39.1 Default

The default is `--exceptions`.

2.39.2 Usage

Using `--no_exceptions` generates an error message if any exceptions sections are present in the image after unused sections have been eliminated. Use this option to ensure that your code is exceptions free.

2.39.3 See also

Concepts

Using the Linker:

- [Using command-line options to control the generation of C++ exception tables on page 4-31.](#)

2.40 --exceptions_tables=*action*

This option specifies how exception tables are generated for objects that do not already contain exception unwinding tables.

2.40.1 Syntax

`--exceptions_tables=action`

Where *action* is one of the following:

- | | |
|-------------------------|---------------------------------------------------------------------------------------------------------------------|
| <code>nocreate</code> | The linker does not create missing exception tables. |
| <code>unwind</code> | The linker creates an unwinding table for each section in your image that does not already have an exception table. |
| <code>cantunwind</code> | The linker creates a nounwind table for each section in your image that does not already have an exception table. |

2.40.2 Default

The default is `--exceptions_tables=nocreate`.

2.40.3 See also

Concepts

Using the Linker:

- [Using command-line options to control the generation of C++ exception tables on page 4-31.](#)

2.41 --feedback=*filename*

This option generates a feedback file for input to the compiler. This file informs the compiler about unused functions.

During your next compilation, use the compiler option `--feedback=filename` to specify the feedback file to use. Unused functions are then placed in their own sections for possible future elimination by the linker.

2.41.1 See also

Concepts

Using the Linker:

- [About linker feedback on page 5-7.](#)

Reference

- [--feedback_image=option on page 2-49](#)
- [--feedback_type=type on page 2-50.](#)

Compiler Reference:

- [--feedback=filename on page 3-68.](#)

2.42 --feedback_image=option

This option changes the behavior of the linker when writing a feedback file with scatter-loading. Use this option to produce a feedback file where an executable ELF image cannot be created. That is, when your code does not fit into the region limits described in your scatter file before unused functions are removed using linker feedback.

2.42.1 Syntax

--feedback_image=option

Where *option* is one of the following:

none	Uses the scatter file to determine region size limits. Disables region overlap and region size overflow messages. Does not write an ELF image. Error messages are still produced if a region overflows the 32-bit address space.
noerrors	Uses the scatter file to determine region size limits. Warns on region overlap and region size overflow messages. Writes an ELF image, which might not be executable. Error messages are still produced if a region overflows the 32-bit address space.
simple	Ignores the scatter file. Disables ROPI/RWPI errors and warnings. Writes an ELF image, which might not be executable.
full	Enables all error and warning messages and writes a valid ELF image.

2.42.2 Default

The default option is --feedback_image=full.

2.42.3 See also

Concepts

Using the Linker:

- [About linker feedback on page 5-7.](#)

Reference

- [--feedback=filename on page 2-48](#)
- [--feedback_type=type on page 2-50](#)
- [--scatter=filename on page 2-109.](#)

Compiler Reference:

- [--feedback=filename on page 3-68.](#)

2.43 --feedback_type=type

This option controls the information that the linker puts into the feedback file.

2.43.1 Syntax

--feedback_type=type

Where *type* is a comma-separated list from the following topic keywords:

[no]iw controls functions that require interworking support.
[no]unused controls unused functions in the image.

2.43.2 Default

The default option is --feedback_type=unused,noiw.

2.43.3 See also

Concepts

Using the Linker:

- [About linker feedback on page 5-7.](#)

Reference

- [--feedback=filename on page 2-48](#)
- [--feedback_image=option on page 2-49.](#)

Compiler Reference:

- [--apcs=qualifer...qualifier on page 3-10](#)
- [--feedback=filename on page 3-68.](#)

2.44 --filtercomment, --no_filtercomment

The linker always removes identical comments. The `--filtercomment` permits the linker to preprocess the `.comment` section and remove some information that prevents merging.

Use `--no_filtercomment` to prevent the linker from modifying the `.comment` section.

2.44.1 Default

The default is `--filtercomment`.

2.44.2 See also

Concepts

Using the Linker:

- [About merging comment sections on page 5-24.](#)

2.45 `--fini=symbol`

This option specifies the symbol name that is used to define the entry point for finalization code. The dynamic linker executes this code when it unloads the executable file or shared object.

2.45.1 See also

Reference

- [--init=symbol](#) on page 2-62.

2.46 --first=section_id

This option places the selected input section first in its execution region. This can, for example, place the section containing the vector table first in the image.

2.46.1 Syntax

`--first=section_id`

Where *section_id* is one of the following:

- symbol* Selects the section that defines *symbol*. You must not specify a symbol that has more than one definition, because only one section can be placed first. For example: `--first=reset`
- object(section)* Selects *section* from *object*. There must be no space between *object* and the following open parenthesis. For example: `--first=init.o(init)`
- object* Selects the single input section in *object*. If you use this short form and there is more than one input section, the linker generates an error message. For example: `--first=init.o`

2.46.2 Usage

The `--first` option cannot be used with `--scatter`. Instead, use the `+FIRST` attribute in a scatter file.

2.46.3 See also

Concepts

Using the Linker:

- [Section placement with the linker on page 4-19](#)
- [Placing sections with FIRST and LAST attributes on page 4-21.](#)

Reference

- [--last=section_id on page 2-71](#)
- [--scatter=filename on page 2-109.](#)

2.47 --force_explicit_attr

The `--cpu` option checks the FPU attributes if the CPU chosen has a built-in FPU.

The error message L6463E: Input Objects contain *archtype* instructions but could not find valid target for *archtype* architecture based on object attributes. Suggest using `--cpu` option to select a specific `cpu`. is given in one of two situations:

- the ELF file contains instructions from architecture *archtype* yet the build attributes claim that *archtype* is not supported
- the build attributes are inconsistent enough that the linker cannot map them to an existing CPU.

If setting the `--cpu` option still fails, use `--force_explicit_attr` to cause the linker to retry the CPU mapping using build attributes constructed from `--cpu=archtype`. This might help if the error is being given solely because of inconsistent build attributes.

2.47.1 See also

Reference

- [--cpu=name](#) on page 2-28
- [--fpu=name](#) on page 2-56.

Compiler Reference:

- [--cpu=name](#) on page 3-33
- [--fpu=name](#) on page 3-75.

Assembler Reference:

- [--cpu=name](#) on page 2-19
- [--fpu=name](#) on page 2-37.

2.48 --fpu=list

This option lists the supported FPU architecture names that you can use with the --fpu=name option.

2.48.1 See also

Reference

- [--fpu=name](#) on page 2-56.

2.49 `--fpu=name`

This option enables the linker to determine the target FPU architecture.

The linker fails if any of the component object files rely on features that are incompatible with the selected FPU architecture. The linker also uses this option to optimize the choice of system libraries. The default is to select an FPU that is compatible with all of the component object files.

This option has the same format as that supported by the compiler.

2.49.1 See also

Concepts

Using the Compiler:

- [Types of floating-point linkage on page 5-65](#)
- [Compiler options for floating-point linkage and computations on page 5-66.](#)

Reference

- [--fpu=list on page 2-55.](#)

Using the Compiler:

- [Floating-point linkage and computational requirements of compiler options on page 5-68](#)
- [Processors and their implicit Floating-Point Units \(FPUs\) on page 5-70.](#)

Compiler Reference:

- [--cpu=name on page 3-33](#)
- [--fpu=list on page 3-74](#)
- [--fpu=name on page 3-75.](#)

2.50 --help

This option displays a summary of the main command-line options.

2.50.1 Default

This is the default if you specify `arm1ink` without any options or source files.

2.50.2 See also

Reference

- [--show_cmdline](#) on page 2-111
- [--version_number](#) on page 2-142
- [--vsn](#) on page 2-145.

2.51 --info=topic[,topic,...]

This option prints information about specific topics. You can write the output to a text file using `--list=file`.

2.51.1 Syntax

`--info=topic[,topic,...]`

Where *topic* is a comma-separated list from the following topic keywords:

any	For sections placed using the .ANY module selector, lists: <ul style="list-style-type: none"> the sort order the placement algorithm the sections that are assigned to each execution region in the order they are assigned by the placement algorithm. Information about the contingency space and policy used for each region. This keyword also displays additional information when you use the execution region attribute ANY_SIZE in a scatter file.
architecture	Summarizes the image architecture by listing the CPU, FPU and byte order.
common	Lists all common sections that are eliminated from the image. Using this option implies <code>--info=common,totals</code> .
compression	Gives extra information about the RW compression process.
debug	Lists all rejected input debug sections that are eliminated from the image as a result of using <code>--remove</code> . Using this option implies <code>--info=debug,totals</code> .
exceptions	Gives information on exception table generation and optimization.
inline	Lists all functions that are inlined by the linker, and the total number of inlines if <code>--inline</code> is used.
inputs	Lists the input symbols, objects and libraries.
libraries	Lists the full path name of every library automatically selected for the link stage. You can use this option with <code>--info_lib_prefix</code> to display information about a specific library.
merge	Lists the const strings that are merged by the linker. Each item lists the merged result, the strings being merged, and the associated object files.
sizes	Lists the code and data (RO Data, RW Data, ZI Data, and Debug Data) sizes for each input object and library member in the image. Using this option implies <code>--info=sizes,totals</code> .
stack	Lists the stack usage of all functions.
summarysizes	Summarizes the code and data sizes of the image.
summarystack	Summarizes the stack usage of all global symbols.
tailreorder	Lists all the tail calling sections that are moved above their targets, as a result of using <code>--tailreorder</code> .
totals	Lists the totals of the code and data (RO Data, RW Data, ZI Data, and Debug Data) sizes for input objects and libraries.

unused	Lists all unused sections that are eliminated from the user code as a result of using <code>--remove</code> . It does not list any unused sections that are loaded from the ARM C libraries.
unusedsymbols	Lists all symbols that have been removed by unused section elimination.
veneers	Lists the linker-generated veneers.
veneercallers	Lists the linker-generated veneers with additional information about the callers to each veneer. Use with <code>--verbose</code> to list each call individually.
veneerpools	Displays information on how the linker has placed veneer pools.
visibility	Lists the symbol visibility information. You can use this option with either <code>--info=inputs</code> or <code>--verbose</code> to enhance the output.
weakrefs	Lists all symbols that are the target of weak references, and whether or not they were defined.

The output from `--info=sizes, totals` always includes the padding values in the totals for input objects and libraries.

If you are using RW data compression (the default), or if you have specified a compressor using the `--datacompressor=id` option, the output from `--info=sizes, totals` includes an entry under Grand Totals to reflect the true size of the image.

Note

Spaces are not permitted between topic keywords in the list. For example, you can enter `--info=sizes, totals` but not `--info=sizes, totals`.

2.51.2 See also

Tasks

Using the Linker:

- [Working with RW data compression on page 5-17](#)
- [Placing unassigned sections with the .ANY module selector on page 8-23.](#)

Concepts

Using the Linker:

- [Elimination of unused sections on page 5-4](#)
- [Optimization with RW data compression on page 5-13](#)
- [How the linker chooses a compressor on page 5-14](#)
- [How compression is applied on page 5-16.](#)

Reference

- [--any_placement=algorithm on page 2-6](#)
- [--any_sort_order=order on page 2-8](#)
- [--datacompressor=opt on page 2-30](#)
- [--info_lib_prefix=opt on page 2-61](#)
- [--inline, --no_inline on page 2-63](#)
- [--merge, --no_merge on page 2-87](#)
- [--remove, --no_remove on page 2-102](#)

- [--tailreorder, --no_tailreorder](#) on page 2-129
- [--veneer_inject_type=type](#) on page 2-138
- [--verbose](#) on page 2-141
- [Execution region attributes](#) on page 4-12.

Using the Linker:

- [Linker options for getting information about images](#) on page 6-2.

2.52 --info_lib_prefix=opt

This option is a filter for the --info=libraries option. The linker only displays the libraries that have the same prefix as the filter.

2.52.1 Syntax

```
armlink --info=libraries --info_lib_prefix=opt
```

Where *opt* is the prefix of the required library.

2.52.2 Example

- Displaying a list of libraries without the filter:

```
armlink --info=libraries test.o
```

 Produces a list of libraries, for example:

```
install_directory\lib\armlib\c_4.1 install_directory\lib\armlib\fbz_4s.1
install_directory\lib\armlib\h_4.1 install_directory\lib\armlib\m_4s.1
install_directory\lib\armlib\vfpsupport.1
```
- Displaying a list of libraries with the filter:

```
armlink --info=libraries --info_lib_prefix=c test.o
```

 Produces a list of libraries with the specified prefix, for example:

```
install_directory\lib\armlib\c_4.1
```

2.52.3 See also

Reference

- [--info=topic\[,topic,...\]](#) on page 2-58.

2.53 `--init=symbol`

This option specifies the symbol name that is used to define initialization code. A dynamic linker executes this code when it loads the executable file or shared object.

2.53.1 See also

Reference

- [--fini=symbol](#) on page 2-52.

2.54 --inline, --no_inline

This option enables or disables branch inlining to optimize small function calls in your image.

2.54.1 Default

The default is `--no_inline`.

Note

This branch optimization is off by default because enabling it changes the image such that debug information might be incorrect. If enabled, the linker makes no attempt to correct the debug information.

2.54.2 See also

Tasks

Using the Linker:

- [Inlining functions with the linker on page 5-18.](#)

Reference

- [--branchnop, --no_branchnop on page 2-15](#)
- [--tailreorder, --no_tailreorder on page 2-129.](#)

2.55 --inlineveneer, --no_inlineveneer

This option enables or disables the generation of inline veneers to give greater control over how the linker places sections.

2.55.1 Default

The default is `--inlineveneer`.

2.55.2 See also

Concepts

Using the Linker:

- [Overview of veneers on page 4-26](#)
- [Veneer sharing on page 4-27](#)
- [Veneer types on page 4-28](#)
- [Generation of position independent to absolute veneers on page 4-29](#)
- [Reuse of veneers when scatter-loading on page 4-30](#).

Reference

- [--piveneer, --no_piveneer on page 2-95](#)
- [--veneershare, --no_veneershare on page 2-140](#).

2.56 *input-file-list*

This is a space-separated list of objects, libraries, or *symbol definitions* (symdefs) files.

2.56.1 Usage

The linker sorts through the input file list in order. If the linker is unable to resolve input file problems then a diagnostic message is produced.

The symdefs files can be included in the list to provide global symbol addresses for previously generated image files.

You can use libraries in the input file list in the following ways:

- Specify a library to be added to the list of libraries that is used to extract members if they resolve any non weak unresolved references. For example, specify `mystring.lib` in the input file list.

Note

Members from the libraries in this list are added to the image only when they resolve an unresolved non weak reference.

- Specify particular members to be extracted from a library and added to the image as individual objects. Members are selected from a comma separated list of patterns that can include wild characters. Spaces are permitted but if you use them you must enclose the whole input file list in quotes.

The following shows an example of an input file list both with and without spaces:

```
mystring.lib(strcmp.o,std*.o)
"mystring.lib(strcmp.o, std*.o)"
```

The linker automatically searches the appropriate C and C++ libraries in order to select the best standard functions for your image. You can use `--no_scanlib` to prevent automatic searching of the standard system libraries.

The linker processes the input file list in the following order:

- Objects are added to the image unconditionally.
- Members selected from libraries using patterns are added to the image unconditionally, as if they are objects. For example, to add all `a*.o` objects and `stdio.o` from `mystring.lib` use the following:

```
"mystring.lib(stdio.o, a*.o)"
```
- Library files listed on the command-line are searched for any unresolved non-weak references. The standard C or C++ libraries are added to the list of libraries that are later used to resolve any remaining references.

2.56.2 See also

Tasks

Using the Linker:

- [Accessing symbols in another image on page 7-17.](#)

Concepts

Using the Linker:

- [How the linker performs library searching, selection, and scanning on page 4-35.](#)

Reference

- [--scanlib, --no_scanlib](#) on page 2-108.

2.57 --keep=section_id

This option specifies input sections that must not be removed by unused section elimination.

2.57.1 Syntax

--keep=section_id

Where *section_id* is one of the following:

symbol Specifies that an input section defining *symbol* is to be retained during unused section elimination. If multiple definitions of *symbol* exist, armlink generates an error message.

For example, you might use --keep=int_handler.

To keep all sections that define a symbol ending in _handler, use --keep=*_handler.

object(section)

Specifies that *section* from *object* is to be retained during unused section elimination. If a single instance of *section* is generated, you can omit *section*, for example, file.o(). Otherwise, you must specify *section*.

For example, to keep the vect section from the vectors.o object use:

--keep=vectors.o(vect)

To keep all sections from the vectors.o object where the first three characters of the name of the sections are vec, use:--keep=vectors.o(vec*)

object Specifies that the single input section from *object* is to be retained during unused section elimination. If you use this short form and there is more than one input section in *object*, the linker generates an error message.

For example, you might use --keep=dspdata.o.

To keep the single input section from each of the objects that has a name starting with dsp, use --keep=dsp*.o.

All forms of the *section_id* argument can contain the * and ? wild characters. Matching is case-insensitive, even on hosts with case-sensitive file naming. For example:

- --keep foo.o(Premier*) causes the entire match for Premier* to be case-insensitive
- --keep foo.o(Premier) causes a case-sensitive match for the string Premier.

Use *.o to match all object files. Use * to match all object files and libraries.

You can specify multiple --keep options on the command line.

2.57.2 Matching a symbol that has the same name as an object

If you name a symbol with the same name as an object, then --keep=symbol_id searches for a symbol that matches *symbol_id*:

- If a symbol is found, it matches the symbol.
- If no symbol is found, it matches the object.

You can force --keep to match an object with --keep=symbol_id(). Therefore, to keep both the symbol and the object, specify --keep foo.o --keep foo.o().

2.57.3 See also

Concepts

Using the Linker:

- [The image structure on page 4-3.](#)

2.58 --keep_protected_symbols

Use this option to explicitly keep STV_PROTECTED symbols even if you are not using dynamic linking.

For example, your application might export functions provided by an API to shared objects that are loaded using a custom loader. However, the linker unused section elimination optimization causes the sections to be removed, even if those sections include STV_PROTECTED symbols. To prevent section containing STV_PROTECTED symbols from being removed, specify --keep_protected_symbols.

2.58.1 See also

Concepts

Using the Linker:

- [Elimination of unused sections on page 5-4.](#)

Reference

- [--max_visibility=type on page 2-86](#)
- [--override_visibility on page 2-90.](#)

2.59 --largeregions, --no_largeregions

This option controls the sorting order of sections in large execution regions to minimize the distance between sections that call each other.

2.59.1 Usage

If the execution region contains more code than the range of a branch instruction then the linker switches to large region mode. In this mode the linker sorts according to the approximated average call depth of each section in ascending order. The linker might also place distribute veneers amongst the code sections to minimize the number of veneers.

———— Note ————

Large region mode can result in large changes to the layout of an image even when small changes are made to the input.

To disable large region mode and revert to lexical order, use `--no_largeregions`. Section placement is then predictable and image comparisons are more predictable. However some branches might not reach the target causing the link step to fail. If this happens you must place code/data sections explicitly using an appropriate scatter file or write your own veneer.

Large region support enables:

- average call depth sorting, `--sort=AvgCallDepth`
- API sorting, `--api`
- veneer injection, `--veneeringinject`.

The following command lines are equivalent:

```
armlink --largeregions --no_api --no_veneeringinject --sort=Lexical
armlink --no_largeregions
```

2.59.2 Default

The default is `--no_largeregions`. The linker automatically switches to `--largeregions` if at least one execution region contains more code than the smallest inter-section branch. The smallest inter-section branch depends on the code in the region and the target processor:

32Mb	Execution region contains only ARM.
16Mb	Execution region contains Thumb, 32-bit Thumb is supported.
4Mb	Execution region contains Thumb, no 32-bit Thumb support.

2.59.3 See also

Concepts

Using the Linker:

- [Overview of veneers](#) on page 4-26
- [Veneer sharing](#) on page 4-27
- [Veneer types](#) on page 4-28
- [Generation of position independent to absolute veneers](#) on page 4-29
- [Reuse of veneers when scatter-loading](#) on page 4-30.

Reference

- [--api, --no_api](#) on page 2-9
- [--sort=algorithm](#) on page 2-115
- [--veneeringinject, --no_veneeringinject](#) on page 2-137.

2.60 --last=section_id

This option places the selected input section last in its execution region. For example, this can force an input section that contains a checksum to be placed last in the RW section.

2.60.1 Syntax

`--last=section_id`

Where *section_id* is one of the following:

- | | |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>symbol</i> | Selects the section that defines <i>symbol</i> . You must not specify a symbol that has more than one definition because only a single section can be placed last. For example: <code>--last=checksum</code> |
| <i>object</i> (<i>section</i>) | Selects the <i>section</i> from <i>object</i> . There must be no space between <i>object</i> and the following open parenthesis. For example: <code>--last=checksum.o(check)</code> |
| <i>object</i> | Selects the single input section from <i>object</i> . If there is more than one input section in <i>object</i> , <code>armlink</code> generates an error message. |

2.60.2 Usage

The `--last` option cannot be used with `--scatter`. Instead, use the `+LAST` attribute in a scatter file.

2.60.3 See also

Concepts

Using the Linker:

- [Section placement with the linker](#) on page 4-19
- [Placing sections with FIRST and LAST attributes](#) on page 4-21.

Reference

- [--first=section_id](#) on page 2-53
- [--scatter=filename](#) on page 2-109.

2.61 --ldpartial

This option enables you to link a partial object with the linker combining sections in the output object. This contrasts with the `--partial` option which does not combine sections. You can control the section combination with a scatter file.

`-r` is a synonym for `--ldpartial`.

2.62 --legacyalign, --no_legacyalign

By default, the linker assumes execution regions and load regions to be four-byte aligned. This option enables the linker to minimize the amount of padding that it inserts into the image.

The `--no_legacyalign` option instructs the linker to insert padding to force natural alignment. Natural alignment is the highest known alignment for that region.

Use `--no_legacyalign` to ensure strict conformance with the ELF specification.

You can also use expression evaluation in a scatter file to avoid padding.

2.62.1 See also

Concepts

Using the Linker:

- [Section placement with the linker on page 4-19.](#)

Reference

- [Load region attributes on page 4-8](#)
- [Execution region attributes on page 4-12](#)
- [Using expression evaluation in a scatter file to avoid padding on page 8-59.](#)

2.63 --libpath=pathlist

This option specifies a list of paths that are used to search for the ARM standard C and C++ libraries.

You can also use the `ARMCCnLIB` environment variable to specify the path for the parent directory containing the ARM libraries is specified by `n`, where `n` is the version of the compilation tools installed. For example, `ARMCC5LIB`. Any paths specified with `--libpath` override the path specified by the environment variable.

2.63.1 Syntax

`--libpath=pathlist`

Where *pathlist* is a comma-separated list of paths that are only used to search for required ARM libraries. Do not include spaces between the comma and the path name when specifying multiple path names, for example, *path1,path2,path3,...,pathn*.

Note

This option does not affect searches for user libraries. Use `--userlibpath` instead for user libraries.

2.63.2 See also

Concepts

Using the Linker:

- [How the linker performs library searching, selection, and scanning on page 4-35.](#)

Reference

- [--userlibpath=pathlist on page 2-136.](#)

Introducing the ARM Compiler toolchain:

- [Toolchain environment variables on page 2-12](#)

2.64 --library_type=*lib*

This option selects the library to be used at link time.

Note

This option can be used with the compiler, assembler or linker.

Use this option with the linker to override all other --library_type options.

2.64.1 Syntax

--library_type=*lib*

Where *lib* can be one of:

standardlib	Specifies that the full runtime libraries are selected at link time.
microlib	Specifies that the <i>C micro-library</i> (microlib) is selected at link time.

2.64.2 Default

If you do not specify --library_type at link time and no object file specifies a preference, then the linker assumes --library_type=standardlib.

2.64.3 See also

Concepts

Using the ARM® C and C++ Libraries and Floating Point Support:

- [Building an application with microlib on page 3-7.](#)

2.65 --licretry

If you are using floating licenses, this option makes up to 10 attempts to obtain a license when you invoke `armlink`.

2.65.1 Usage

Use this option if your builds are failing to obtain a license from your license server, and only after you have ruled out any other problems with the network or the license server setup.

It is recommended that you place this option in the `ARMCCn_LINKOPT` environment variable. In this way, you do not have to modify your build files.

2.65.2 See also

Reference

Introducing the ARM Compiler toolchain:

- [Toolchain environment variables](#) on page 2-12.

Compiler Reference:

- [--licretry](#) on page 3-98.

Using the fromelf Image Converter:

- [--licretry](#) on page 4-41.

Assembler Reference:

- [--licretry](#) on page 2-46.

Other information

- *FLEXnet for ARM® Tools License Management Guide*,
<http://infocenter.arm.com/help/topic/com.arm.doc.dui0209-/index.html>.

2.66 --list=*filename*

This option redirects the diagnostics output by the `--info`, `--map`, `--symbols`, `--verbose`, `--xref`, `--xreffrom`, and `--xrefto` options to *file*.

The specified file is created when diagnostics are output. If a file of the same name already exists, it is overwritten. However, if diagnostics are not output, a file is not created. In this case, the contents of any existing file with the same name remain unchanged.

If *filename* is specified without a path, it is created in the output directory, that is, the directory where the output image is being written.

2.66.1 See also

Reference

- [--info=topic\[,topic,...\]](#) on page 2-58
- [--map, --no_map](#) on page 2-83
- [--symbols, --no_symbols](#) on page 2-127
- [--verbose](#) on page 2-141
- [--xref, --no_xref](#) on page 2-146
- [--xrefdbg, --no_xrefdbg](#) on page 2-147
- [--xref{from|to}=object\(section\)](#) on page 2-148.

2.67 --list_mapping_symbols, --no_list_mapping_symbols

This option enables or disables the addition of mapping symbols \$a, \$d, \$t, and \$t.x in the output produced by --symbols.

Mapping symbols are used to flag transitions between ARM code, Thumb code, and data.

2.67.1 Default

The default is --no_list_mapping_symbols.

2.67.2 See also

Concepts

Using the Linker:

- [About mapping symbols on page 7-3.](#)

Reference

- [--symbols, --no_symbols on page 2-127.](#)

Other information

- *ELF for the ARM Architecture*,
<http://infocenter.arm.com/help/topic/com.arm.doc.ih0044-/index.html>.

2.68 --load_addr_map_info, --no_load_addr_map_info

This option includes load addresses for execution regions in the map file.

If an input section is compressed, then the load address has no meaning and COMPRESSED is displayed instead.

For sections that do not have a load address, such as ZI data, the load address is blank

2.68.1 Default

The default is `--no_load_addr_map_info`.

2.68.2 Restrictions

You must use the `--map` with this option.

2.68.3 Example

The following example shows the format of the map file output:

Base Addr	Load Addr	Size	Type	Attr	Idx	E Section Name	Object
0x00008000	0x00008000	0x00000008	Code	RO	25	* !!!main	__main.o(c_4.1)
0x00010000	COMPRESSED	0x00001000	Data	RW	2	dataA	data.o
0x00003000	-	0x00000004	Zero	RW	2	.bss	test.o

2.68.4 See also

Reference

- [--map, --no_map](#) on page 2-83.

2.69 --locals, --no_locals

The `--locals` option adds local symbols in the output symbol table.

The effect of the `--no_locals` option is different for images and object files.

When producing an executable image `--no_locals` removes local symbols from the output symbol table.

For object files built with the `--partial` option, the `--no_locals` option:

- Keeps mapping symbols and build attributes in the symbol table.
- Removes those local symbols that can be removed without loss of functionality. Symbols that cannot be removed, such as the targets for relocations, are kept. For these symbols, the names are removed. These are marked as [Anonymous Symbol] in the `fromelf --text` output.

`--no_locals` is a useful optimization if you want to reduce the size of the output symbol table in the final image.

2.69.1 Default

The default is `--locals`.

2.70 --ltcg

This option enables *link-time code generation* (LTCG). You must use this option if any of your input objects have been compiled with `--ltcg`.

Note

The LTCG feature is deprecated. As an alternative ARM recommends you use the `--multifile` compiler option.

2.70.1 See also

Concepts

Using the Linker:

- [About link-time code generation on page 5-11.](#)

Reference

Compiler Reference:

- [--ltcg on page 3-110](#)
- [--multifile, --no_multifile on page 3-117.](#)

2.71 --mangled, --unmangled

This option instructs the linker to display mangled or unmangled C++ symbol names in diagnostic messages, and in listings produced by the `--xref`, `--xreffrom`, `--xrefto`, and `--symbols` options.

2.71.1 Default

The default is `--unmangled`.

2.71.2 Usage

If `--unmangled` is selected, C++ symbol names are displayed as they appear in your source code.

If `--mangled` is selected, C++ symbol names are displayed as they appear in the object symbol tables.

2.71.3 See also

Reference

- [--match=crossmangled](#) on page 2-84
- [--symbols, --no_symbols](#) on page 2-127
- [--xref, --no_xref](#) on page 2-146
- [--xrefdbg, --no_xrefdbg](#) on page 2-147
- [--xref{from|to}=object\(section\)](#) on page 2-148.

2.72 --map, --no_map

This option enables or disables the printing of a memory map.

The map contains the address and the size of each load region, execution region, and input section in the image, including linker-generated input sections. This can be output to a text file using `--list=filename`.

2.72.1 Default

The default is `--no_map`.

2.72.2 See also

Tasks

Using the Linker:

- [How to find where a symbol is placed when linking](#) on page 6-6.

Reference

- [--list=filename](#) on page 2-77
- [--load_addr_map_info, --no_load_addr_map_info](#) on page 2-79
- [--section_index_display=type](#) on page 2-110.

2.73 --match=crossmangled

This option instructs the linker to match the following combinations together:

- a reference to an unmangled symbol with the mangled definition
- a reference to a mangled symbol with the unmangled definition.

Libraries and matching combinations operate as follows:

- If the library members define a mangled definition, and there is an unresolved unmangled reference, the member is loaded to satisfy it.
- If the library members define an unmangled definition, and there is an unresolved mangled reference, the member is loaded to satisfy it.

Note

This option has no effect if used with partial linking. The partial object contains all the unresolved references to unmangled symbols, even if the mangled definition exists. Matching is done only in the final link step.

2.73.1 See also

Reference

- [--mangled, --unmangled](#) on page 2-82.

2.74 --max_veneer_passes=*value*

This option specifies a limit to the number of veneer generation passes the linker attempts to make when both the following conditions are met:

- a Section that is sufficiently large has a relocation that requires a veneer
- the linker cannot place the veneer close enough to the call site.

The linker attempts to diagnose the failure if the maximum number of veneer generation passes you specify is exceeded, and displays a warning message. You can downgrade this warning message using `--diag_remark`.

2.74.1 Syntax

```
--max_veneer_passes=value
```

Where *value* is the maximum number of veneer passes the linker is to attempt. The minimum value you can specify is one.

2.74.2 Default

The default number of passes is 10.

2.74.3 See also

Reference

- [--diag_remark=tag\[,tag,...\]](#) on page 2-33
- [--diag_warning=tag\[,tag,...\]](#) on page 2-36.

2.75 --max_visibility=type

This option controls the visibility of all symbol definitions.

2.75.1 Syntax

`--max_visibility=type`

Where *type* can be one of:

<code>default</code>	Default visibility.
<code>protected</code>	Protected visibility.

2.75.2 Usage

Use `--max_visibility=protected` to limit the visibility of all symbol definitions. Global symbol definitions that normally have default visibility, are given protected visibility when this option is specified.

2.75.3 Default

The default is `--max_visibility=default`.

2.75.4 See also

Reference

- [--keep_protected_symbols](#) on page 2-69
- [--override_visibility](#) on page 2-90.

2.76 --merge, --no_merge

This option enables or disables the merging of **const** strings that are placed in shareable sections by the compiler. Using `--merge` can reduce the size of the image if there are similarities between **const** strings.

For a listing of the merged **const** strings you can use `--info=merge`.

2.76.1 Default

The default is `--merge`.

By default, merging happens between different load and execution regions. Therefore, code from one execution or load region might use a string stored in different region. If you do not want this behavior, then do one of the following:

- use the `PROTECTED` load region attribute if you are using scatter-loading
- globally disable merging with `--no_merge`.

2.76.2 See also

Reference

- [--info=topic\[,topic,...\]](#) on page 2-58
- [Load region attributes](#) on page 4-8.

2.77 --muldefweak, --no_muldefweak

This option enables or disables multiple weak definitions of a symbol.

If enabled, the linker chooses the first definition that it encounters and discards all the other duplicate definitions. If disabled, the linker generates an error message for all multiply defined weak symbols.

2.77.1 Default

The default is `--no_muldefweak`.

2.78 --output=*filename*

This option specifies the name of the output file. The file can be either a partially-linked object or an executable image, depending on the command-line options used.

2.78.1 Syntax

--output=*filename*

If --output=*filename* is not specified, the linker uses the following default filenames:

__image.axf	if the output is an executable image
__object.o	if the output is a partially-linked object.

If *filename* is specified without path information, it is created in the current working directory. If path information is specified, then that directory becomes the default output directory.

2.78.2 See also

Reference

- [--callgraph_file=filename](#) on page 2-18
- [--partial](#) on page 2-94.

2.79 --override_visibility

This option enables `EXPORT` and `IMPORT` directives in a steering file to override the visibility of a symbol.

By default:

- only symbol definitions with `STV_DEFAULT` or `STV_PROTECTED` visibility can be exported
- only symbol references with `STV_DEFAULT` visibility can be imported.

When you specify `--override_visibility`, any global symbol definition can be exported and any global symbol reference can be imported.

2.79.1 See also

Reference

- [--keep_protected_symbols](#) on page 2-69
- [--undefined_and_export=symbol](#) on page 2-133
- [EXPORT](#) on page 3-2
- [IMPORT](#) on page 3-4.

2.80 --pad=num

This option enables you to set a value for padding bytes. The linker assigns this value to all padding bytes inserted in load or execution regions.

2.80.1 Syntax

--pad=num

Where *num* is an integer, which can be given in hexadecimal format. For example, setting *num* to 0xFF might help to speed up ROM programming time. If *num* is greater than 0xFF, then the padding byte is cast to a char, that is (char)*num*.

Note

Padding is only inserted:

- Within load regions. No padding is present between load regions.
 - Between fixed execution regions (in addition to forcing alignment). Padding is not inserted up to the maximum length of a load region unless it has a fixed execution region at the top.
 - Between sections to ensure that they conform to alignment constraints.
-

2.80.2 See also

Concepts

- [Input sections, output sections, regions, and Program Segments on page 4-5](#)
- [Load view and execution view of an image on page 4-6.](#)

2.81 --paged

This option enables Demand Paging mode to help produce ELF files that can be demand paged efficiently.

A default page size of 0x8000 bytes is used. You can change this with the `--pagesize` command-line option.

2.81.1 See also

Concepts

Using the Linker:

- [Demand paging on page 4-23](#)
- [About creating regions on page boundaries on page 8-54.](#)

Reference

- [--pagesize=pagesize on page 2-93.](#)

2.82 --pagesize=*pagesize*

This option enables you to change the page size used when demand paging.

2.82.1 Syntax

`--pagesize=pagesize`

Where *pagesize* is the page size in bytes. The default value is 0x8000.

2.82.2 See also

Concepts

Using the Linker:

- [Demand paging on page 4-23](#)
- [About creating regions on page boundaries on page 8-54.](#)

Reference

- [--paged on page 2-92.](#)

2.83 --partial

This option creates a partially-linked object that can be used in a subsequent link step.

2.83.1 See also

Concepts

Using the Linker:

- [Partial linking model on page 3-4.](#)

2.84 --piveneer, --no_piveneer

This option enables or disables the generation of a veneer for a call from *position independent* (PI) code to absolute code. When using `--no_piveneer`, an error message is produced if the linker detects a call from PI code to absolute code.

2.84.1 Default

The default is `--piveneer`.

2.84.2 See also

Concepts

Using the Linker:

- [Overview of veneers](#) on page 4-26
- [Veneer sharing](#) on page 4-27
- [Veneer types](#) on page 4-28
- [Generation of position independent to absolute veneers](#) on page 4-29
- [Reuse of veneers when scatter-loading](#) on page 4-30.

Reference

- [--inlineveneer, --no_inlineveneer](#) on page 2-64
- [--veneershare, --no_veneershare](#) on page 2-140.

2.85 --predefine="string"

When preprocessing the scatter file, this option enables commands to be passed to the preprocessor. You specify a preprocessor on the first line of the scatter file.

2.85.1 Syntax

```
--predefine="string"
```

You can use more than one --predefine option on the command-line.

You can also use the synonym: --pd="string".

2.85.2 Restrictions

Use this option with --scatter.

2.85.3 Example

The following example shows the scatter file contents before preprocessing.

Example 2-1 Scatter file before preprocessing

```

#! armcc -E
lr1 BASE
{
    er1 BASE
    {
        *(+R0)
    }
    er2 BASE2
    {
        *(+RW+ZI)
    }
}

```

Use armlink with the command-line options:

```
--predefine="-DBASE=0x8000" --predefine="-DBASE2=0x1000000" --scatter=filename
```

This passes the command-line options: -DBASE=0x8000 -DBASE2=0x1000000 to the compiler to preprocess the scatter file.

The following example shows how the scatter file looks after preprocessing:

Example 2-2 Scatter file after preprocessing

```

lr1 0x8000
{
    er1 0x8000
    {
        *(+R0)
    }
    er2 0x1000000
    {

```



```
        *(+RW+ZI)  
    }  
}
```

2.85.4 See also

Concepts

Using the Linker:

- [Using preprocessing commands in a scatter file](#) on page 8-57.

Reference

- [--scatter=filename](#) on page 2-109.

2.86 --reduce_paths, --no_reduce_paths

This option enables or disables the elimination of redundant path name information in file paths.

2.86.1 Mode

Effective on Windows systems only.

2.86.2 Default

The default is --no_reduce_paths.

2.86.3 Usage

Windows systems impose a 260 character limit on file paths. Where path names exist whose absolute names expand to longer than 260 characters, you can use the --reduce_paths option to reduce absolute path name length by matching up directories with corresponding instances of .. and eliminating the directory/.. sequences in pairs.

———— Note ————

It is recommended that you avoid using long and deeply nested file paths, in preference to minimizing path lengths using the --reduce_paths option.

2.86.4 Example

A file to be linked might be at the location:

```
..\..\..\xyzy\xyzy\objects\file.c
```

Your current working directory might be at the location:

```
\foo\bar\baz\gazonk\quux\bop
```

The combination of these paths results in the path:

```
\foo\bar\baz\gazonk\quux\bop\..\..\..\xyzy\xyzy\objects\file.o
```

By using the option --reduce_paths the path becomes:

```
\foo\bar\baz\xyzy\xyzy\objects\file.c
```

2.87 --ref_cpp_init, --no_ref_cpp_init

This option enables or disables the linker adding a reference to the C++ static object initialization routine in the ARM libraries. The default reference added is `__cpp_initialize__aeabi__`. To change this you can use `--cppinit`.

2.87.1 Usage

Use `--no_ref_cpp_init` if you are not going to use the ARM libraries.

2.87.2 Default

The default is `--ref_cpp_init`.

2.87.3 See also

Concepts

Using C and C++ Libraries and Floating-Point Support:

- [C++ initialization, construction and destruction on page 2-56.](#)

Reference

- [--cppinit, --no_cppinit on page 2-26.](#)

2.88 --reloc

This option creates a single relocatable load region with contiguous execution regions.

2.88.1 Usage

Only use this option for legacy systems with the type of relocatable ELF images that conform to the *ELF for the ARM Architecture* specification. The generated image might not be compliant with the ELF for the ARM Architecture specification.

When relocated MOV_T and MOV_W instructions are encountered in an image being linked with --reloc, arm_{link} produces the following additional dynamic tags:

DT_RELA The address of a relocation table.

DT_RELASZ

The total size, in bytes, of the DT_RELA relocation table.

DT_RELAENT

The size, in bytes, of the DT_RELA relocation entry.

2.88.2 See also

Concepts

Using the Linker:

- [Type 1 image, one load region and contiguous execution regions](#) on page 8-61
- [Type 3 image, two load regions and non-contiguous execution regions](#) on page 8-65.

Other information

- *ELF for the ARM Architecture*,
<http://infocenter.arm.com/help/topic/com.arm.doc.ih0044-/index.html>.

2.89 --remarks

This option forces the linker to display remarks that are otherwise hidden by default when used with the `--diag_remarks` option.

Note

The linker does not issue remarks by default.

2.89.1 See also

Reference

- [--diag_remark=tag\[,tag,...\]](#) on page 2-33
- [--errors=filename](#) on page 2-45.

2.90 --remove, --no_remove

This option enables or disables the removal of unused input sections from the image. An input section is considered used if it contains an entry point, or if it is referred to from a used section.

2.90.1 Default

The default is --remove.

2.90.2 Usage

Use --no_remove when debugging to retain all input sections in the final image even if they are unused.

Use --remove with the --keep option to retain specific sections in a normal build.

2.90.3 See also

Concepts

Using the Linker:

- [Elimination of common debug sections on page 5-2](#)
- [Elimination of common groups or sections on page 5-3](#)
- [Elimination of unused sections on page 5-4](#)
- [Elimination of unused virtual functions on page 5-6.](#)

Reference

- [--keep=section_id on page 2-67.](#)

2.91 --ro_base=address

This option sets both the load and execution addresses of the region containing the RO output section at a specified address.

2.91.1 Syntax

`--ro_base=address`

Where *address* must be word-aligned.

2.91.2 Default

If this option is not specified, and no scatter file is specified, the default is `--ro_base=0x8000`.

2.91.3 Restrictions

You cannot use `--ro_base` with `--scatter`.

2.91.4 See also

Reference

- [--ropi on page 2-104](#)
- [--rosplit on page 2-105](#)
- [--rw_base=address on page 2-106](#)
- [--rwpi on page 2-107](#)
- [--scatter=filename on page 2-109](#)
- [--zi_base=address on page 2-149](#).

2.92 --ropi

This option makes the load and execution region containing the RO output section position-independent. If this option is not used, the region is marked as absolute. Usually each read-only input section must be *Read-Only Position-Independent* (ROPI). If this option is selected, the linker:

- checks that relocations between sections are valid
- ensures that any code generated by the linker itself, such as interworking veneers, is ROPI.

Note

The linker gives a downgradable error if `--ropi` is used without `--rwp` or `--rw_base`.

2.92.1 Restrictions

You cannot use `--ropi` with `--scatter`.

2.92.2 See also

Reference

- [--ro_base=address](#) on page 2-103
- [--rosplit](#) on page 2-105
- [--rw_base=address](#) on page 2-106
- [--rwp](#) on page 2-107
- [--scatter=filename](#) on page 2-109.

2.93 --rosplit

This option splits the default RO load region into two RO output sections, one for RO-CODE and one for RO-DATA.

2.93.1 Restrictions

You cannot use `--rosplit` with `--scatter`.

2.93.2 See also

Reference

- [--ro_base=address](#) on page 2-103
- [--ropi](#) on page 2-104
- [--rw_base=address](#) on page 2-106
- [--rwpi](#) on page 2-107
- [--scatter=filename](#) on page 2-109.

2.94 --rw_base=address

This option sets the execution addresses of the region containing the RW output section at a specified address.

2.94.1 Syntax

`--rw_base=address`

Where *address* must be word-aligned.

2.94.2 Restrictions

You cannot use `--rw_base` with `--scatter`.

2.94.3 See also

Reference

- [--ro_base=address](#) on page 2-103
- [--ropi](#) on page 2-104
- [--rosplit](#) on page 2-105
- [--rwpi](#) on page 2-107
- [--scatter=filename](#) on page 2-109
- [--split](#) on page 2-117
- [--zi_base=address](#) on page 2-149.

2.95 --rwp*i*

This option makes the load and execution region containing the RW and ZI output section position-independent. If this option is not used the region is marked as absolute. This option requires a value for `--rw_base`. If `--rw_base` is not specified, `--rw_base=0` is assumed. Usually each writable input section must be *read-write position-independent* (RWPI).

If this option is selected, the linker:

- checks that the PI attribute is set on input sections to any read-write execution regions
- checks that relocations between sections are valid
- generates entries relative to the static base in the table `Region$$Table`.

This is used when regions are copied, decompressed, or initialized.

2.95.1 Restrictions

You cannot use `--rwpi` with `--scatter`.

2.95.2 See also

Reference

- [--ro_base=address on page 2-103](#)
- [--ropi on page 2-104](#)
- [--rosplit on page 2-105](#)
- [--rw_base=address on page 2-106](#)
- [--scatter=filename on page 2-109](#)
- [--split on page 2-117](#).

2.96 --scanlib, --no_scanlib

This option enables or disables scanning of the ARM libraries to resolve references. Use `--no_scanlib` if you want to link your own libraries.

2.96.1 Default

The default is `--scanlib`.

2.97 --scatter=*filename*

This option creates an image memory map using the scatter-loading description contained in the specified file. The description provides grouping and placement details of the various regions and sections in the image.

2.97.1 Syntax

`--scatter=filename`

Where *filename* is the name of a scatter file.

2.97.2 Usage

To modify the placement of any unassigned input sections when `.ANY` selectors are present, use the following command-line options with `--scatter`:

- `--any_contingency`
- `--any_placement`
- `--any_sort_order`
- `--tiebreaker`.

The `--scatter` option cannot be used with `--first`, `--last`, `--partial`, `--reloc`, `--ro_base`, `--ropi`, `--rosplit`, `--rw_base`, `--rwpi`, `--split`, `--startup`, and `--zi_base`.

2.97.3 See also

Concepts

- [Behavior when `.ANY` sections overflow because of linker-generated content on page 4-29.](#)

Using the Linker:

- [Chapter 8 Using scatter files.](#)

Reference

- [--any_contingency on page 2-5](#)
- [--any_placement=algorithm on page 2-6](#)
- [--any_sort_order=order on page 2-8](#)
- [--first=section_id on page 2-53](#)
- [--last=section_id on page 2-71](#)
- [--partial on page 2-94](#)
- [--reloc on page 2-100](#)
- [--ro_base=address on page 2-103](#)
- [--ropi on page 2-104](#)
- [--rosplit on page 2-105](#)
- [--rw_base=address on page 2-106](#)
- [--rwpi on page 2-107](#)
- [--split on page 2-117](#)
- [--startup=symbol, --no_startup on page 2-118](#)
- [--tiebreaker=option on page 2-131](#)
- [--zi_base=address on page 2-149.](#)

2.98 --section_index_display=type

This option changes the display of the index column when printing memory map output. Use this option with `--map`.

2.98.1 Syntax

`--section_index_display=type`

Where *type* is one of the following:

`cmdline` Alters the display of the map file to show the order that a section appears on the command-line. The command-line order is defined as `File.Object.Section` where:

- Section is the section index, `sh_idx`, of the Section in the Object
- Object is the order that Object appears in the File
- File is the order the File appears on the command line.

The order the Object appears in the File is only significant if the file is an archive.

`internal` The index value represents the order in which the linker creates the section.

`input` The index value represents the section index of the section in the original input file.

2.98.2 Usage

Use `--map` with `--section_index_display=input` when you want to find the exact section in an input object.

2.98.3 Default

The default is `--section_index_display=internal`.

2.98.4 See also

Reference

- [--map, --no_map](#) on page 2-83
- [--tiebreaker=option](#) on page 2-131.

2.99 --show_cmdline

This option outputs the command-line used by the linker. It shows the command-line after processing by the linker, and can be useful to check:

- the command-line a build system is using
- how the linker is interpreting the supplied command-line, for example, the ordering of command line options.

The commands are shown normalized, and the contents of any via files are expanded.

The output is sent to the standard output stream (stdout).

2.99.1 See also

Reference

- [--help](#) on page 2-57
- [--via=filename](#) on page 2-144.

2.100 --show_full_path

If the file representing object `obj` has full path name `path/to/obj` then the linker displays `path/to/obj` instead of `obj` in any diagnostic.

2.100.1 See also

Reference

- [--show_parent_lib](#) on page 2-113
- [--show_sec_idx](#) on page 2-114.

2.101 --show_parent_lib

If an object `obj` comes from library `lib`, then displays `lib(obj)` instead of `obj` in any diagnostic.

2.101.1 See also

Reference

- [--show_full_path](#) on page 2-112
- [--show_sec_idx](#) on page 2-114.

2.102 --show_sec_idx

Displays the section index, `sh_idx`, of section in the originating object.

For example, if section `sec` has section index 3 then it is displayed as `sec:3` in all diagnostics

2.102.1 See also

Reference

- [--show_full_path](#) on page 2-112
- [--show_parent_lib](#) on page 2-113.

2.103 --sort=*algorithm*

This option specifies the sorting algorithm used to determine the order of sections in an output image. The sorting algorithms conform to the standard rules, placing input sections in ascending order by attributes.

Sort algorithms can also be specified in a scatter file for individual execution regions using the SORTTYPE keyword.

2.103.1 Syntax

--sort=*algorithm*

where *algorithm* is one of the following:

Alignment Sorts input sections by ascending order of alignment value.

AlignmentLexical

Sorts input sections by ascending order of alignment value, then sorts lexically.

AvgCallDepth Sorts all Thumb code before ARM code and then sorts according to the approximated average call depth of each section in ascending order.

Use this algorithm to minimize the number of long branch veneers.

———— **Note** ————

The approximation of the average call depth depends on the order of input sections. Therefore, this sorting algorithm is more dependent on the order of input sections than using, say, **RunningDepth**.

BreadthFirstCallTree

This is similar to the **CallTree** algorithm except that it uses a breadth-first traversal when flattening the Call Tree into a list.

CallTree The linker flattens the call tree into a list containing the read-only code sections from all execution regions that have **CallTree** sorting enabled.

Sections in this list are copied back into their execution regions, followed by all the non read-only code sections, sorted lexically. Doing this ensures that sections calling each other are placed close together.

———— **Note** ————

This sorting algorithm is less dependent on the order of input sections than using either **RunningDepth** or **AvgCallDepth**.

Lexical Sorts according to the name of the section and then by input order if the names are the same.

LexicalAlignment

Sorts input sections lexically, then according to the name of the section, and then by input order if the names are the same.

LexicalState Sorts Thumb code before ARM code, then sorts lexically.

List Provides a list of the available sorting algorithms. The linker terminates after displaying the list.

ObjectCode Sorts code sections by tiebreaker. All other sections are sorted lexically. This is most useful when used with `--tiebreaker=cmdline` because it attempts to group all the sections from the same object together in the memory map.

RunningDepth Sorts all Thumb code before ARM code and then sorts according to the running depth of the section in ascending order. The running depth of a section S is the average call depth of all the sections that call S, weighted by the number of times that they call S.

Use this algorithm to minimize the number of long branch veneers.

2.103.2 Default

The default algorithm is `--sort=Lexical`. In large region mode, the default algorithm is `--sort=AvgCallDepth`.

2.103.3 See also

Concepts

- [About execution region descriptions on page 4-9.](#)

Using the Linker:

- [Section placement with the linker on page 4-19.](#)

Reference

- [--largeregions, --no_largeregions on page 2-70](#)
- [--tiebreaker=option on page 2-131](#)
- [Execution region attributes on page 4-12.](#)

2.104 --split

This option splits the default load region, that contains the RO and RW output sections, into the following load regions:

- One region containing the RO output section. The default load address is 0x8000, but a different address can be specified with the `--ro_base` option.
- One region containing the RW and ZI output sections. The load address is specified with the `--rw_base` option. This option requires a value for `--rw_base`. If `--rw_base` is not specified, `--rw_base=0` is assumed.

Both regions are root regions.

2.104.1 Restrictions

You cannot use `--split` with `--scatter`.

2.104.2 See also

Concepts

Using the Linker:

- [The image structure on page 4-3.](#)

Reference

- [--ro_base=address on page 2-103](#)
- [--rw_base=address on page 2-106](#)
- [--scatter=filename on page 2-109.](#)

2.105 --startup=*symbol*, --no_startup

This option enables the linker to use alternative C libraries with a different startup symbol if required.

2.105.1 Syntax

--startup=*symbol*

By default, *symbol* is set to `__main`.

--no_startup does not take a *symbol* argument.

2.105.2 Default

The default is --startup=`__main`.

2.105.3 Usage

The linker includes the C library startup code if there is a reference to a symbol that is defined by the C library startup code. This symbol reference is called the startup symbol. It is automatically created by the linker when it sees a definition of `main()`. The --startup option enables you to change this symbol reference.

- If the linker finds a definition of `main()` and does not find a reference to (or definition of) *symbol*, then it generates an error.
- If the linker finds a definition of `main()` and a reference to (or definition of) *symbol*, and no entry point is specified, then the linker generates a warning.

2.105.4 See also

Reference

- [--entry=location on page 2-43](#).

2.106 --strict

This option instructs the linker to perform additional conformance checks, such as reporting conditions that might result in failures. An example of such a condition is taking the address of an interworking function from a non-interworking function.

2.106.1 Usage

--strict causes the linker to check for taking the address of:

- A non-interworking location from a non-interworking location in a different state.
- A RWPI location from a location that uses the static base register R9.
- A stack checked location from a location that uses the reserved stack checking register R10. (This is for ADS compatibility only.)
- A location that uses the reserved stack checking register r10 from a stack checked location. (This is for ADS compatibility only.)

2.106.2 See also

Concepts

Using the Linker:

- [Use of the strict family of options in the linker on page 4-41.](#)

Reference

- [--diag_error=tag\[,tag,...\] on page 2-32](#)
- [--diag_suppress=tag\[,tag,...\] on page 2-35](#)
- [--diag_warning=tag\[,tag,...\] on page 2-36](#)
- [--errors=filename on page 2-45](#)
- [--strict_enum_size, --no_strict_enum_size on page 2-120](#)
- [--strict_flags, --no_strict_flags on page 2-121](#)
- [--strict_ph, --no_strict_ph on page 2-122](#)
- [--strict_relocations, --no_strict_relocations on page 2-123](#)
- [--strict_symbols, --no_strict_symbols on page 2-124](#)
- [--strict_visibility, --no_strict_visibility on page 2-125](#)
- [--strict_wchar_size, --no_strict_wchar_size on page 2-126.](#)

Assembler Reference:

- [--diag_error=tag{, tag} on page 2-23](#)
- [--diag_suppress=tag{, tag} on page 2-26](#)
- [--diag_warning=tag{, tag} on page 2-27.](#)

Compiler Reference:

- [--diag_error=tag\[,tag,...\] on page 3-50](#)
- [--diag_suppress=tag\[,tag,...\] on page 3-53](#)
- [--diag_warning=tag\[,tag,...\] on page 3-55](#)
- [--strict, --no_strict on page 3-157](#)
- [--strict_warnings on page 3-158.](#)

2.107 --strict_enum_size, --no_strict_enum_size

The option `--strict_enum_size` causes the linker to display an error message if the enum size is not consistent across all inputs. This is the default.

Use `--no_strict_enum_size` for compatibility with objects built using RVCT v3.1 and earlier.

2.107.1 See also

Concepts

Using the Linker:

- [Use of the strict family of options in the linker](#) on page 4-41.

Reference

- [--strict](#) on page 2-119
- [--strict_flags, --no_strict_flags](#) on page 2-121
- [--strict_ph, --no_strict_ph](#) on page 2-122
- [--strict_relocations, --no_strict_relocations](#) on page 2-123
- [--strict_symbols, --no_strict_symbols](#) on page 2-124
- [--strict_visibility, --no_strict_visibility](#) on page 2-125
- [--strict_wchar_size, --no_strict_wchar_size](#) on page 2-126.

Compiler Reference:

- [--enum_is_int](#) on page 3-63.

2.108 --strict_flags, --no_strict_flags

The option `--strict_flags` prevents the `EF_ARM_HASENTRY` flag from being generated.

2.108.1 Default

The default is `--no_strict_flags`.

2.108.2 See also

Concepts

Using the Linker:

- [Use of the strict family of options in the linker](#) on page 4-41.

Reference

- [--strict](#) on page 2-119
- [--strict_enum_size, --no_strict_enum_size](#) on page 2-120
- [--strict_ph, --no_strict_ph](#) on page 2-122
- [--strict_relocations, --no_strict_relocations](#) on page 2-123
- [--strict_symbols, --no_strict_symbols](#) on page 2-124
- [--strict_visibility, --no_strict_visibility](#) on page 2-125
- [--strict_wchar_size, --no_strict_wchar_size](#) on page 2-126.

Other information

- *ARM ELF Specification (SWS ESPC 0003 B-02)*,
<http://infocenter.arm.com/help/topic/com.arm.doc.espc0003/index.html>.

2.109 --strict_ph, --no_strict_ph

The linker writes the contents of load regions into the output ELF file in the order that load regions are written in the scatter file. Each load region is represented by one ELF program segment. In RVCT v2.2 the Program Header Table entries describing the program segments are given the same order as the program segments in the ELF file. To be more compliant with the ELF specification, in RVCT v3.0 and later the Program Header Table entries are sorted in ascending virtual address order.

Use the `--no_strict_ph` command-line option to switch off the sorting of the Program Header Table entries.

2.109.1 See also

Concepts

Using the Linker:

- [Use of the strict family of options in the linker](#) on page 4-41.

Reference

- [--strict](#) on page 2-119
- [--strict_enum_size, --no_strict_enum_size](#) on page 2-120
- [--strict_flags, --no_strict_flags](#) on page 2-121
- [--strict_relocations, --no_strict_relocations](#) on page 2-123
- [--strict_symbols, --no_strict_symbols](#) on page 2-124
- [--strict_visibility, --no_strict_visibility](#) on page 2-125
- [--strict_wchar_size, --no_strict_wchar_size](#) on page 2-126.

2.110 --strict_relocations, --no_strict_relocations

This option enables you to ensure *Application Binary Interface* (ABI) compliance of legacy or third party objects. It checks that branch relocation applies to a branch instruction bit-pattern. The linker generates an error if there is a mismatch.

2.110.1 Usage

Use `--strict_relocations` to instruct the linker to report instances of obsolete and deprecated relocations.

Relocation errors and warnings are most likely to occur if you are linking object files built with previous versions of the ARM tools.

2.110.2 Default

The default is `--no_strict_relocations`.

2.110.3 See also

Concepts

Using the Linker:

- [Use of the strict family of options in the linker](#) on page 4-41.

Reference

- [--strict](#) on page 2-119
- [--strict_enum_size, --no_strict_enum_size](#) on page 2-120
- [--strict_flags, --no_strict_flags](#) on page 2-121
- [--strict_ph, --no_strict_ph](#) on page 2-122
- [--strict_symbols, --no_strict_symbols](#) on page 2-124
- [--strict_visibility, --no_strict_visibility](#) on page 2-125
- [--strict_wchar_size, --no_strict_wchar_size](#) on page 2-126.

2.111 --strict_symbols, --no_strict_symbols

The option `--strict_symbols` checks that the mapping symbol type matches ABI symbol type. The linker displays a warning if the types do not match.

A mismatch can occur only if you have hand-coded your own assembler.

2.111.1 Default

The default is `--no_strict_symbols`.

2.111.2 Example

In the following assembler code the symbol `sym` has type `STT_FUNC` and is ARM:

```

        area code, readonly
        DCD sym + 4
        ARM
sym PROC
        NOP
        THUMB
        NOP
        ENDP
        END

```

The difference in behavior is the meaning of `DCD sym + 4`:

- In pre-ABI linkers the state of the symbol is the state of the only of the mapping symbol at that location. In this example, the state is Thumb.
- In ABI linkers the type of the symbol is the state of the location of symbol plus the offset.

2.111.3 See also

Concepts

Using the Linker:

- [Use of the strict family of options in the linker](#) on page 4-41
- [About mapping symbols](#) on page 7-3.

Reference

- [--strict](#) on page 2-119
- [--strict_enum_size, --no_strict_enum_size](#) on page 2-120
- [--strict_flags, --no_strict_flags](#) on page 2-121
- [--strict_ph, --no_strict_ph](#) on page 2-122
- [--strict_relocations, --no_strict_relocations](#) on page 2-123
- [--strict_visibility, --no_strict_visibility](#) on page 2-125
- [--strict_wchar_size, --no_strict_wchar_size](#) on page 2-126.

2.112 --strict_visibility, --no_strict_visibility

A linker is not permitted to match a symbol reference with STT_HIDDEN visibility to a dynamic shared object. Some older linkers might permit this.

Use --no_strict_visibility to permit a hidden visibility reference to match against a shared object.

2.112.1 Default

The default is --strict_visibility.

2.112.2 See also

Concepts

Using the Linker:

- [Use of the strict family of options in the linker](#) on page 4-41.

Reference

- [--strict](#) on page 2-119
- [--strict_enum_size, --no_strict_enum_size](#) on page 2-120
- [--strict_flags, --no_strict_flags](#) on page 2-121
- [--strict_ph, --no_strict_ph](#) on page 2-122
- [--strict_relocations, --no_strict_relocations](#) on page 2-123
- [--strict_symbols, --no_strict_symbols](#) on page 2-124
- [--strict_wchar_size, --no_strict_wchar_size](#) on page 2-126.

2.113 --strict_wchar_size, --no_strict_wchar_size

The option `--strict_wchar_size` causes the linker to display an error message if the wide character size is not consistent across all inputs. This is the default.

Use `--no_strict_wchar_size` for compatibility with objects built using RVCT v3.1 and earlier.

2.113.1 See also

Concepts

Using the Linker:

- [Use of the strict family of options in the linker](#) on page 4-41.

Reference

- [--strict](#) on page 2-119
- [--strict_enum_size, --no_strict_enum_size](#) on page 2-120
- [--strict_flags, --no_strict_flags](#) on page 2-121
- [--strict_ph, --no_strict_ph](#) on page 2-122
- [--strict_relocations, --no_strict_relocations](#) on page 2-123
- [--strict_symbols, --no_strict_symbols](#) on page 2-124
- [--strict_visibility, --no_strict_visibility](#) on page 2-125.

Compiler Reference:

- [--wchar16](#) on page 3-176
- [--wchar32](#) on page 3-177.

2.114 --symbols, --no_symbols

This option enables or disables the listing of each local and global symbol used in the link step, and its value.

Note

This does not include mapping symbols output to stdout. Use `--list_mapping_symbols` to include mapping symbols in the output.

2.114.1 Default

The default is `--no_symbols`.

2.114.2 See also

Reference

- [--list_mapping_symbols, --no_list_mapping_symbols](#) on page 2-78.

2.115 --symdefs=*filename*

This option creates a file containing the global symbol definitions from the output image.

2.115.1 Syntax

--symdefs=*filename*

where *filename* is the name of the text file to contain the global symbol definitions.

2.115.2 Default

By default, all global symbols are written to the symdefs file. If a symdefs file called *filename* already exists, the linker restricts its output to the symbols already listed in this file.

———— **Note** ————

If you do not want this behavior, be sure to delete any existing symdefs file before the link step.

2.115.3 Usage

If *filename* is specified without path information, the linker searches for it in the directory where the output image is being written. If it is not found, it is created in that directory.

You can use the symbol definitions file as input when linking another image.

2.115.4 See also

Concepts

Using the Linker:

- [Accessing symbols in another image on page 7-17.](#)

2.116 --tailreorder, --no_tailreorder

This option moves tail calling sections immediately before their target, if possible, to optimize the branch instruction at the end of a section. A tail calling section is a section that contains a branch instruction at the end of the section. The branch must have a relocation that targets a function at the start of a section.

2.116.1 Default

The default is `--no_tailreorder`.

2.116.2 Restrictions

The linker:

- Can only move one tail calling section for each tail call target. If there are multiple tail calls to a single section, the tail calling section with an identical section name is moved before the target. If no section name is found in the tail calling section that has a matching name, then the linker moves the *first* section it encounters.
- Cannot move a tail calling section out of its execution region.
- Does not move tail calling sections before inline veneers.

2.116.3 See also

Concepts

Using the Linker:

- [Handling branches that optimize to a NOP on page 5-21](#)
- [About reordering of tail calling sections on page 5-22](#).

Reference

- [--branchnop, --no_branchnop on page 2-15](#).

2.117 --thumb2_library, --no_thumb2_library

Enables you to link against the combined ARM and 32-bit Thumb library. `--thumb2_library` only applies when the processor supports ARM and Thumb-2, such as the Cortex-A and Cortex-R series processors.

Use the `--no_thumb2_library` option to revert to the ARMv5T and later libraries.

Note

The linker ignores `--thumb2_library` if the target does not support Thumb-2.

2.117.1 Default

The default is `--thumb2_library`.

2.117.2 See also

Reference

Using ARM C and C++ Libraries and Floating-Point Support:

- [C and C++ library naming conventions on page 2-120.](#)

2.118 --tiebreaker=*option*

A tiebreaker is used when a sorting algorithm requires a total ordering of sections. It is used to resolve the order when the sorting criteria results in more than one input section with equal properties.

2.118.1 Syntax

--tiebreaker=*option*

where *option* is one of:

- | | |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| creation | <p>The order that the linker creates sections in its internal section data structure.</p> <p>When the linker creates an input section for each ELF section in the input objects, it increments a global counter. The value of this counter is stored in the section as the creation index.</p> <p>The creation index of a section is unique apart from the special case of inline veneers.</p> |
| cmdline | <p>The order that the section appears on the linker command-line. The command-line order is defined as <code>File.Object.Section</code> where:</p> <ul style="list-style-type: none"> • Section is the section index, <code>sh_idx</code>, of the Section in the Object • Object is the order that Object appears in the File • File is the order the File appears on the command line. <p>The order the Object appears in the File is only significant if the file is an archive.</p> <p>This option is useful if you are doing a binary difference between the results of different links, <code>link1</code> and <code>link2</code>. If <code>link2</code> has only small changes from <code>link1</code>, then you might want the differences in one source file to be localized. In general, creation index works well for objects, but because of the multiple pass selection of members from libraries, a small difference such as calling a new function can result in a different order of objects and therefore a different tiebreak. The command-line index is more stable across builds.</p> |

Use this option with the --scatter option.

2.118.2 Default

The default option is creation.

2.118.3 See also

Concepts

Using the Linker:

- [Examples of using sorting algorithms for .ANY sections](#) on page 8-30.

Reference

- [--any_sort_order=order](#) on page 2-8
- [--map, --no_map](#) on page 2-83
- [--scatter=filename](#) on page 2-109
- [--section_index_display=type](#) on page 2-110
- [--sort=algorithm](#) on page 2-115.

2.119 `--undefined=symbol`

This option causes the linker to:

1. Create a symbol reference to the specified symbol name.
2. Issue an implicit `--keep(symbol)` to prevent any sections brought in to define that symbol from being removed.

2.119.1 Syntax

`--undefined=symbol`

2.119.2 See also

Reference

- [--keep=section_id](#) on page 2-67
- [--undefined_and_export=symbol](#) on page 2-133.

2.120 `--undefined_and_export=symbol`

This option causes the linker to:

1. Create a symbol reference to the specified symbol name.
2. Issue an implicit `--keep(symbol)` to prevent any sections brought in to define that symbol from being removed.
3. Add an implicit `EXPORT symbol` to push the specified symbol into the dynamic symbol table.

2.120.1 Syntax

`--undefined_and_export=symbol`

2.120.2 Usage

Be aware of the following when using this option:

- It does not change the visibility of a symbol unless you specify the `--override_visibility` option.
- A warning is issued if the visibility of the specified symbol is not high enough.
- A warning is issued if the visibility of the specified symbol is overridden because you also specified the `--override_visibility` option.
- Hidden symbols are not exported unless you specify the `--override_visibility` option.

2.120.3 See also

Reference

- [--keep=section_id](#) on page 2-67
- [--override_visibility](#) on page 2-90
- [--undefined=symbol](#) on page 2-132
- [EXPORT](#) on page 3-2.

2.121 --unresolved=*symbol*

This option takes each reference to an undefined symbol and matches it to the global definition of the specified symbol.

2.121.1 Syntax

`--unresolved=symbol`

Where *symbol* must be both defined and global, otherwise it appears in the list of undefined symbols and the link step fails.

2.121.2 Usage

This option is particularly useful during top-down development, because it enables you to test a partially-implemented system by matching each reference to a missing function to a dummy function.

2.121.3 See also

Reference

- [--undefined=*symbol* on page 2-132](#)
- [--undefined_and_export=*symbol* on page 2-133](#)

2.122 --use_definition_visibility

When the linker combines global symbols the visibility of the symbol is set with the strictest visibility of the symbols being combined. Therefore, a symbol reference with STV_HIDDEN visibility combined with a definition with STV_DEFAULT visibility results in a definition with STV_HIDDEN visibility.

This option enables the linker to use the visibility of the definition in preference to the visibility a reference when combining symbols. For example, a symbol reference with STV_HIDDEN visibility combined with a definition with STV_DEFAULT visibility results in a definition with STV_DEFAULT visibility.

This can be useful when you want a reference to not match a Shared Library, but you want to export the definition.

Note

This option is not ELF-compliant and is disabled by default. To create ELF-compliant images, you must use symbol references with the appropriate visibility.

2.123 --userlibpath=*pathlist*

This option specifies a list of paths that are used to search for user libraries.

2.123.1 Syntax

`--userlibpath=pathlist`

Where *pathlist* is a comma-separated list of paths that are used to search for the required libraries. Do not include spaces between the comma and the path name when specifying multiple path names, for example, *path1,path2,path3,...,pathn*.

2.123.2 See also

Concepts

Using the Linker:

- [How the linker performs library searching, selection, and scanning on page 4-35.](#)

Reference

- [--libpath=*pathlist* on page 2-74.](#)

2.124 --veneereinject,--no_veneereinject

Enables or disables the placement of veneers outside of the sorting order for the Execution Region.

2.124.1 Usage

Use `--veneereinject` to allow the linker to place veneers outside of the sorting order for the Execution Region. This option is a subset of the `--largeregions` command. Use `--veneereinject` if you want to allow the veneer placement behavior described, but do not want to implicitly set the `--api` and `--sort=AvgCallDepth`.

Use `--no_veneereinject` to allow the linker use the sorting order for the Execution Region.

Use `--veneer_inject_type` to control the strategy the linker uses to place injected veneers.

The following command-line options allow stable veneer placement with large Execution Regions:

```
--veneereinject --veneer_inject_type=pool --sort=lexical
```

2.124.2 Default

The default is `--no_veneereinject`. The linker automatically switches to large region mode if it is required to successfully link the image.

Note

`--veneereinject` is the default for large region mode.

2.124.3 See also

Reference

- [--api, --no_api](#) on page 2-9
- [--largeregions, --no_largeregions](#) on page 2-70
- [--sort=algorithm](#) on page 2-115
- [--veneer_inject_type=type](#) on page 2-138.

2.125 --veneer_inject_type=type

This option controls the veneer layout when `--largeregions` mode is on.

2.125.1 Syntax

`--veneer_inject_type=type`

where *type* is one of:

individual The linker places veneers to ensure they can be reached by the largest amount of sections that use the veneer. Veneer reuse between execution regions is permitted. This type minimizes the number of veneers that are required but disrupts the structure of the image the most.

pool The linker:

1. Collects veneers from a contiguous range of the execution region
2. Places all the veneers generated from that range into a pool.
3. Places that pool at the end of the range.

A large execution region might have more than one range and therefore more than one pool. Although this type has much less impact on the structure of image, it has fewer opportunities for reuse. This is because a range of code cannot reuse a veneer in another pool. The linker calculates the range based on the presence of branch instructions that the linker predicts might require veneers. A branch is predicted to require a veneer when either:

- a state change is required
- the distance from source to target plus a contingency greater than the branch range.

You can set the size of the contingency with the `--veneer_pool_size=size` option. By default the contingency size is set to 102400 bytes. The `--info=veneerpools` option provides information on how the linker has placed veneer pools.

2.125.2 Restrictions

You must use `--largeregions` with this option.

2.125.3 See also

Reference

- [--info=topic\[,topic,...\]](#) on page 2-58
- [--largeregions, --no_largeregions](#) on page 2-70
- [--veneerinject, --no_veneerinject](#) on page 2-137
- [--veneer_pool_size=size](#) on page 2-139.

2.126 --veneer_pool_size=size

Sets the contingency size for the veneer pool in an execution region.

2.126.1 Syntax

`--veneer_pool_size=pool`

where *pool* is the size in bytes.

2.126.2 Default

The default size is 102400 bytes.

2.126.3 See also

Reference

- [--veneer_inject_type=type](#) on page 2-138.

2.127 --veneershare, --no_veneershare

This option enables or disables veneer sharing. Veneer sharing can cause a significant decrease in image size.

2.127.1 default

The default is --veneershare.

2.127.2 See also

Concepts

Using the Linker:

- [Overview of veneers on page 4-26](#)
- [Veneer sharing on page 4-27](#)
- [Veneer types on page 4-28](#)
- [Generation of position independent to absolute veneers on page 4-29](#)
- [Reuse of veneers when scatter-loading on page 4-30](#).

Reference

- [--inlineveneer, --no_inlineveneer on page 2-64](#)
- [--piveneer, --no_piveneer on page 2-95](#).

2.128 --verbose

This option prints detailed information about the link operation, including the objects that are included and the libraries from which they are taken. This output is particularly useful for tracing undefined symbols reference or multiply defined symbols. Because this output is typically quite long, you might want to use this command with the `--list=filename` command to redirect the information to *filename*.

Use `--verbose` to output diagnostics to stdout.

2.128.1 See also

Reference

- [--list=filename](#) on page 2-77
- [--muldefweak, --no_muldefweak](#) on page 2-88
- [--unresolved=symbol](#) on page 2-134.

2.129 --version_number

This option displays the version of armlink you are using.

2.129.1 Syntax

```
armlink --version_number
```

The linker displays the version number in the format nnnbbbb, where:

- nnn is the version number
- bbbb is the build number.

2.129.2 Example

Version 5.02 build 0019 is displayed as 5020019.

2.129.3 See also

Reference

- [--help](#) on page 2-57
- [--vsn](#) on page 2-145

2.130 --vfemode=*mode*

Virtual Function Elimination (VFE) is a technique that enables the linker to identify more unused sections.

Use this option to specify how VFE, and *Runtime Type Information* (RTTI) objects, are eliminated.

2.130.1 Syntax

--vfemode=*mode*

where *mode* is one of the following:

- | | |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| on | Use the command-line option --vfemode=on to make the linker VFE aware. In this mode the linker chooses force or off mode based on the content of object files: <ul style="list-style-type: none"> • Where every object file contains VFE information or does not refer to a symbol with a mangled C++ name, the linker assumes force mode and continues with the elimination. • If any object file is missing VFE information and refers to a symbol with a mangled C++ name, for example, where code has been compiled with a previous release of the ARM tools, the linker assumes off mode, and VFE is disabled silently. Choosing off mode to disable VFE in this situation ensures that the linker does not remove a virtual function that is used by an object with no VFE information. |
| off | Use the command-line option --vfemode=off to make arm1ink ignore any extra information supplied by the compiler. In this mode, the final image is the same as that produced by compiling and linking without VFE awareness. |
| force | Use the command-line option --vfemode=force to make the linker VFE aware and force the VFE algorithm to be applied. If some of the object files do not contain VFE information, for example, where they have been compiled with a previous release of the ARM tools, the linker continues with the elimination but displays a warning to alert you to possible errors. |
| force_no_rtti | Use the command-line option --vfemode=force_no_rtti to make the linker VFE aware and force the removal of all RTTI objects. In this mode all virtual functions are retained. |

2.130.2 Default

The default is --vfemode=on.

2.130.3 See also

Concepts

Using the Linker:

- [Elimination of common debug sections on page 5-2](#)
- [Elimination of common groups or sections on page 5-3](#)
- [Elimination of unused sections on page 5-4](#)
- [Elimination of unused virtual functions on page 5-6.](#)

2.131 --via=*filename*

This option reads an additional list of input filenames and linker options from *filename*.

You can enter multiple --via options on the linker command line. The --via options can also be included within a via file.

2.131.1 See also

Concepts

Compiler Reference:

- [Overview of via files on page B-2.](#)

2.132 --vsn

This option displays the version information and the license details. For example:

```
>armlink --vsn  
ARM Linker, N.nn [Build num] license_type  
Software supplied by: ARM Limited
```

2.132.1 See also

Reference

- [--help](#) on page 2-57
- [--version_number](#) on page 2-142.

2.133 --xref, --no_xref

This option lists to stdout all cross-references between input sections.

2.133.1 Default

The default is `--no_xref`.

2.133.2 See also

Reference

- [--list=filename](#) on page 2-77
- [--xrefdbg, --no_xrefdbg](#) on page 2-147
- [--xref{from|to}=object\(section\)](#) on page 2-148.

2.134 --xrefdbg, --no_xrefdbg

This option lists to stdout all cross-references between input debug sections.

2.134.1 Default

The default is `--no_xrefdbg`.

2.134.2 See also

Reference

- [--list=filename](#) on page 2-77
- [--xref, --no_xref](#) on page 2-146
- [--xref{from|to}=object\(section\)](#) on page 2-148.

2.135 --xref{from|to}=object(section)

This option lists to stdout cross-references:

- from input *section* in *object* to other input sections
- to input *section* in *object* from other input sections.

This is a useful subset of the listing produced by the `--xref` linker option if you are interested in references from or to a specific input section. You can have multiple occurrences of this option to list references from or to more than one input section.

2.135.1 See also

Reference

- [--list=filename](#) on page 2-77
- [--xref, --no_xref](#) on page 2-146
- [--xrefdbg, --no_xrefdbg](#) on page 2-147.

2.136 --zi_base=address

This option specifies the base address of an ER_ZI execution region.

2.136.1 Syntax

`--zi_base=address`

Where *address* must be word-aligned.

2.136.2 Restrictions

The linker ignores `--zi_base` if one of the following options is also specified:

- `--reloc`
- `--rwpi`
- `--split`.

You cannot use `--zi_base` with `--scatter`.

2.136.3 See also

Reference

- [--reloc on page 2-100](#)
- [--rwpi on page 2-107](#)
- [--scatter=filename on page 2-109](#)
- [--split on page 2-117](#).

Chapter 3

Linker steering file command reference

The following topics describe the steering file commands supported by the linker, `arm1ink`:

- [*EXPORT* on page 3-2](#)
- [*HIDE* on page 3-3](#)
- [*IMPORT* on page 3-4](#)
- [*RENAME* on page 3-5](#)
- [*REQUIRE* on page 3-7](#)
- [*RESOLVE* on page 3-8](#)
- [*SHOW* on page 3-10.](#)

3.1 EXPORT

The EXPORT command specifies that a symbol can be accessed by other shared objects or executables.

Note

A symbol can be exported only if the reference has STV_DEFAULT visibility. You must use the `--override_visibility` command-line option to enable the linker to override symbol visibility to STV_DEFAULT.

3.1.1 Syntax

```
EXPORT pattern [AS replacement_pattern] [,pattern [AS replacement_pattern]]
```

where:

pattern is a string, optionally including wildcard characters (either * or ?), that matches zero or more defined global symbols. If *pattern* does not match any defined global symbol, the linker ignores the command. The operand can match only defined global symbols.

If the symbol is not defined, the linker issues:

Warning: L6331W: No eligible global symbol matches pattern symbol

replacement_pattern

is a string, optionally including wildcard characters (either * or ?), to which the defined global symbol is to be renamed. Wild characters must have a corresponding wildcard in *pattern*. The characters matched by the *replacement_pattern* wildcard are substituted for the *pattern* wildcard.

For example:

```
EXPORT my_func AS func1
```

renames and exports the defined symbol `my_func` as `func1`.

3.1.2 Usage

You cannot export a symbol to a name that already exists. Only one wildcard character (either * or ?) is permitted in EXPORT.

The defined global symbol is included in the dynamic symbol table (as *replacement_pattern* if given, otherwise as *pattern*), if a dynamic symbol table is present.

3.1.3 See also

Concepts

Using the Linker:

- [What is a steering file? on page 7-23.](#)

Reference

- [--override_visibility on page 2-90](#)
- [IMPORT on page 3-4.](#)

3.2 HIDE

The HIDE command makes defined global symbols in the symbol table anonymous.

3.2.1 Syntax

```
HIDE pattern [,pattern]
```

where:

pattern is a string, optionally including wildcard characters, that matches zero or more defined global symbols. If *pattern* does not match any defined global symbol, the linker ignores the command. You cannot hide undefined symbols.

3.2.2 Usage

HIDE and SHOW can be used to make certain global symbols anonymous in an output image or partially linked object. Hiding symbols in an object file or library can be useful as a means of protecting intellectual property, as shown in [Example 3-1](#). This example produces a partially linked object with all global symbols hidden, except those beginning with `os_`.

Example 3-1 Using the HIDE command

```
; steer.txt

; Hides all global symbols
HIDE *
; Shows all symbols beginning with 'os_'
SHOW os_*
```

Link this example with the command:

```
armlink --partial input_object.o --edit steer.txt --o partial_object.o
```

You can link the resulting partial object with other objects, provided they do not contain references to the hidden symbols. When symbols are hidden in the output object, SHOW commands in subsequent link steps have no effect on them. The hidden references are removed from the output symbol table.

3.2.3 See also

Concepts

Using the Linker:

- [What is a steering file?](#) on page 7-23.

Reference

- [--edit=file_list](#) on page 2-38
- [--partial](#) on page 2-94
- [SHOW](#) on page 3-10.

3.3 IMPORT

The `IMPORT` command specifies that a symbol is defined in a shared object at runtime.

———— Note ————

A symbol can be imported only if the reference has `STV_DEFAULT` visibility. You must use the `--override_visibility` command-line option to enable the linker to override symbol visibility to `STV_DEFAULT`.

3.3.1 Syntax

```
IMPORT pattern [AS replacement_pattern] [,pattern [AS replacement_pattern]]
```

where:

pattern is a string, optionally including wildcard characters (either `*` or `?`), that matches zero or more undefined global symbols. If *pattern* does not match any undefined global symbol, the linker ignores the command. The operand can match only undefined global symbols.

replacement_pattern

is a string, optionally including wildcard characters (either `*` or `?`), to which the symbol is to be renamed. Wild characters must have a corresponding wildcard in *pattern*. The characters matched by the *pattern* wildcard are substituted for the *replacement_pattern* wildcard.

For example:

```
IMPORT my_func AS func
```

imports and renames the undefined symbol `my_func` as `func`.

3.3.2 Usage

You cannot import a symbol that has been defined in the current shared object or executable. Only one wildcard character (either `*` or `?`) is permitted in `IMPORT`.

The undefined symbol is included in the dynamic symbol table (as *replacement_pattern* if given, otherwise as *pattern*), if a dynamic symbol table is present.

———— Note ————

The `IMPORT` command only affects undefined global symbols. Symbols that have been resolved by a shared library are implicitly imported into the dynamic symbol table. The linker ignores any `IMPORT` directive that targets an implicitly imported symbol.

3.3.3 See also

Concepts

Using the Linker:

- [What is a steering file? on page 7-23.](#)

Reference

- [--override_visibility on page 2-90](#)
- [EXPORT on page 3-2.](#)

3.4 RENAME

The RENAME command renames defined and undefined global symbol names.

3.4.1 Syntax

```
RENAME pattern AS replacement_pattern [,pattern AS replacement_pattern]
```

where:

pattern is a string, optionally including wildcard characters (either * or ?), that matches zero or more global symbols. If *pattern* does not match any global symbol, the linker ignores the command. The operand can match both defined and undefined symbols.

replacement_pattern

is a string, optionally including wildcard characters (either * or ?), to which the symbol is to be renamed. Wild characters must have a corresponding wildcard in *pattern*. The characters matched by the *pattern* wildcard are substituted for the *replacement_pattern* wildcard.

For example, for a symbol named func1:

```
RENAME f* AS my_f*
renames func1 to my_func1.
```

3.4.2 Usage

You cannot rename a symbol to a global symbol name that already exists, even if the target symbol name is being renamed itself.

You cannot rename a symbol to the same name as another symbol. For example, you cannot do the following:

```
RENAME foo1 bar
RENAME foo2 bar
```

Renames only take effect at the end of the link step. Therefore, renaming a symbol does not remove its original name. This means that you cannot do the following:

```
RENAME func1 func2
RENAME func2 func3
```

The linker gives an error that func1 cannot be renamed to func2 as a symbol already exists with that name.

Only one wildcard character (either * or ?) is permitted in RENAME.

3.4.3 Example

Given an image containing the symbols func1, func2, and func3, you might have a steering file containing the following commands:

```
;invalid, func2 already exists EXPORT func1 AS func2

; valid RENAME func3 AS b2
;invalid, func3 still exists because the link step is not yet complete EXPORT func1 AS func3
```

3.4.4 See also

Concepts

Using the Linker:

- [What is a steering file? on page 7-23.](#)

3.5 REQUIRE

The REQUIRE command creates a DT_NEEDED tag in the dynamic array. DT_NEEDED tags specify dependencies to other shared objects used by the application, for example, a shared library.

3.5.1 Syntax

```
REQUIRE pattern [,pattern]
```

where:

pattern is a string representing a filename. No wild characters are permitted.

3.5.2 Usage

The linker inserts a DT_NEEDED tag with the value of *pattern* into the dynamic array. This tells the dynamic loader that the file it is currently loading requires *pattern* to be loaded.

Note

DT_NEEDED tags inserted as a result of a REQUIRE command are added after DT_NEEDED tags generated from shared objects or *dynamically linked libraries* (DLLs) placed on the command line.

3.5.3 See also

Concepts

Using the Linker:

- [What is a steering file? on page 7-23.](#)

3.6 RESOLVE

The RESOLVE command matches specific undefined references to a defined global symbol.

3.6.1 Syntax

```
RESOLVE pattern AS defined_pattern
```

where:

pattern is a string, optionally including wildcard characters (either * or ?), that matches zero or more undefined global symbols. If *pattern* does not match any undefined global symbol, the linker ignores the command. The operand can match only undefined global symbols.

defined_pattern

is a string, optionally including wildcard characters, that matches zero or more defined global symbols. If *defined_pattern* does not match any defined global symbol, the linker ignores the command. You cannot match an undefined reference to an undefined symbol.

3.6.2 Usage

RESOLVE is an extension of the existing `armlink --unresolved` command-line option. The difference is that `--unresolved` enables all undefined references to match one single definition, whereas RESOLVE enables more specific matching of references to symbols.

The undefined references are removed from the output symbol table.

RESOLVE works when performing partial-linking and when linking normally.

3.6.3 Example

You might have two files `file1.c` and `file2.c`, as shown in the following example:

Example 3-2 Using the RESOLVE command

`file1.c`

```
extern int foo;
extern void MP3_Init(void);
extern void MP3_Play(void);
```

```
int main(void)
{
    int x = foo + 1;
    MP3_Init();
    MP3_Play();
    return x;
}
```

`file2.c:`

```
int foobar;
void MyMP3_Init()
{
}
```

```
void MyMP3_Play()
{
}
```

Create a steering file, `ed.txt`, containing the line:

```
RESOLVE MP3* AS MyMP3*.
```

Enter the following command:

```
armlink file1.o file2.o --edit ed.txt --unresolved foobar
```

This command has the following effects:

- The references from `file1.o` (`foo`, `MP3_Init()` and `MP3_Play()`) are matched to the definitions in `file2.o` (`foobar`, `MyMP3_Init()` and `MyMP3_Play()` respectively), as specified by the steering file `ed.txt`.
- The `RESOLVE` command in `ed.txt` matches the MP3 functions and the `--unresolved` option matches any other remaining references, in this case, `foo` to `foobar`.
- The output symbol table, whether it is an image or a partial object, does not contain the symbols `foo`, `MP3_Init` or `MP3_Play`.

3.6.4 See also

Concepts

Using the Linker:

- [What is a steering file? on page 7-23.](#)

Reference

- [--edit=file_list on page 2-38](#)
- [--unresolved=symbol on page 2-134.](#)

3.7 SHOW

The SHOW command makes global symbols visible. This command is useful if you want to make a specific symbol visible that is hidden using a HIDE command with a wildcard.

3.7.1 Syntax

```
SHOW pattern [,pattern]
```

where:

pattern is a string, optionally including wildcard characters, that matches zero or more global symbols. If *pattern* does not match any global symbol, the linker ignores the command.

3.7.2 Usage

The usage of SHOW is closely related to that of HIDE.

3.7.3 See also

Concepts

Using the Linker:

- [What is a steering file? on page 7-23.](#)

Reference

- [HIDE on page 3-3.](#)

Chapter 4

Formal syntax of the scatter file

The following topics describe the format of scatter files:

Concepts

- *About load region descriptions on page 4-5*
- *About execution region descriptions on page 4-9*
- *Considerations when using a relative address +offset for load regions on page 4-17*
- *Considerations when using a relative address +offset for execution regions on page 4-18*
- *Inheritance rules for load region address attributes on page 4-19*
- *Inheritance rules for load region address attributes on page 4-19*
- *Inheritance rules for the RELOC address attribute on page 4-21*
- *About input section descriptions on page 4-22*
- *How the linker resolves multiple matches when processing scatter files on page 4-27*
- *Behavior when .ANY sections overflow because of linker-generated content on page 4-29*
- *How the linker resolves path names when processing scatter files on page 4-30*
- *About Expression evaluation in scatter files on page 4-31*
- *Expression usage in scatter files on page 4-32*
- *Expression rules in scatter files on page 4-33*
- *Execution address built-in functions for use in scatter files on page 4-35*
- *Scatter files containing relative base address load regions and a ZI execution region on page 4-37*
- *ScatterAssert function and load address related functions on page 4-39*

- *Symbol related function in a scatter file on page 4-41*
- *Example of aligning a base address in execution space but still tightly packed in load space on page 4-42.*

Reference

- *BNF notation used in scatter-loading description syntax on page 4-3*
- *Syntax of a scatter file on page 4-4*
- *Syntax of a load region description on page 4-6*
- *Load region attributes on page 4-8*
- *Syntax of an execution region description on page 4-10*
- *Execution region attributes on page 4-12*
- *Address attributes for load and execution regions on page 4-15*
- *Syntax of an input section description on page 4-23*
- *AlignExpr(expr; align) function on page 4-43*
- *GetPageSize() function on page 4-44*
- *SizeOfHeaders() function on page 4-45.*

4.1 BNF notation used in scatter-loading description syntax

Table 4-1 summarizes the *Backus-Naur Form* (BNF) symbols that are used to describe a formal language.

Table 4-1 BNF notation

Symbol	Description
"	Quotation marks are used to indicate that a character that is normally part of the BNF syntax is used as a literal character in the definition. The definition B"+C, for example, can only be replaced by the pattern B+C. The definition B+C can be replaced by, for example, patterns BC, BBC, or BBBC.
A ::= B	Defines A as B. For example, A ::= B"+" C means that A is equivalent to either B+ or C. The ::= notation is used to define a higher level construct in terms of its components. Each component might also have a ::= definition that defines it in terms of even simpler components. For example, A ::= B and B ::= C D means that the definition A is equivalent to the patterns C or D.
[A]	Optional element A. For example, A ::= B[C]D means that the definition A can be expanded into either BD or BCD.
A+	Element A can have one or more occurrences. For example, A ::= B+ means that the definition A can be expanded into B, BB, or BBB.
A*	Element A can have zero or more occurrences.
A B	Either element A or B can occur, but not both.
(A B)	Element A and B are grouped together. This is particularly useful when the operator is used or when a complex pattern is repeated. For example, A ::= (B C)+ (D E) means that the definition A can be expanded into any of BCD, BCE, BCBCD, BCBCE, BCBBCD, or BCBBCBE.

4.1.1 See also

Concepts

- [Syntax of a scatter file on page 4-4.](#)

4.2 Syntax of a scatter file

The following figure shows the components and organization of a typical scatter file:

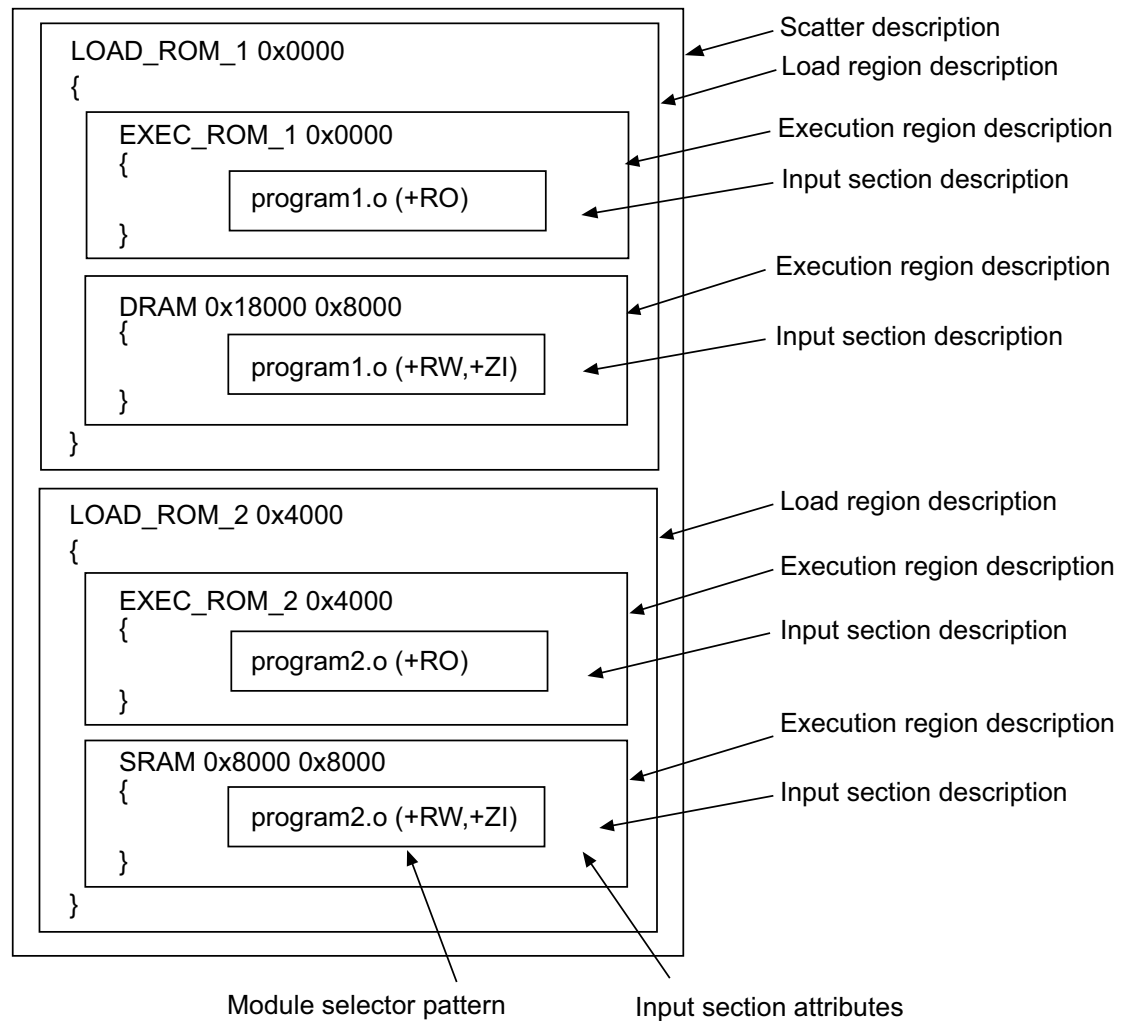


Figure 4-1 Components of a scatter file

4.2.1 See also

Tasks

Using the Linker:

- [Chapter 8 Using scatter files.](#)

Concepts

- [About load region descriptions on page 4-5](#)
- [About execution region descriptions on page 4-9](#)

4.3 About load region descriptions

A load region description has:

- a name (used by the linker to identify different load regions)
- a base address (the start address for the code and data in the load view)
- attributes that specify the properties of the load region
- an optional maximum size specification
- one or more execution regions.

The following figure shows the components of a typical load region description:

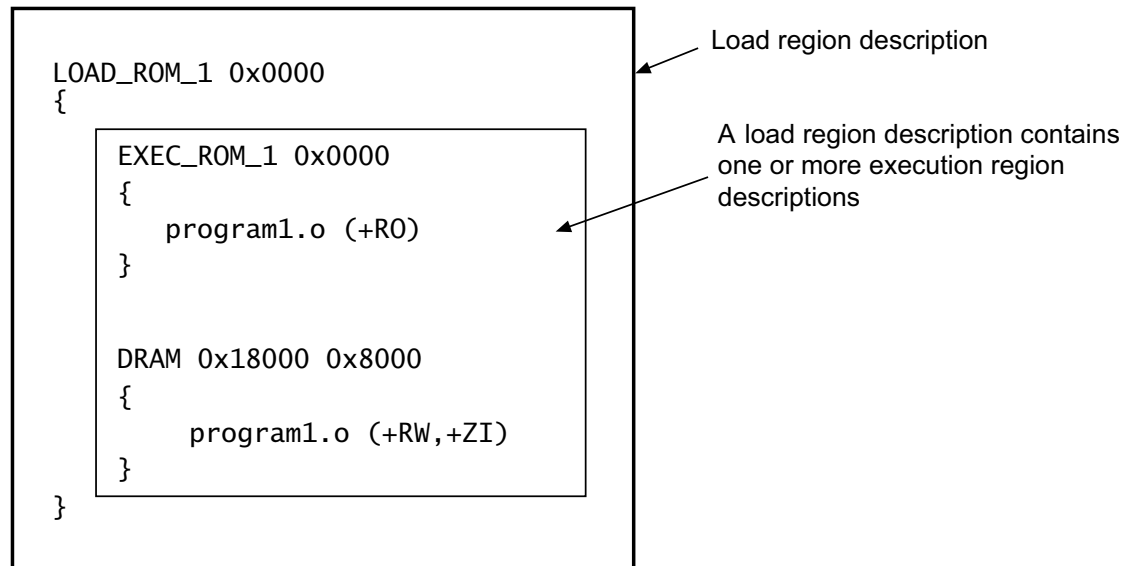


Figure 4-2 Components of a load region description

4.3.1 See also

Tasks

Using the Linker:

- [About creating regions on page boundaries](#) on page 8-54
- [Chapter 8 Using scatter files.](#)

Concepts

- [About Expression evaluation in scatter files](#) on page 4-31.

Reference

- [Syntax of a scatter file](#) on page 4-4
- [Syntax of a load region description](#) on page 4-6
- [Load region attributes](#) on page 4-8
- [Address attributes for load and execution regions](#) on page 4-15.

4.4 Syntax of a load region description

The syntax of a load region description, in *Backus-Naur Form* (BNF), is:

```
load_region_description ::=
    load_region_name (base_address | ("+" offset)) [attribute_list] [max_size]
    "{"
        execution_region_description+
    "}"
```

where:

load_region_name

Names the load region. You can use a quoted name. The name is case-sensitive only if you use any region-related linker-defined symbols.

base_address Specifies the address where objects in the region are to be linked. *base_address* must satisfy the alignment constraints of the load region.

+offset Describes a base address that is *offset* bytes beyond the end of the preceding load region. The value of *offset* must be zero modulo four. If this is the first load region, then *+offset* means that the base address begins *offset* bytes from zero. If you use *+offset*, then the load region might inherit certain attributes from a previous load region.

attribute_list

The attributes that specify the properties of the load region contents.

max_size Specifies the maximum size of the load region. This is the size of the load region before any decompression or zero initialization take place. If the optional *max_size* value is specified, *arm-link* generates an error if the region has more than *max_size* bytes allocated to it.

execution_region_description

Specifies the execution region name, address, and contents.

———— Note ————

The *Backus-Naur Form* (BNF) definitions contain additional line returns and spaces to improve readability. They are not required in the scatter-loading definition and are ignored if present in the file.

4.4.1 See also

Concepts

- [About load region descriptions on page 4-5](#)
- [Considerations when using a relative address +offset for load regions on page 4-17](#)
- [Inheritance rules for load region address attributes on page 4-19](#)
- [About Expression evaluation in scatter files on page 4-31](#)

Using the Linker:

- [Region-related symbols on page 7-5](#).

Reference

- [BNF notation used in scatter-loading description syntax on page 4-3](#)
- [Syntax of a scatter file on page 4-4](#)
- [Syntax of a load region description](#)

- *Load region attributes* on page 4-8
- *Address attributes for load and execution regions* on page 4-15.

4.5 Load region attributes

The load region attributes are:

ABSOLUTE	Absolute address. The load address of the region is specified by the base designator. This is the default, unless you use PI or RELOC.
ALIGN <i>alignment</i>	<p>Increase the alignment constraint for the load region from 4 to <i>alignment</i>. <i>alignment</i> must be a positive power of 2. If the load region has a <i>base_address</i> then this must be <i>alignment</i> aligned. If the load region has a <i>+offset</i> then the linker aligns the calculated base address of the region to an <i>alignment</i> boundary.</p> <p>This can also affect the offset in the ELF file. For example, the following causes the data for F00 to be written out at 4k offset into the ELF file:</p> <pre>F00 +4 ALIGN 4096</pre>
NOCOMPRESS	RW data compression is enabled by default. The NOCOMPRESS keyword enables you to specify that the contents of a load region must not be compressed in the final image.
OVERLAY	The OVERLAY keyword enables you to have multiple load regions at the same address. ARM tools do not provide an overlay mechanism. To use multiple load regions at the same address, you must provide your own overlay manager.
PI	This region is position independent.
PROTECTED	<p>The PROTECTED keyword prevents:</p> <ul style="list-style-type: none"> • overlapping of load regions • veneer sharing • string sharing with the --merge option.
RELOC	This region is relocatable.

4.5.1 See also

Concepts

- [Considerations when using a relative address +offset for load regions on page 4-17](#)
- [Inheritance rules for the RELOC address attribute on page 4-21.](#)

Using the Linker:

- [About load region descriptions on page 4-5](#)
- [Section alignment with the linker on page 4-22](#)
- [Veneer sharing on page 4-27](#)
- [Generation of position independent to absolute veneers on page 4-29](#)
- [Reuse of veneers when scatter-loading on page 4-30](#)
- [Optimization with RW data compression on page 5-13](#)
- [Placement of sections with overlays on page 8-44](#)
- [About creating regions on page boundaries on page 8-54.](#)

Reference

- [--merge, --no_merge on page 2-87](#)
- [Example of aligning a base address in execution space but still tightly packed in load space on page 4-42.](#)

4.6 About execution region descriptions

An execution region description has:

- a name (used by the linker to identify different execution regions)
- a base address (either absolute or relative)
- attributes that specify the properties of the execution region
- an optional maximum size specification
- one or more input section descriptions (the modules placed into this execution region).

The following figure shows the components of a typical execution region description:

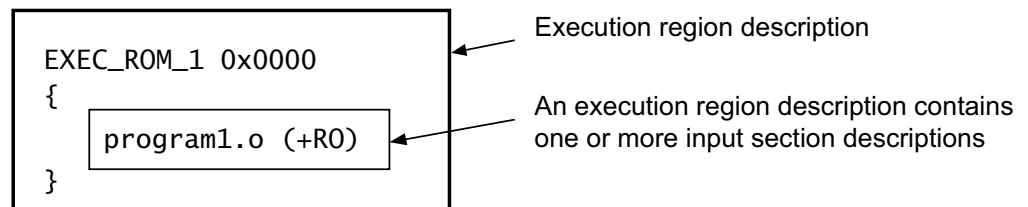


Figure 4-3 Components of an execution region description

4.6.1 See also

Tasks

Using the Linker:

- [Chapter 8 Using scatter files.](#)

Concepts

- [About Expression evaluation in scatter files](#) on page 4-31.

Using the Linker:

- [Placement of sections with overlays](#) on page 8-44
- [About creating regions on page boundaries](#) on page 8-54.

Reference

- [Syntax of a scatter file](#) on page 4-4
- [Syntax of an execution region description](#) on page 4-10
- [Execution region attributes](#) on page 4-12
- [Address attributes for load and execution regions](#) on page 4-15
- [About input section descriptions](#) on page 4-22.

4.7 Syntax of an execution region description

The syntax of an execution region description, in *Backus-Naur Form* (BNF), is:

execution_region_description ::=

```

exec_region_name (base_address | "+" offset) [attribute_list] [max_size | length]
    "{"
        input_section_description*
    "}"

```

where:

exec_region_name

Names the execution region. You can use a quoted name. The name is case-sensitive only if you use any region-related linker-defined symbols.

base_address Specifies the address where objects in the region are to be linked. *base_address* must be word-aligned.

———— **Note** ————

Using `ALIGN` on an execution region causes both the load address and execution address to be aligned.

+offset Describes a base address that is *offset* bytes beyond the end of the preceding execution region. The value of *offset* must be zero modulo four.

If this is the first execution region in the load region then *+offset* means that the base address begins *offset* bytes after the base of the containing load region.

If you use *+offset*, then the execution region might inherit certain attributes from the parent load region, or from a previous execution region within the same load region.

attribute_list

The attributes that specify the properties of the execution region contents.

max_size For an execution region marked `EMPTY` or `FILL` the *max_size* value is interpreted as the length of the region. Otherwise the *max_size* value is interpreted as the maximum size of the execution region.

[-]length Can only be used with `EMPTY` to represent a stack that grows down in memory. If the length is given as a negative value, the *base_address* is taken to be the end address of the region.

input_section_description

Specifies the content of the input sections.

———— **Note** ————

The *Backus-Naur Form* (BNF) definitions contain additional line returns and spaces to improve readability. They are not required in the scatter-loading definition and are ignored if present in the file.

4.7.1 See also

Tasks

Using the Linker:

- [Chapter 8 Using scatter files.](#)

Concepts

- [About execution region descriptions on page 4-9](#)
- [Considerations when using a relative address +offset for execution regions on page 4-18](#)
- [About Expression evaluation in scatter files on page 4-31.](#)

Using the Linker:

- [Region-related symbols on page 7-5](#)
- [Placement of sections with overlays on page 8-44](#)
- [About creating regions on page boundaries on page 8-54.](#)

Reference

- [BNF notation used in scatter-loading description syntax on page 4-3](#)
- [Syntax of a scatter file on page 4-4](#)
- [Execution region attributes on page 4-12](#)
- [Address attributes for load and execution regions on page 4-15](#)
- [Inheritance rules for load region address attributes on page 4-19](#)
- [Inheritance rules for execution region address attributes on page 4-20](#)
- [Inheritance rules for the RELOC address attribute on page 4-21](#)
- [About input section descriptions on page 4-22.](#)

4.8 Execution region attributes

The execution region attributes are:

ABSOLUTE	Absolute address. The execution address of the region is specified by the base designator.
ALIGN <i>alignment</i>	Increase the alignment constraint for the execution region from 4 to <i>alignment</i> . <i>alignment</i> must be a positive power of 2. If the execution region has a <i>base_address</i> then this must be <i>alignment</i> aligned. If the execution region has a <i>+offset</i> then the linker aligns the calculated base address of the region to an <i>alignment</i> boundary.

Note

ALIGN on an execution region causes both the load address and execution address to be aligned. This can result in padding being added to the ELF file. To align only the execution address, use the AlignExpr expression on the base address.

ALIGNALL <i>value</i>	Increases the alignment of sections within the execution region. The value must be a positive power of 2 and must be greater than or equal to 4.
ANY_SIZE <i>max_size</i>	Specifies the maximum size within the execution region that armlink can fill with unassigned sections. You can use a simple expression to specify the <i>max_size</i> . That is, you cannot use functions such as ImageLimit().

Note

max_size is not the contingency, but the maximum size permitted for placing unassigned sections in an execution region. For example, if an execution region is to be filled only with .ANY sections, a two percent contingency is still set aside for veneers. This leaves 98% of the region for .ANY section assignments.

Be aware of the following restrictions when using this keyword:

- *max_size* must be less than or equal to the region size
- you can use ANY_SIZE on a region without a .ANY selector but it is ignored by armlink.

EMPTY [-] <i>length</i>	Reserves an empty block of memory of a given <i>size</i> in the execution region, typically used by a heap or stack. No section can be placed in a region with the EMPTY attribute. <i>length</i> represent a stack that grows down in memory. If the length is given as a negative value, the <i>base_address</i> is taken to be the end address of the region.
FILL <i>value</i>	Creates a linker generated region containing a <i>value</i> . If you specify FILL, you must give a value, for example: FILL 0xFFFFFFFF. The FILL attribute replaces the following combination: EMPTY ZEROPAD PADVALUE. In certain situations, for example, simulation, this is preferable to spending a long time in a zeroing loop.
FIXED	Fixed address. The linker attempts to make the execution address equal the load address. This makes the region a root region. If this is not possible the linker produces an error.

Note

The linker inserts padding with this attribute.

NOCOMPRESS	RW data compression is enabled by default. The NOCOMPRESS keyword enables you to specify that RW data in an execution region must not be compressed in the final image.
OVERLAY	Use for sections with overlaying address ranges. If consecutive execution regions have the same <i>+offset</i> then they are given the same base address.
PADVALUE	<p>Defines the value of any padding. If you specify PADVALUE, you must give a value, for example:</p> <pre>EXEC 0x10000 PADVALUE 0xFFFFFFFF EMPTY ZEROPAD 0x2000</pre> <p>This creates a region of size 0x2000 full of 0xFFFFFFFF.</p> <p>PADVALUE must be a word in size. PADVALUE attributes on load regions are ignored.</p>
PI	This region contains only position independent sections.
SORTTYPE	<p>Specifies the sorting algorithm for the execution region, for example:</p> <pre>ER1 +0 SORTTYPE CallTree</pre>
UNINIT	Use to create execution regions containing uninitialized data or memory-mapped I/O.
ZEROPAD	<p>Zero-initialized sections are written in the ELF file as a block of zeros and, therefore, do not have to be zero-filled at runtime.</p> <p>This sets the load length of a ZI output section to <code>Image\$\$region_name\$\$ZI\$Length</code>.</p> <p>Only root execution regions can be zero-initialized using the ZEROPAD attribute. Using the ZEROPAD attribute with a non root execution region generates a warning and the attribute is ignored.</p> <p>In certain situations, for example, simulation, this is preferable to spending a long time in a zeroing loop.</p>

4.8.1 See also

Concepts

- [About execution region descriptions on page 4-9](#)
- [Considerations when using a relative address +offset for execution regions on page 4-18](#)
- [Behavior when .ANY sections overflow because of linker-generated content on page 4-29](#)
- [About Expression evaluation in scatter files on page 4-31.](#)

Using the Linker:

- [Section alignment with the linker on page 4-22](#)
- [Optimization with RW data compression on page 5-13](#)
- [Image\\$\\$ execution region symbols on page 7-6](#)
- [Load\\$\\$ execution region symbols on page 7-7](#)
- [Placement of sections with overlays on page 8-44](#)
- [About creating regions on page boundaries on page 8-54](#)
- [Overalignment of execution regions and input sections on page 8-56](#)
- [Using expression evaluation in a scatter file to avoid padding on page 8-59.](#)

Reference

- *--any_contingency* on page 2-5
- *--sort=algorithm* on page 2-115
- *Syntax of a scatter file* on page 4-4
- *Syntax of an execution region description* on page 4-10
- *Syntax of an input section description* on page 4-23
- *Example of aligning a base address in execution space but still tightly packed in load space* on page 4-42
- *AlignExpr(expr, align)* function on page 4-43.

4.9 Address attributes for load and execution regions

A subset of the load and execution region attributes inform the linker about the content of the region and how it behaves after linking. These attributes are:

ABSOLUTE	The content is placed at a fixed address that does not change after linking.
PI	The content does not depend on any fixed address and might be moved after linking without any extra processing.
RELOC	The content depends on fixed addresses, relocation information is output to enable the content to be moved to another location by another tool.

Note

You cannot explicitly use this attribute for an execution region.

OVERLAY	The content is placed at a fixed address that does not change after linking. The content might overlap with other regions designated as OVERLAY regions.
---------	----------------------------------------------------------------------------------------------------------------------------------------------------------

4.9.1 Inheritance rules for address attributes

In general, all the execution regions within a load region have the same address attribute. To make this easy to select, the address attributes can be inherited from a previous region so that they only have to be set in one place. The rules for setting and inheriting address attributes are:

- Explicitly setting the address attribute:
 - A load region can be explicitly set with the ABSOLUTE, PI, RELOC, or OVERLAY attributes.
 - An execution region can be explicitly set with the ABSOLUTE, PI, or OVERLAY attributes. An execution region can only inherit the RELOC attribute from the parent load region.
- Implicitly setting the address attribute when none is specified:
 - The OVERLAY attribute cannot be inherited. A region with the OVERLAY attribute cannot inherit.
 - A base address load or execution region always defaults to ABSOLUTE.
 - A *+offset* load region inherits the address attribute from the previous load region or ABSOLUTE if no previous load region exists.
 - A *+offset* execution region inherits the address attribute from the previous execution region or parent load region if no previous execution region exists.

4.9.2 See also

Concepts

- [About load region descriptions on page 4-5](#)
- [About execution region descriptions on page 4-9](#)
- [Considerations when using a relative address *+offset* for load regions on page 4-17](#)
- [Considerations when using a relative address *+offset* for execution regions on page 4-18](#)

Using the Linker:

- [Placement of sections with overlays on page 8-44.](#)

Reference

- [Syntax of a scatter file on page 4-4](#)
- [Syntax of a load region description on page 4-6](#)
- [Load region attributes on page 4-8](#)

- *Syntax of an execution region description* on page 4-10
- *Execution region attributes* on page 4-12.

4.10 Considerations when using a relative address +offset for load regions

Be aware of the following when using *+offset* to specify a load region base address:

- If the *+offset* load region LR2 follows a load region LR1 containing ZI data, then LR2 overlaps the ZI data. To fix this, use the `ImageLimit()` function to specify the base address of LR2.
- A *+offset* load region LR2 inherits the attributes of the load region LR1 immediately before it, unless:
 - LR1 has the `OVERLAY` attribute
 - LR2 has an explicit attribute set.

If a load region is unable to inherit an attribute, then it gets the attribute `ABSOLUTE`.

4.10.1 See also

Concepts

- [Inheritance rules for load region address attributes on page 4-19](#)
- [Execution address built-in functions for use in scatter files on page 4-35](#).

4.11 Considerations when using a relative address `+offset` for execution regions

Be aware of the following when using `+offset` to specify an execution region base address:

- The first execution region inherits the attributes of the parent load region, unless an attribute is explicitly set on that execution region.
- A `+offset` execution region ER2 inherits the attributes of the execution region ER1 immediately before it, unless:
 - ER1 has the `OVERLAY` attribute
 - ER2 has an explicit attribute set.

If an execution region is unable to inherit an attribute, then it gets the attribute `ABSOLUTE`.

- If the parent load region has the `RELOC` attribute, then all execution regions within that load region must have a `+offset` base address.

4.11.1 See also

Concepts

- [Inheritance rules for execution region address attributes on page 4-20](#)
- [Inheritance rules for the `RELOC` address attribute on page 4-21](#).

4.12 Inheritance rules for load region address attributes

For a load region to inherit the attributes of a previous load region, specify a *+offset* base address for that region. A load region cannot inherit attributes if:

- you explicitly set the attribute of that load region
- the load region immediately before has the OVERLAY attribute.

You can explicitly set a load region with the ABSOLUTE, PI, RELOC, or OVERLAY address attributes.

This example shows the inheritance rules for setting the address attributes of load regions:

Example 4-1 Load region inheritance

```

LR1 0x8000 PI
{
    ...
}
LR2 +0          ; LR2 inherits PI from LR1
{
    ...
}
LR3 0x1000      ; LR3 does not inherit because it has no relative base
                ; address, gets default of ABSOLUTE
{
    ...
}
LR4 +0          ; LR4 inherits ABSOLUTE from LR3
{
    ...
}
LR5 +0 RELOC    ; LR5 does not inherit because it explicitly sets RELOC
{
    ...
}
LR6 +0 OVERLAY  ; LR6 does not inherit, an OVERLAY cannot inherit
{
    ...
}
LR7 +0          ; LR7 cannot inherit OVERLAY, gets default of ABSOLUTE
{
    ...
}

```

4.12.1 See also

Concepts

- [Address attributes for load and execution regions](#) on page 4-15
- [Considerations when using a relative address +offset for load regions](#) on page 4-17.

4.13 Inheritance rules for execution region address attributes

For an execution region to inherit the attributes of a previous execution region, specify a *+offset* base address for that region. The first *+offset* execution region can inherit the attributes of the parent load region. An execution region cannot inherit attributes if you:

- explicitly set the attribute of that execution region
- the previous execution region has the OVERLAY attribute.

You can explicitly set an execution region with the ABSOLUTE, PI, or OVERLAY attributes. However, an execution region can only inherit the RELOC attribute from the parent load region.

This example shows the inheritance rules for setting the address attributes of execution regions:

Example 4-2 Execution region inheritance

```

LR1 0x8000 PI
{
    ER1 +0          ; ER1 inherits PI from LR1
    {
        ...
    }
    ER2 +0          ; ER2 inherits PI from ER1
    {
        ...
    }
    ER3 0x10000     ; ER3 does not inherit because it has no relative base
                    ; address and gets the default of ABSOLUTE
    {
        ...
    }
    ER4 +0          ; ER4 inherits ABSOLUTE from ER3
    {
        ...
    }
    ER5 +0 PI       ; ER5 does not inherit, it explicitly sets PI
    {
        ...
    }
    ER6 +0 OVERLAY ; ER6 does not inherit, an OVERLAY cannot inherit
    {
        ...
    }
    ER7 +0          ; ER7 cannot inherit OVERLAY, gets the default of ABSOLUTE
    {
        ...
    }
}

```

4.13.1 See also

Concepts

- [Address attributes for load and execution regions](#) on page 4-15
- [Considerations when using a relative address +offset for execution regions](#) on page 4-18.

4.14 Inheritance rules for the RELOC address attribute

You can explicitly set the RELOC attribute for a load region. However, an execution region can only inherit the RELOC attribute from the parent load region.

This example shows the inheritance rules for setting the address attributes with RELOC:

Example 4-3 Inheriting RELOC

```

LR1 0x8000 RELOC
{
    ER1 +0 ; inherits RELOC from LR1
    {
        ...
    }
    ER2 +0 ; inherits RELOC from ER1
    {
        ...
    }
    ER3 +0 RELOC ; Error cannot explicitly set RELOC on an execution region
    {
        ...
    }
}

```

4.14.1 See also

Concepts

- [Address attributes for load and execution regions](#) on page 4-15
- [Considerations when using a relative address +offset for load regions](#) on page 4-17
- [Considerations when using a relative address +offset for execution regions](#) on page 4-18.

4.15 About input section descriptions

An input section description is a pattern that identifies input sections by:

- Module name (object filename, library member name, or library filename). The module name can use wildcard characters.
- Input section name, or input section attributes such as READ-ONLY, or CODE. You can use wildcard characters for the input section name.
- Symbol name.

The following figure shows the components of a typical input section description.

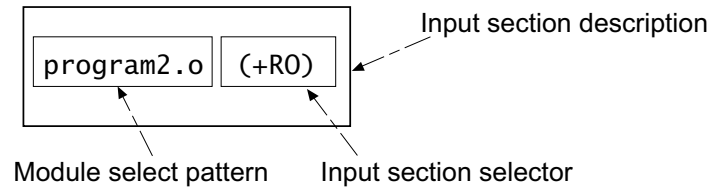


Figure 4-4 Components of an input section description

Note

Ordering in an execution region does not affect the ordering of sections in the output image.

4.15.1 See also

Reference

- [Syntax of a scatter file on page 4-4](#)
- [Syntax of an input section description on page 4-23](#).

4.16 Syntax of an input section description

The syntax of an input section description, in *Backus-Naur Form* (BNF), is:

```
input_section_description ::=
    module_select_pattern
    [ "(" input_section_selector ( "," input_section_selector )* ")" ]
input_section_selector ::=
    ("+" input_section_attr | input_section_pattern | input_symbol_pattern |
    section_properties)
```

where:

module_select_pattern

A pattern constructed from literal text. The wildcard character * matches zero or more characters and ? matches any single character.

Matching is not case-sensitive, even on hosts with case-sensitive file naming.

Use *.o to match all objects. Use * to match all object files and libraries.

You can use quoted filenames, for example "file one.o".

An input section matches a module selector pattern when *module_select_pattern* matches one of the following:

- The name of the object file containing the section.
- The name of the library member (without leading path name).
- The full name of the library (including path name) the section is extracted from. If the names contain spaces, use wild characters to simplify searching. For example, use *libname.lib to match C:\lib dir\libname.lib.

The following module selector patterns describe the placement order of an input section within the execution region:

.ANY module selector for unassigned sections

The special module selector pattern .ANY enables you to assign input sections to execution regions without considering their parent module. Use .ANY to fill up the execution regions with input sections that do not have to be placed at specific locations.

Modified selectors

You cannot have two * selectors in a scatter file. You can, however, use two modified selectors, for example *A and *B, and you can use a .ANY selector together with a * module selector. The * module selector has higher precedence than .ANY. If the portion of the file containing the * selector is removed, the .ANY selector then becomes active.

————— Note —————

- Only input sections that match both *module_select_pattern* and at least one *input_section_attr* or *input_section_pattern* are included in the execution region.
If you omit (+ *input_section_attr*) and (*input_section_pattern*), the default is +R0.

- Do not rely on input section names generated by the compiler, or used by ARM library code. These can change between compilations if, for example, different compiler options are used. In addition, section naming conventions used by the compiler are not guaranteed to remain constant between releases.

input_section_attr

An attribute selector matched against the input section attributes. Each *input_section_attr* follows a +.

If you are specifying a pattern to match the input section name, the name must be preceded by a +. You can omit any comma immediately followed by a +.

The selectors are not case-sensitive. The following selectors are recognized:

- RO-CODE
- RO-DATA
- RO, selects both RO-CODE and RO-DATA
- RW-DATA
- RW-CODE
- RW, selects both RW-CODE and RW-DATA
- ZI
- ENTRY, that is, a section containing an ENTRY point.

The following synonyms are recognized:

- CODE for RO-CODE
- CONST for RO-DATA
- TEXT for RO
- DATA for RW
- BSS for ZI.

The following pseudo-attributes are recognized:

- FIRST
- LAST.

Use FIRST and LAST to mark the first and last sections in an execution region if the placement order is important. For example, if a specific input section must be first in the region and an input section containing a checksum must be last.

There can be only one FIRST or one LAST attribute for an execution region, and it must follow a single *input_section_attr*. For example:

```
*(section, +FIRST)
```

This pattern is correct.

```
*(+FIRST, section)
```

This pattern is incorrect and produces an error message.

input_section_pattern

A pattern that is matched, without case sensitivity, against the input section name. It is constructed from literal text. The wildcard character * matches 0 or more characters, and ? matches any single character.

You can use a quoted input section name.

Note

If you use more than one *input_section_pattern*, ensure that there are no duplicate patterns in different execution regions to avoid ambiguity errors.

input_symbol_pattern

You can select the input section by the name of a global symbol that the section defines. This enables you to choose individual sections with the same name from partially linked objects.

The `:gdef:` prefix distinguishes a global symbol pattern from a section pattern. For example, use `:gdef:mysym` to select the section that defines `mysym`. The following example shows a scatter file in which `ExecReg1` contains the section that defines global symbol `mysym1`, and the section that contains global symbol `mysym2`:

```
LoadRegion 0x8000
{
    ExecReg1 +0
    {
        *(:gdef:mysym1)
        *(:gdef:mysym2)
    }
    ; rest of scatter-loading description
}
```

You can use a quoted global symbol pattern. The `:gdef:` prefix can be inside or outside the quotes.

Note

If you use more than one *input_symbol_pattern*, ensure that there are no duplicate patterns in different execution regions to avoid ambiguity errors.

The order of input section descriptors is not significant.

section_properties

A section property can be `+FIRST`, `+LAST`, and `OVERALIGN value`.

The value for `OVERALIGN` must be a positive power of 2 and must be greater than or equal to 4.

Note

The BNF definitions contain additional line returns and spaces to improve readability. They are not required in the scatter-loading definition and are ignored if present in the file.

4.16.1 Examples of module select patterns

Examples of *module_select_pattern* specifications are:

- `*` matches any module or library
- `*.o` matches any object module
- `math.o` matches the `math.o` module
- `*armlib*` matches all C libraries supplied by ARM
- `"file 1.o"` matches the file `file 1.o`
- `*math.lib` matches any library path ending with `math.lib`. For example, `C:\apps\lib\math\satmath.lib`.

4.16.2 Examples of input section selector patterns

Examples of *input_section_selector* specifications are:

- `+RO` is an input section attribute that matches all RO code and all RO data
- `+RW,+ZI` is an input section attribute that matches all RW code, all RW data, and all ZI data
- `BLOCK_42` is an input section pattern that matches sections named `BLOCK_42`. There can be multiple ELF sections with the same `BLOCK_42` name that possess different attributes, for example `+RO-CODE,+RW`.

4.16.3 See also

Tasks

- [Behavior when .ANY sections overflow because of linker-generated content on page 4-29.](#)

Using the Linker:

- [Placing unassigned sections with the .ANY module selector on page 8-23.](#)

Concepts

- [About input section descriptions on page 4-22.](#)

Using the Linker:

- [Examples of using placement algorithms for .ANY sections on page 8-26](#)
- [Example of next_fit algorithm showing behavior of full regions, selectors, and priority on page 8-28](#)
- [Examples of using sorting algorithms for .ANY sections on page 8-30.](#)

Using the Linker:

- [Overalignment of execution regions and input sections on page 8-56.](#)

Reference

- [BNF notation used in scatter-loading description syntax on page 4-3](#)
- [Syntax of a scatter file on page 4-4.](#)

4.17 How the linker resolves multiple matches when processing scatter files

An input section must be unique. In the case of multiple matches, the linker attempts to assign the input section to a region based on a *module_select_pattern* and *input_section_selector* pair that is the most specific. However, if a unique match cannot be found, the linker faults the scatter-loading description.

The following variables are used to describe how the linker matches multiple input sections:

- *m1* and *m2* represent module selector patterns
- *s1* and *s2* represent input section selectors.

For example, if input section A matches *m1,s1* for execution region R1, and A matches *m2,s2* for execution region R2, the linker:

- assigns A to R1 if *m1,s1* is more specific than *m2,s2*
- assigns A to R2 if *m2,s2* is more specific than *m1,s1*
- diagnoses the scatter-loading description as faulty if *m1,s1* is not more specific than *m2,s2* and *m2,s2* is not more specific than *m1,s1*.

armlink uses the following sequence to determine the most specific *module_select_pattern*, *input_section_selector* pair:

1. For the module selector patterns:
m1 is more specific than *m2* if the text string *m1* matches pattern *m2* and the text string *m2* does not match pattern *m1*.
2. For the input section selectors:
 - If *s1* and *s2* are both patterns matching section names, the same definition as for module selector patterns is used.
 - If one of *s1*, *s2* matches the input section name and the other matches the input section attributes, *s1* and *s2* are unordered and the description is diagnosed as faulty.
 - If both *s1* and *s2* match input section attributes, the determination of whether *s1* is more specific than *s2* is defined by the relationships below:
 - ENTRY is more specific than R0-CODE, R0-DATA, RW-CODE or RW-DATA
 - R0-CODE is more specific than R0
 - R0-DATA is more specific than R0
 - RW-CODE is more specific than RW
 - RW-DATA is more specific than RW
 - There are no other members of the (*s1* more specific than *s2*) relationship between section attributes.
3. For the *module_select_pattern*, *input_section_selector* pair, *m1,s1* is more specific than *m2,s2* only if any of the following are true:
 - a. *s1* is a literal input section name that is, it contains no pattern characters, and *s2* matches input section attributes other than +ENTRY
 - b. *m1* is more specific than *m2*
 - c. *s1* is more specific than *s2*.

The conditions are tested in order so condition a takes precedence over condition b and c, and condition b takes precedence over condition c.

This matching strategy has the following consequences:

- Descriptions do not depend on the order they are written in the file.

- Generally, the more specific the description of an object, the more specific the description of the input sections it contains.
- The *input_section_selectors* are not examined unless:
 - Object selection is inconclusive.
 - One selector fully names an input section and the other selects by attribute. In this case, the explicit input section name is more specific than any attribute, other than ENTRY, that selects exactly one input section from one object. This is true even if the object selector associated with the input section name is less specific than that of the attribute.

The .ANY module selector is available to assign any sections that cannot be resolved from the scatter-loading description.

The following example shows multiple execution regions and pattern matching:

Example 4-4 Multiple execution regions and pattern matching

```

LR_1 0x040000
{
    ER_ROM 0x040000          ; The startup exec region address is the same
    {                        ; as the load address.
        application.o (+ENTRY) ; The section containing the entry point from
    }                          ; the object is placed here.
    ER_RAM1 0x048000
    {
        application.o (+RO-CODE) ; Other RO code from the object goes here
    }
    ER_RAM2 0x050000
    {
        application.o (+RO-DATA) ; The RO data goes here
    }
    ER_RAM3 0x060000
    {
        application.o (+RW)      ; RW code and data go here
    }
    ER_RAM4 +0                ; Follows on from end of ER_R3
    {
        *.o (+RO, +RW, +ZI)     ; Everything except for application.o goes here
    }
}

```

4.17.1 See also

Tasks

Using the Linker:

- [Placing unassigned sections with the .ANY module selector on page 8-23.](#)

Concepts

- [About input section descriptions on page 4-22.](#)

Reference

- [Syntax of a scatter file on page 4-4](#)
- [Syntax of an input section description on page 4-23.](#)

4.18 Behavior when .ANY sections overflow because of linker-generated content

Linker-generated content might cause .ANY regions to overflow. This is because the linker does not know the address of a section until it is assigned to a region. Therefore, when filling .ANY regions, the linker cannot calculate the contingency space and cannot determine if calling functions require veneers. The linker provides a contingency algorithm that gives a worst-case estimate for padding and an additional two percent for veneers. To enable this algorithm use the `--any_contingency` command-line option.

The following diagram is a representation of the notional image layout during .ANY placement:

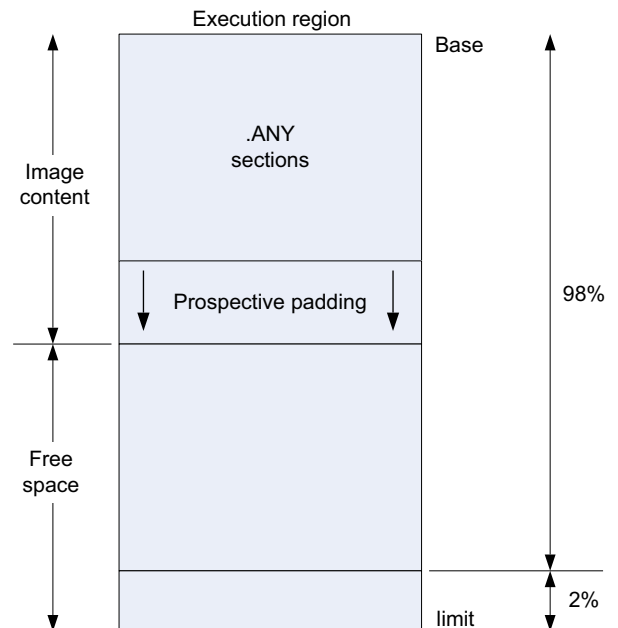


Figure 4-5 .ANY contingency

The downward arrows for prospective padding show that the prospective padding continues to grow as more sections are added to the .ANY selector.

Prospective padding is dealt with before the two percent veneer contingency.

When the prospective padding is cleared the priority is set to zero. When the two percent is cleared the priority is decremented again.

You can also use the `ANY_SIZE` keyword on an execution region to specify the maximum amount of space in the region to set aside for .ANY section assignments.

4.18.1 See also

Concepts

- [How the linker resolves multiple matches when processing scatter files on page 4-27.](#)

Using the Linker:

- [Placing unassigned sections with the .ANY module selector on page 8-23.](#)

Reference

- [--any_contingency on page 2-5](#)
- [Execution region attributes on page 4-12](#)
- [Syntax of an input section description on page 4-23.](#)

4.19 How the linker resolves path names when processing scatter files

The linker matches wildcard patterns in scatter files against any combination of forward slashes and backslashes it finds in path names. This might be useful where the paths are taken from environment variables or multiple sources, or where you want to use the same scatter file to build on Windows or Unix platforms.

Note

Use forward slashes in path names to ensure they are understood on Windows and Unix platforms.

4.19.1 See also

Reference

- [Syntax of a scatter file on page 4-4.](#)

4.20 About Expression evaluation in scatter files

Scatter files frequently contain numeric constants. You can use specify numeric constants using:

- Expressions.
- Execution address built-in functions.
- ScatterAssert function with load address related functions that take an expression as a parameter. An error message is generated if this expression does not evaluate to true.
- The symbol related function, `defined(global_symbol_name) ? expr1 : expr2`.

4.20.1 See also

Concepts

- [Example of aligning a base address in execution space but still tightly packed in load space on page 4-42.](#)

Reference

- [Expression usage in scatter files on page 4-32](#)
- [Expression rules in scatter files on page 4-33](#)
- [Execution address built-in functions for use in scatter files on page 4-35](#)
- [ScatterAssert function and load address related functions on page 4-39](#)
- [Symbol related function in a scatter file on page 4-41.](#)

4.21 Expression usage in scatter files

Expressions can be used in the following places:

- load and execution region *base_address*
- load and execution region *+offset*
- load and execution region *max_size*
- parameter for the ALIGN, FILL or PADVALUE keywords
- parameter for the ScatterAssert function.

Example 4-5 Specifying the maximum size in terms of an expression

```

LR1 0x8000 (2 * 1024)
{
    ER1 +0 (1 * 1024)
    {
        *(+R0)
    }
    ER2 +0 (1 * 1024)
    {
        *(+RW +ZI)
    }
}

```

4.21.1 See also

Concepts

- [Considerations when using a relative address +offset for load regions on page 4-17](#)
- [Considerations when using a relative address +offset for execution regions on page 4-18](#)
- [About Expression evaluation in scatter files on page 4-31](#)
- [Example of aligning a base address in execution space but still tightly packed in load space on page 4-42.](#)

Reference

- [Syntax of a scatter file on page 4-4](#)
- [Syntax of a load region description on page 4-6](#)
- [Syntax of an execution region description on page 4-10](#)
- [Expression rules in scatter files on page 4-33](#)
- [Execution address built-in functions for use in scatter files on page 4-35](#)
- [ScatterAssert function and load address related functions on page 4-39](#)
- [Symbol related function in a scatter file on page 4-41.](#)

4.22 Expression rules in scatter files

Expressions follow the C-Precedence rules and are made up of the following:

- Decimal or hexadecimal numbers.
- Arithmetic operators: +, -, /, *, ~, OR, and AND
The OR and AND operators map to the C operators | and & respectively.
- Logical operators: LOR, LAND, and !
The LOR and LAND operators map to the C operators || and && respectively.
- Relational operators: <, <=, >, >=, and ==
Zero is returned when the expression evaluates to false and nonzero is returned when true.
- Conditional operator: *Expression* ? *Expression1* : *Expression2*
This matches the C conditional operator. If *Expression* evaluates to nonzero then *Expression1* is evaluated otherwise *Expression2* is evaluated.

———— Note ————

When using a conditional operator in a *+offset* context on an execution region or load region description, the final expression is considered relative only if both *Expression1* and *Expression2*, are considered relative. For example:

```
er1 0x8000
{
    ...
}
er2 ((ImageLimit(er1) < 0x9000) ? +0 : +0x1000) ; er2 has a relative address
{
    ...
}
er3 ((ImageLimit(er2) < 0x10000) ? 0x0 : +0) ; er3 has an absolute address
{
    ...
}
```

- Functions that return numbers.

All operators match their C counterparts in meaning and precedence.

Expressions are not case sensitive and you can use parentheses for clarity.

4.22.1 See also

Concepts

- [About Expression evaluation in scatter files on page 4-31](#)
- [Considerations when using a relative address +offset for load regions on page 4-17](#)
- [Considerations when using a relative address +offset for execution regions on page 4-18](#)
- [Example of aligning a base address in execution space but still tightly packed in load space on page 4-42.](#)

Reference

- [Syntax of a scatter file on page 4-4](#)
- [Syntax of a load region description on page 4-6](#)
- [Syntax of an execution region description on page 4-10](#)
- [Expression usage in scatter files on page 4-32](#)

- *Execution address built-in functions for use in scatter files* on page 4-35
- *ScatterAssert function and load address related functions* on page 4-39
- *Symbol related function in a scatter file* on page 4-41.

4.23 Execution address built-in functions for use in scatter files

The execution address related functions can only be used when specifying a *base_address*, *+offset* value, or *max_size*. They map to combinations of the linker defined symbols shown in [Table 4-2](#).

Table 4-2 Execution address related functions

Function	Linker defined symbol value
<code>ImageBase(<i>region_name</i>)</code>	<code>Image\$\$<i>region_name</i>\$\$Base</code>
<code>ImageLength(<i>region_name</i>)</code>	<code>Image\$\$<i>region_name</i>\$\$Length + Image\$\$<i>region_name</i>\$\$ZI\$Length</code>
<code>ImageLimit(<i>region_name</i>)</code>	<code>Image\$\$<i>region_name</i>\$\$Base + Image\$\$<i>region_name</i>\$\$Length + Image\$\$<i>region_name</i>\$\$ZI\$Length</code>

The parameter *region_name* can be either a load or an execution region name. Forward references are not permitted. The *region_name* can only refer to load or execution regions that have already been defined.

———— Note ————

You cannot use these functions when using the `.ANY` selector pattern. This is because a `.ANY` region uses the maximum size when assigning sections. The maximum size might not be available at that point, because the size of all regions is not known until after the `.ANY` assignment.

The following example shows how to use `ImageLimit(region_name)` to place one execution region immediately after another:

Example 4-6 Placing an execution region after another

```

LR1 0x8000
{
    ER1 0x100000
    {
        *(+R0)
    }
}
LR2 0x100000
{
    ER2 (ImageLimit(ER1))           ; Place ER2 after ER1 has finished
    {
        *(+RW +ZI)
    }
}

```

4.23.1 Using *+offset* with expressions

A *+offset* value for an execution region is defined in terms of the previous region. You can use this as an input to other expressions such as `AlignExpr`. For example:

```

LR1 0x4000
{
    ER1 AlignExpr(+0, 0x8000)
}

```

```

    {
        ...
    }
}

```

By using `AlignExpr`, the result of `+0` is aligned to a `0x8000` boundary. This creates an execution region with a load address of `0x4000` but an execution address of `0x8000`.

4.23.2 See also

Concepts

- [Considerations when using a relative address +offset for load regions on page 4-17](#)
- [Considerations when using a relative address +offset for execution regions on page 4-18](#)
- [About Expression evaluation in scatter files on page 4-31](#)
- [Scatter files containing relative base address load regions and a ZI execution region on page 4-37](#)
- [Example of aligning a base address in execution space but still tightly packed in load space on page 4-42.](#)

Reference

- [Syntax of a scatter file on page 4-4](#)
- [Syntax of a load region description on page 4-6](#)
- [Syntax of an execution region description on page 4-10](#)
- [Expression usage in scatter files on page 4-32](#)
- [Expression rules in scatter files on page 4-33](#)
- [ScatterAssert function and load address related functions on page 4-39](#)
- [Symbol related function in a scatter file on page 4-41](#)
- [AlignExpr\(expr, align\) function on page 4-43.](#)

Using the Linker:

- [Image\\$\\$ execution region symbols on page 7-6.](#)

4.24 Scatter files containing relative base address load regions and a ZI execution region

You might want to place *Zero Initialized (ZI)* data in load region LR1, and use a relative base address for the next load region LR2, for example:

```
LR1 0x8000
{
    er_progbits +0
    {
        *(+R0,+RW) ; Takes space in the Load Region
    }
    er_zi +0
    {
        *(+ZI) ; Takes no space in the Load Region
    }
}
LR2 +0 ; Load Region follows immediately from LR1
{
    er_moreprogbits +0
    {
        file1.o(+R0) ; Takes space in the Load Region
    }
}
```

Because the linker does not adjust the base address of LR2 to account for ZI data, the execution region `er_zi` overlaps the execution region `er_moreprogbits`. This generates an error when linking.

To correct this, use the `ImageLimit()` function with the name of the ZI execution region to calculate the base address of LR2. For example:

```
LR1 0x8000
{
    er_progbits +0
    {
        *(+R0,+RW) ; Takes space in the Load Region
    }
    er_zi +0
    {
        *(+ZI) ; Takes no space in the Load Region
    }
}
LR2 ImageLimit(er_zi) ; Set the address of LR2 to limit of er_zi
{
    er_moreprogbits +0
    {
        file1.o(+R0) ; Takes space in the Load Region
    }
}
```

4.24.1 See also

Concepts

- [About Expression evaluation in scatter files on page 4-31.](#)

Reference

- [Syntax of a scatter file on page 4-4](#)
- [Syntax of a load region description on page 4-6](#)
- [Syntax of an execution region description on page 4-10](#)
- [Expression usage in scatter files on page 4-32](#)

- [Expression rules in scatter files](#) on page 4-33
- [Execution address built-in functions for use in scatter files](#) on page 4-35.

Using the Linker:

- [Image\\$\\$ execution region symbols](#) on page 7-6.

4.25 ScatterAssert function and load address related functions

The `ScatterAssert(expression)` function can be used at the top level, or within a load region. It is evaluated after the link has completed and gives an error message if *expression* evaluates to false.

The load address related functions can only be used within the `ScatterAssert` function. They map to the three linker defined symbol values:

Table 4-3 Load address related functions

Function	Linker defined symbol value
<code>LoadBase(<i>region_name</i>)</code>	<code>Load\$\$<i>region_name</i>\$\$Base</code>
<code>LoadLength(<i>region_name</i>)</code>	<code>Load\$\$<i>region_name</i>\$\$Length</code>
<code>LoadLimit(<i>region_name</i>)</code>	<code>Load\$\$<i>region_name</i>\$\$Limit</code>

The parameter *region_name* can be either a load or an execution region name. Forward references are not permitted. The *region_name* can only refer to load or execution regions that have already been defined.

The following example shows how to use the `ScatterAssert` function to write more complex size checks than those permitted by the *max_size* of the region:

Example 4-7 Using ScatterAssert to check the size of multiple regions

```

LR1 0x8000
{
    ER0 +0
    {
        *(+R0)
    }
    ER1 +0
    {
        file1.o(+RW)
    }
    ER2 +0
    {
        file2.o(+RW)
    }
    ScatterAssert((LoadLength(ER1) + LoadLength(ER2)) < 0x1000)
                                ; LoadLength is compressed size
    ScatterAssert((ImageLength(ER1) + ImageLength(ER2)) < 0x2000)
                                ; ImageLength is uncompressed size
}
ScatterAssert(ImageLength(LR1) < 0x3000) ; Check uncompressed size of LoadRegion

```

4.25.1 See also

Concepts

- [About Expression evaluation in scatter files on page 4-31](#)
- [Example of aligning a base address in execution space but still tightly packed in load space on page 4-42.](#)

Reference

- [Syntax of a scatter file on page 4-4](#)

- [Syntax of a load region description on page 4-6](#)
- [Syntax of an execution region description on page 4-10](#)
- [Expression usage in scatter files on page 4-32](#)
- [Expression rules in scatter files on page 4-33](#)
- [Execution address built-in functions for use in scatter files on page 4-35](#)
- [Symbol related function in a scatter file on page 4-41.](#)

Using the Linker:

- [Load\\$\\$ execution region symbols on page 7-7.](#)

4.26 Symbol related function in a scatter file

The symbol related function, defined(*global_symbol_name*) returns zero if *global_symbol_name* is not defined and nonzero if it is defined.

Example 4-8 Conditionalizing a base address based on the presence of a symbol

```

LR1 0x8000
{
    ER1 (defined(version1) ? 0x8000 : 0x10000)    ; Base address is 0x8000
                                                    ; if version1 is defined
                                                    ; 0x10000 if not
    {
        *(+R0)
    }
    ER2 +0
    {
        *(+RW +ZI)
    }
}

```

4.26.1 See also

Concepts

- [About Expression evaluation in scatter files](#) on page 4-31
- [Example of aligning a base address in execution space but still tightly packed in load space](#) on page 4-42.

Reference

- [Syntax of a scatter file](#) on page 4-4
- [Syntax of a load region description](#) on page 4-6
- [Syntax of an execution region description](#) on page 4-10
- [Expression usage in scatter files](#) on page 4-32
- [Expression rules in scatter files](#) on page 4-33
- [Execution address built-in functions for use in scatter files](#) on page 4-35
- [ScatterAssert function and load address related functions](#) on page 4-39.

4.27 Example of aligning a base address in execution space but still tightly packed in load space

This example uses a combination of preprocessor macros and expressions to copy tightly packed execution regions to execution addresses in a page-boundary. Using the `ALIGN` scatter-loading keyword aligns the load addresses of `ER2` and `ER3` as well as the execution addresses

Example 4-9 Aligning a base address in execution space but still tightly packed in load space

```

#! armcc -E
#define START_ADDRESS 0x100000
#define PAGE_ALIGNMENT 0x100000

LR1 0x8000
{
    ER0 +0
    {
        *(InRoot$$Sections)
    }
    ER1 START_ADDRESS
    {
        file1.o(*)
    }
    ER2 AlignExpr(ImageLimit(ER1), PAGE_ALIGNMENT)
    {
        file2.o(*)
    }
    ER3 AlignExpr(ImageLimit(ER2), PAGE_ALIGNMENT)
    {
        file3.o(*)
    }
}

```

4.27.1 See also

Concepts

- [About Expression evaluation in scatter files](#) on page 4-31.

Reference

- [Syntax of a load region description](#) on page 4-6
- [Load region attributes](#) on page 4-8
- [Syntax of an execution region description](#) on page 4-10
- [Execution region attributes](#) on page 4-12
- [AlignExpr\(expr, align\) function](#) on page 4-43
- [GetPageSize\(\) function](#) on page 4-44
- [SizeOfHeaders\(\) function](#) on page 4-45.

4.28 AlignExpr(expr, align) function

This function returns:

$$(\text{expr} + (\text{align}-1)) \& \sim(\text{align}-1)$$

where:

- expr is a valid address expression
- align is the alignment, and must be a positive power of 2.

It increases expr until it is:

$$0 \bmod \text{align}$$

4.28.1 Example

This example aligns the address of ER2 on an 8-byte boundary:

```
ER +0
{
    ...
}

ER2 AlignExpr(+0x8000,8)
{
    ...
}
```

4.28.2 Relationship with the ALIGN keyword

The following relationship exists between ALIGN and AlignExpr:

ALIGN keyword

Load and execution regions already have an ALIGN keyword:

- for load regions the ALIGN keyword aligns the base of the load region in load space and in the file to the specified alignment
- for execution regions the ALIGN keyword aligns the base of the execution region in execution and load space to the specified alignment.

AlignExpr Aligns the expression it operates on, but has no effect on the properties of the load or execution region.

4.28.3 See also

Reference

- [Execution region attributes on page 4-12.](#)

4.29 GetPageSize() function

Returns the page size. This is useful when used with `AlignExpr`

Returns the value of the internal page size that `armlink` uses in its alignment calculations. By default this value is set to `0x8000`, but you can change it with the `--pagesize` command-line option.

4.29.1 Example

This example aligns the base address of `ER` to a Page Boundary:

```
ER AlignExpr(+0, GetPageSize())
{
    ...
}
```

4.29.2 See also

Concepts

- [Example of aligning a base address in execution space but still tightly packed in load space on page 4-42.](#)

Reference

- [--pagesize=pagesize on page 2-93](#)
- [AlignExpr\(expr; align\) function on page 4-43.](#)

4.30 SizeOfHeaders() function

Returns the size of ELF Header plus the estimated size of the Program Header Table. This is useful when writing demand paged images to start code and data immediately after the ELF Header and Program Header Table.

4.30.1 Example

This example sets the base of LR1 to start immediately after the ELF Header and Program Headers:

```
LR1 SizeOfHeaders(){ ...}
```

4.30.2 See also

Concepts

- [Example of aligning a base address in execution space but still tightly packed in load space on page 4-42.](#)

Using the Linker:

- [Demand paging on page 4-23](#)
- [About creating regions on page boundaries on page 8-54.](#)