

**PhxLnk**

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# Contents

<b>1</b>	<b>PhxLnk</b>	<b>1</b>
1.1	PhxLnk V4.25 (11-Oct-96)	1
1.2	Introduction	1
1.3	History since V3.00	1
1.4	Instructions	4
1.5	Sytem Requirements	4
1.6	Starting PhxLnk	4
1.7	Description of command line parameters	5
1.8	Linker Symbols	6
1.9	Small Data	7
1.10	Known Bugs	7
1.11	My Address	7

# Chapter 1

# PhxLnk

## 1.1 PhxLnk V4.25 (11-Oct-96)

Phantasm's

P h x L n k      V4.25

AMIGA-DOS Module Linker

## Contents

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Introduction  
History since V3  
Instructions  
Bugs  
Author's Address

## 1.2 Introduction

PhxLnk was written in pure assembler-code, assembled with PhxAss and linked with BLink (first version) and PhxLnk itself. It supports all features of a standard Amiga-DOS linker (like BLink), except of overlay hunks and automatic link vectors (ALV).

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### 1.3 History since V3.00

- V4.25 (08-Nov-96) The search for XDEF symbols was enhanced by use of a large hash table. The hash table's size can be modified with the HT=HASHTAB/K/N option. Ctrl-C now works everywhere and not only during displaying the list of unknown symbols. The EXT\_REF types EXT\_ABSREF8 (\$8b) and EXT\_ABSREF16 (\$8a), which were introduced by OS3.0, are supported. Norwegian catalog.
- V4.24 (06-Jul-96) Multiple defined XDEFs in object files are recognized and displayed.
- V4.23 (03-May-96) LoadSeg() V40 doesn't like a section length of zero, because it will refuse to clear the bss-part of a section in this special case. Now, a minimal section length of one longword is guaranteed. PhxLnk uses its own buffered I/O routines instead those which the dos.library offers. The size of the buffer is adjustable by the new CLI parameter BUFSIZE/K/N, which defaults to 8192. Creating an FFS file is more than five times faster as with v4.22.
- V4.22 (23-Mar-96) The maximum length of the destination file name was much too small and was redimensioned to 233. The XREF sub type EXT\_RELREF32 (\$88) for 32-Bit PC-relative references is supported. PhxLnk uses buffered I/O (FWrite) for creating the destination file.
- V4.21 (08-Mar-96) PhxLnk couldn't handle multiple dots in a file name. So the object file "a.b.c.o" became "a" instead of "a.b.c". The listing of undefined symbols may be interrupted with CTRL-C at any time.
- V4.20 (20-Dec-95) Since v4.20 there are two versions of PhxLnk. One for OS2.x and the other for OS3.x. This splitting is a result of the intensive usage of MemPool functions, which are part of the exec.library under OS3.x (the OS2.x version gets their MemPool functions from amiga.lib). The MemPool adaption was done by Volker Barthelmann <volker@vb.franken.de>. It enables library-linking with a multiple speed. There were some crashes, when empty sections, which contained some required XDEFs, were automatically removed. The only possibility to prevent it was by setting the PRESERVE/S switch.
- V4.17 (24-May-95) Partial support for the SLink (SAS/C). PhxLnk defines \_\_\_\_ctors and \_\_\_\_dtors as NULL to avoid errors during linking. Complete SLink-support may follow in a later release. (if somebody needs
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it :-)

- V4.16 (18-May-95) Fixing the bug with `__MERGED` sections in V4.10 generated a new one in the 'normal' small data mode.  
The shortening of sections, as introduced in V4.00, doesn't work very well.
- V4.15 (19-Mar-95) PhxLnk can generate `RELOC32SHORT` blocks.
- V4.10 (21-Feb-95) Linking of `__MERGED` sections had a bug.
- V4.03 (09-Feb-95) When PhxLnk discovers a read error, while reading a '@'-file, it crashed.
- V4.02 (25-Jan-95) PhxLnk can read the object and library names from one or several files.
- V4.00 (18-Nov-94) PhxLnk V4.00 requires OS2.04 as a minimum. As a result it offers the standard `ReadArgs()`-Command Line parsing and is much shorter.  
DEBUG Hunk blocks are treated the same way as with SAS/C's BLink, which gives the possibility to generate load files for a Source Level Debugger.  
The latest version of the PowerVisor Debugger, V1.42, unfortunately has still some problems with BLinked programs, consisting of several source files, so there is a compatibility switch, called `PVCOMPAT`.  
The new argument `DEFINE` (see CLI Parameters) gives the possibility to define an absolute Linker-Symbol (quite similar to the small data symbols supplied by PhxLnk).  
By utilizing the new switch `BLINKCOMPAT` PhxLnk will treat small data modules the same way like SAS/C's BLink does.  
Data and Bss sections, which were named `"__MERGED"`, will be coalesced into a small data section (without having to specify the `SMALLDATA` switch).  
Zero bytes at the end of a Code or Data section will be ignored, which shortens the resulting load file.  
Because that doesn't work under Kickstart 1.x, there is a compatibility switch called `KICK1`.
- V3.10 (04-Aug-94) Fixed a bug with catastrophic proportions, which sometimes appeared when linking with libraries.  
To be honest: I don't think, that one of the pre-V3.10 versions are safe enough to link libraries ;-)  
PhxLnk was completely localized. Until now, german and polish catalogs are available.  
Documentation was converted into Amiga-Guide format.
- V3.05 (31-Jul-94) Fixed a linker-library bug: Sometimes sections of a library, though not included, appeared in `HUNK_HEADER` with random length.  
`HUNK_RELOC` and `HUNK_SYMBOL` of zero length will no longer be included.
-

- V3.01 (22-Jan-94) Because of massive changes in V3.00, there was a little bug with the name of the output file.
- V3.00 (18-Jan-94) Fixed many problems with library linking, which could lead to a FreeMemoryTwice Guru (or even worse).  
Some linker symbols of Lattice/SAS (`__LinkerDB`, `__BSSBAS`, `__BSSLEN`) and DICE (`__RESIDENT`, `__DATA_BAS`, `__DATA_LEN`, `__BSS_LEN`) are supported.  
The special library format of Lattice/SAS, using `HUNK_LIB` and `HUNK_INDEX`, is also supported. PhxLnk converts them into standard library format.

## 1.4 Instructions

Requirements  
Starting PhxLnk  
Parameters  
Linker Symbols  
Small Data

## 1.5 Sytem Requirements

Since PhxLnk V4.00 you *must* have OS2.04 (V37) as a minimum. This makes PhxLnk much shorter, faster and easier for me to code. I don't think that this limitation (which is a progress in my eyes) doesn't hurt anybody nowadays.

## 1.6 Starting PhxLnk

Normally, PhxLnk is started from your shell. You should copy PhxLnk from the OS2.x directory, if you have OS2.x installed, or from the OS3.x directory otherwise, and copy it to C: or define a path or link. The OS2.x version will run on OS3.x Amigas too, but it's a bit larger.

Format: `PhxLnk [FROM] {<object module|library module>}`  
`[TO <output file>] [SMALLCODE] [SMALLDATA] [NODEBUG] [CHIP]`  
`[PRESERVE] [PVCOMPAT] [BLINKCOMPAT] [KICK1] [MAXSECTS=<n>]`  
`[BUFSIZE=<n>] [HASHTAB=<n>]`  
`[DEFINE "<symbol>[=value][,<symbol>...]" ]`

Template: `FROM/M, TO/K, SC=SMALLCODE/S, SD=SMALLDATA/S, ND=NODEBUG/S, CHIP/S,`  
`PRESERVE/S, PV=PVCOMPAT/S, B=BLINKCOMPAT/S, K1=KICK1/S,`  
`MAXSECTS/K/N, BUFSIZE/K/N, HT=HASHTAB/K/N, DEF=DEFINE/K`

Starting PhxLnk with no argument or with a single '?' will display a short description. For a more precise description, refer to Parameters.

There are three types of modules which can be linked:

- o Object modules with extension ".o" or ".obj" which normally consist of one unit. PhxLnk also links object modules with several units.
- o Library modules with extension ".lib" which can consist of any number of units. PhxLnk will only include units, if at least one ext\_def-symbol is referenced in an object module unit or in an already included library unit.
- o Lattice/SAS Extended Library modules (also with ".lib" extension). They are translated into the standard library format by PhxLnk (not a very good solution - but it works).

Names with another extension will be rejected.

The module names can appear in any order, provided the first is an object module which contains the startup code.

IMPORTANT!

Load files created by PhxLnk are NOT Kickstart 1.x compatible by default! PhxLnk deletes zero-bytes at the end of a section and tries to use the much shorter RELOC32SHORT blocks, unless you set the KICK1 switch.

## 1.7 Description of command line parameters

FROM/M	All parameters without a keyword specify the names of the object and library modules to link. For valid name extensions refer to Starting PhxLnk. Names which start with an '@' specify the name of an ascii file, which contains object and library names (or even more '@'s, if you like). These names can be separated by blanks, tabs, linefeeds or whatever you want. '"' are supported.
TO/K	Determines the name of the output file to be produced. If not specified, the output file has the name of the first module without its extension. Example: "PhxLnk prog1.o prog2.o c.lib m.lib" will generate a load file with the name "prog1".
CHIP/S	This switch forces all sections to be loaded to Chip memory.
PRESERVE/S	The normal case is, that PhxLnk removes all section with zero length to save memory. Choose this switch, if you want to preserve empty sections.
B=BLINKCOMPAT/S	PhxLnk will be compatible to BLink, when linking small data modules. That means, that if the small data section is smaller than 32k, PhxLnk will use a small data pointer (_LinkerDB) which points to the beginning of this section instead 32766 bytes into it. As a result all near-offsets will start with 0 instead -32766.
K1=KICK1/S	PhxLnk creates a load file which is compatible to Kickstart 1.x. That will prevent PhxLnk from deleting zero-bytes at the end of a section or trying to generate these nice RELOC32SHORT blocks.
SC=SMALLCODE/S	Normally only the sections with the same type and name will



be coalesced. This switch makes PhxLnk to ignore the names of Code sections and to produce one large Code sections. Usually SMALLCODE is chosen, when using the small code model with your assembler or compiler.

SD=SMALLDATA/S	<p>As with SMALLCODE the section names are ignored, but now for all Data and Bss sections. Important: Data and Bss will not be mixed. This large section will contain first all Data and then all Bss sections.</p> <p>Because the Bss part has no definite contents (only zeros), only the Data part will be stored. The size of Bss is stored together with the Data size in the load file's header. Since OS2.0 the Bss part will be initialized to zero, when it's loaded (e.g. by LoadSegment()). But beware (!!), this is not the case with Kickstart 1.x!</p> <p>If you don't want to see your programs crash on some Kick 1.3 dinosaurs, I recommend to clear the Bss part manually by using the special Linker-symbols <code>_DATA_BAS_</code>, <code>_DATA_LEN_</code> and <code>_BSS_LEN_</code> (refer to Linker Symbols for more information). All references to symbols of this Small Data section will be calculated as if the Bss sections were directly behind the Data.</p> <p>You should use this switch, when compiling/assembling your code with Small Data model enabled.</p>
ND=NODEBUG/S	The HUNK_SYMBOL and HUNK_DEBUG blocks, which contain informations for a debugger will not be included in the output file.
PV=PVCOMPAT/S	This switch activates the PowerVisor compatibility mode, which is necessary when using Source Level Debugging informations in your program. Unfortunately the author of PowerVisor, Jorrit Tyberghein, currently does not plan a new release.
MAXSECTS/K/N	Determines the maximum number of sections per unit. The default value is 16, which should be enough for most cases.
BUFSIZE/K/N	Changes the size of the buffer, required for buffered I/O. The buffer size defaults to 8192 bytes.
DEF=DEFINE/K	Defines an absolute Linker Symbol. Definition of multiple symbols must be separated by commas. Don't forget to embed the whole term, which follows DEFINE, in quotes (because of some problems with ReadArgs()) !
HT=HASHTAB/K/N	Number of entries in the hash table for XDEF symbols as a power of 2. It is valid from $2^8$ to $2^{16}$ . The default value is $2^{10}$ .

## 1.8 Linker Symbols

The linker itself creates some `ext_def($01xxxxxx)` and `ext_abs($02xxxxxx)` symbols which will be needed by the startup code of a program using the Small Data model.

`_DATA_BAS_` (ext\_def) Base address of the small-data section.  
`_DATA_LEN_` (ext\_abs) Length of the Data-part of the small-data section.  
`_BSS_LEN_` (ext\_abs) Length of the Bss-part of the small-data section.

For compatibility with Lattice/SAS or DICE you may also use these symbols:

Lattice/SAS:

`_LinkerDB` (ext\_def) This symbol can be used to initialize your small data base register. Normally it will point 32766 bytes into the small data section, but when the BLink compatibility switch was selected and the small data area is smaller than 32k, it will point to its beginning.  
`__BSSBAS` (ext\_def) Base address of the Bss-part of the small-data section.  
`__BSSLLEN` (ext\_abs) Length of the Bss-part in longwords.  
`___ctors` and `___dtors` are always zero.

DICE:

`__DATA_BAS` (ext\_def) Base address of the small-data section.  
`__DATA_LEN` (ext\_abs) Length of the Data-part of the small-data section in longwords.  
`__BSS_LEN` (ext\_abs) Length of the Bss-part of the small-data section in longwords.  
`__RESIDENT` (ext\_abs) Always zero.

## 1.9 Small Data

Small-data symbols can be accessed in a range of 65534 (\$ffff) bytes. When a symbol is outside of this range, the linker will display an error. The small data model must be initialized by the startup code. When you're using A4 as small data pointer, the initialization would look like this:

```

xref    _DATA_BAS_          ; _DATA_BAS_ is a linker symbol

lea     _DATA_BAS_+32766,a4  ; a4 always points to the mid. of small data
  
```

## 1.10 Known Bugs

- o If the output file has more than 1000 sections there could be a stack overflow :-)

If any bugs or questions occur, please write to :

My Address

## 1.11 My Address

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A M I G A F O R E V E R !