

xpkdisk

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Chapter 1

xpkdisk

1.1 xpkdisk.guide

```
xpkdisk.device
*****
```

This file documents xpkdisk.device 37.8.

Copyright (C) 1993, 1994, 1995 by Olaf 'Rhialto' Seibert.

Permission is granted to copy the whole package, in accordance with the GNU General Public License, and some additional restrictions.

Overview	What is in the package?
Requirements	What else do you need?
Usage	How do you use it?
Limitations	What does it not do?
Implementation	Interesting things to know.
License	What you may do with it.
Index	Where to find what in this manual.

1.2 xpkdisk.guide/Overview

```
Overview
*****
```

xpkdisk.device is an exec-style device that looks like trackdisk.device and similar disks. The difference is that it compresses its data and stores it in multiple files in an existing filesystem.

* Version 37.8 works around a horrible bug that is really caused by XPK when track files are not compressible. Look in the source file devio.c for details, near the symbol XPKBUG.

The bug was pointed out to me by Ulrik Jensen <uj2001@hdc.hha.dk>.

- * Fixes a bug in xdclear which assumed that all partitions started at track 0.

The bug was pointed out to me by Michael Barsoom
<mbars@bluejay.creighton.edu>.

- * You can now change the XPKD: assign on the fly, if you're careful.
- * xdclear now works with the fake scsi.device, which does not seem to know about ETD_* commands.
- * Now keeps the old track file while writing a new one. The old track file is only deleted after successfully writing the new one. You have more control about what to do in such situations.
- * Now includes a utility to reclaim space from deleted files.
- * Now uses a hierarchical track naming scheme for faster access! See Upgrade on what to do if you are upgrading from the old naming scheme.
- * Now behaves better in case of threatening lack of disk space.
- * Now handles read-only media.

It uses the XPK (eXternal PacKer) standard to do the actual compression. This has many advantages:

- * You can choose which compression is most effective for your purpose. For one disk, you might want a very tight compression that is slow, for another you may prefer a faster but less efficient compression.
- * As soon as another XPK library is released, you can use it for your compressed disk(s).
- * Because each track is a standard XPK-compressed file, you can use the normal XPK utilities to uncompress your data, should you wish to do so.
- * You can change the compression type of a disk on-the-fly. All already compressed data remains perfectly usable, but upon re-compression your new choice will be used.
- * You can even manually decompress and recompress your disk (when xpkdisk is not accessing it, of course) with another compression method.

1.3 xpkdisk.guide/Requirements

Requirements

What you further need is the XPK user package. At the time of this

writing, version 2.5 is current, and can be found (at least) on aminet ftp sites under the name Xpk25Usr.lha. This package contains the necessary libraries for using the programs.

Running xpkdisk.device probably needs lots of processor cycles and a hard disk to be enjoyable in any real sense. If you only have an unaccelerated Amiga, you should probably stick to the faster (and thus less-efficient) compressing methods.

xpkdisk.device runs under Kickstart versions 1.2 and higher, but the fancy preferences program xdPrefs and xdClear require 2.04 or higher. Some other features are also non-functional under 1.2/1.3.

If you want to recompile the source, you also need the XPK developer's package, named Xpk25Dev.lha.

1.4 xpkdisk.guide/Usage

Usage

Installation	Where to put what.
Preferences	How to tune the operation of xpkdisk.device.
General Usage	Some usage info.
Upgrade	How to upgrade from a previous release.
Disk Optimizers	Hints when you wish to optimize the disk structure.
Free Space Recovery	How to recover space from deleted files.
Partitioning	How to partition an XpkDisk.

1.5 xpkdisk.guide/Installation

Installation

=====

Installation can be performed by the Installer, or you can do it by hand. In that case, you must carry out the following steps.

1. First, you need to copy xpkdisk.device to your DEVS: directory. On my system, I would keep it in LOCAL:devs, and DEVS: is a multi-assign pointing to SYS:devs and LOCAL:devs.
 2. Then, you need to create a Mountlist entry and add it to your DEVS:Mountlist file. An example in the 1.3 style is given.
 3. Finally, you need to make an assignment XPKD: to a directory where you want the compressed disk to be stored. xpkdisk.device will create subdirectories as necessary.
-

4. Before the first use you must format the disk. The following options are recommended, as far as they are available in your system version:

Format drive XD0: name Compress0 QUICK FFS DIRCACHE

1.6 xpkdisk.guide/Mountlist

Mountlist

```
/*
 * XpkDisk Partition: Unit 0, Size 1 Mb
 */
XD0:
    Device = xpkdisk.device
    Unit   = 0
    Flags  = 0
    Surfaces = 1
    BlocksPerTrack = 64
    Reserved = 2
    Interleave = 0
    LowCyl = 0 ; HighCyl = 31
    Buffers = 20
    BufMemType = 1
    DosType = 0x444F5301
    Mount = 0
#
```

The important parameters are:

Unit

This is your choice of the xpkdisk unit. Since there are 8 units, you can use values from 0 to 7.

BlocksPerTrack

This is used by xpkdisk.device to determine how large the chunks of compression should be. So in this example with 64 blocks per track, the disk is compressed in chunks of 32 kilobytes each.

LowCyl, HighCyl

This determines the size of your compressed disk. It is not necessary that LowCyl equals 0. The disk size in bytes can be calculated with $\text{Size} = 512 * \text{BlocksPerTrack} * \text{Surfaces} * (\text{HighCyl} - \text{LowCyl} + 1)$.

DosType

A DosType value of 0x444F5301 specifies FFS. If you have it, DCFS is probably better.

The other parameters are simply the same values that would be used for "normal" disks.

1.7 xpkdisk.guide/Preferences

Preferences
=====

Unlike xpkdisk.device, the preferences program (xdPrefs) requires at least system 2.04.

xdPrefs	Nice user-interface.
File Format	How to set your preferences "by hand".

1.8 xpkdisk.guide/xdPrefs

xdPrefs

The xdPrefs program (1) opens a window when started from either the Workbench or the Shell. No special Workbench processing takes place, so ToolTypes have no effect.

All settings that can be changed with xdPrefs may be changed at any time during operation of xpkdisk.device.

There are several gadgets and menus available.

Unit

This slider determines which unit you are seeing and setting. If you drag it before clicking on either Save or Use, your settings will be lost.

Save

Saves the currently visible settings in the permanent settings file. This file is located in the XPKD: directory. It also implies "Use". It does not quit the program.

Use

Saves the currently visible settings in a temporary settings file. This file is located in the ENV: directory. The unit is notified that it should re-read its internal settings. It does not quit the program.

Quit

This button does quit the program (and so will the close gadget).

The reason that these three functions are separate is that I hate the fact that usually "Save" and "Use" imply "Quit". Especially here, when you may want to change the settings of several units in one go.

Compression

This string gadget allows you to specify the compression you'd like to use. This string should be in the standard XPK format of

ABCD(.nnn): a four letter name, optionally followed by a period and a number from 0 to 100 to specify the efficiency.

Watch out: it allows you to specify compression methods that are not (currently) available. In that case, no compression will be used. You will get annoying requesters about XPK errors -15 (XPKERR_MISSINGLIB).

Timeout required

This item is the first of the 3 gadgets relating to xpkdisk.device's behaviour when faced with the option of compression its internal buffers. Every time a modification is made to the internal buffers, a timeout is restarted. When the timeout expires, it is examined whether it is appropriate to do the compression.

Checking this option means that the compression will not be done unless the timeout has expired.

Time

This slider determines the time used for the timeout of the previous gadget. The actual timeout will be between this value and half this value, depending on the actual sequence of events.

CMD_UPDATE required

Normally, a filesystem sends CMD_UPDATE commands to xpkdisk.device if it has completed its current operations. Every time such a command is received, it is examined whether it is appropriate to do the compression.

Checking this option means that the compression will not be done unless this command has been received.

There are several combinations possible of Timeout and CMD_UPDATE.

None checked

Compression will be done every time a CMD_UPDATE command is received, and every time the timeout expires. In this case it is probably best to take a long timeout, unless the overlying program is lax about sending the CMD_UPDATE commands.

Only Timeout checked

Compression will be done every time the timeout expires. CMD_UPDATE commands are effectively ignored, since the occurrence of the timeout leaves no work to do for the CMD_UPDATE.

Only CMD_UPDATE checked

Compression will be done every time a CMD_UPDATE command is received. Timeouts are effectively ignored, since the occurrence of the command leaves no work to do for the timeout.

Both Timeout and CMD_UPDATE checked

This is the default case. It means that even when a CMD_UPDATE command is received, compression is delayed until the timeout expires. Not usually, the timeout could expire first, in

which case the CMD_UPDATE command will be waited for.

This is convenient in case new disk operations occur soon afterwards, which is often the case.

To recapitulate: There are two occasions at which compression is considered: after a timeout, and upon receiving a CMD_UPDATE. Both events are noted, and then it is determined whether all required events have happened. If so, compression takes place (and the events are cleared). If not, no further action is taken at that time.

Safe write

This enables the use of the ripcord (see General Usage).

Cache size

This is the highest number of tracks that xpkdisk.device will keep in memory. Setting this to a higher value usually increases speed, but at the cost of (by default) 32 kilobytes of memory per track. If there are already the maximum number of tracks in memory, and access to another track is requested, one of the current tracks is selected to be replaced, compressing and writing it to disk if necessary.

----- Footnotes -----

(1) xdPrefs requires system 2.04 or newer.

1.9 xpkdisk.guide/File Format

File Format

The file XPKD:XpkDisk<unit>.prefs that is produced by the preferences program looks like

```
CMDUPDATE=1,DELAY=1,SAFE=0,CACHE=8,TIME=5,METHOD=BLZW.100
```

These are the default settings, and correspond to the settings of the gadgets with similar indications.

It must be a single line of text, with the items separated by a comma.

The order in which the settings are given is not important, but the full name is: no abbreviations are possible.

Refer to the previous section for a detailed explanation of all items.

1.10 xpkdisk.guide/General Usage

General Usage Information

=====

Once you have mounted your compressed disk, you can use it as a normal AmigaDOS harddisk.

Disk-full handling

There is a provision for disk-full conditions of the underlying file system, but this can't be perfect. This means that disasters may still happen if you make your compressed disk too large for the space that is actually available. This is only functional if you checked "Safe write" in the xdPrefs program.

If for any currently in-use unit the "Safe write" option is checked, xpddisk.device creates a "ripcord" file (XPKD:Ripcord) that has at least the size of two uncompressed tracks. Every time a track is written out, the available size on XPKD: is checked. If it falls below the same threshold (two uncompressed tracks), a warning requester is put up if you are running 2.04+. It gives you the following options:

Rip Cord

The file XPKD:Ripcord is deleted, in order to make space, and the operation proceeds. This option is always chosen under 1.2/1.3.

Try Anyway

The operation proceeds regardless of the little available space. This may cause the write to fail.

Abort

The operation is aborted: the track is not written out.

When the track is not written, or when an error occurs while trying to write it, the track is kept in memory, even if this means that huge amounts of memory will be used. It is also remembered that it needs to be written, so that retries will occur.

Also, xpkdisk will report a write error to the upper file system. Hopefully, this will only affect the file you are currently writing, but you may have a stroke of bad luck.

This means that as soon as you get the requester, you should abort whatever program is writing to the compressed disk. The spare space from the ripcord should allow the file system to keep its directory information consistent, but if you let the writing continue there will not even be space for that and you may end up with a corrupted file system anyway.

If aborting the writing program won't work, or not quick enough, the following strategy may limit the damage done. The first few times, click on the "Abort" button. This will (hopefully) propagate an error condition from xpkdisk.device, through the file system, to the application. When the application aborts, and the file system is

cleaning up, click on "Try Anyway" or "Rip Cord".

If you are using 1.3, the choice "Rip Cord" is always made for you.

Trackfile write errors

Regardless of the above, if there is an error detected when writing a compressed track, two corrective actions are taken. First, it is tried to write the track uncompressed. If for instance the disk is full, this is not likely to help, but it might be useful when you are low on memory. If this still does not work, a requester is put up, offering a choice between "Retry", "Revert to old" and "Abort". As long as you keep selecting Retry the process is started again. This allows you to free up memory and/or disk space to enable the writing to proceed successfully.

If you select "Cancel", then the old version of the trackfile is left, with an extension of ".old", because the new one is most likely unusable.

If you select "Revert to old", the old trackfile is left with its original name.

Read-only disks

If the underlying filesystem is read-only, then the compressed disk will also be read-only. If the read-only status changes, you may need to give a DiskChange command for the compressed disk, so that the file system will re-examine the disk.

Compressed floppies

Compressed floppy disks are currently not very practical, but they may be possible if you use a non-binding Assign for XPKD:, i.e.

Assign PATH XPKD: DF0:

However, you can then use only one unit, and you have to be very careful to do a DiskChange XD0: every time you swap floppies.

1.11 xpkdisk.guide/Upgrade

Upgrading from a previous release

=====

If you want to upgrade from a previous release that didn't have the hierarchical track naming scheme yet, the program xdName will be useful to you.

First, determine the highest track number that needs to be converted. To be on the safe side, use the value of HighCyl from the Mountlist, but you can also use the highest number that is actually in use.

Then, in the Shell, use the command

```
xdName track >script
```

where "track" is the track number you determined. This will create a script that will create the necessary new directories and rename all tracks. Then execute this script to do the actual conversion. You don't need to keep the script around:

```
execute script
delete script
```

Should you wish to convert back, use the -r flag. If you just want to know the file for a certain track, use `xdName -n track`.

1.12 xpkdisk.guide/Disk Optimizers

Disk Optimizers

=====

If you wish to use a disk optimizer (also called defragmenter), you can do this if you take a few precautions. I have personally used ReOrg with success, so the hints below are biased for ReOrg.

- * Set the number of cached tracks very low, such as 1 or 2. The reorganizer will usually have a cache that is more effective for its specific purposes.
 - * The reorganizer should have a setting that keeps it from using all system memory. Set this amount to 300 - 400 kilobytes more than the normally recommended setting. This is because many of the xpk compressors use relatively a lot of memory. You should consult the compressor libraries documentation to check its memory usage if you want a lower setting.
 - * If the reorganizer is of the "safe" type (that moves only a few blocks at a time to keep a consistent disk structure), then it will not use all system memory for itself. In that case you can allow a larger xpkdisk cache. In fact you'll probably have to do this to prevent trashing.
 - * If there is still not enough memory to compress, you will get an alarming requester with xpk error messages. In this case the track will already be written uncompressed, so there is usually no real danger to ignore the situation. However, you should verify this from another Shell window or the Workbench. Also, if you reorganize your whole disk this way it will be decompressed entirely, which is probably not what you want.
 - * Don't set any option to clear unused blocks. It is usually better to use `xdClear` for that purpose afterwards.
 - * During compression the compressed disk may take more space than
-

before or afterwards, especially if the reorganizer decides to move lots of blocks to previously unused tracks. The worst case (a half full disk being moved completely) could temporarily take twice as much space as before.

- * A time-remaining indication by the reorganizer will not be very reliable at first since decompressing tends to be much faster than compressing for most methods.

1.13 xpkdisk.guide/Free Space Recovery

Free Space Recovery =====

or, On A Clear Disk You Can Seek Forever...

The normal Amiga filesystem does nothing special with files that you delete. The only thing it does is unlink the file from the directory structure. The advantage is that you can recover the file if nothing new has been written over it.

The disadvantage of this is that if you delete a file, your disk does not shrink.

To overcome this little problem, I have written a program, called `xdClear` (1), that fills all unused sectors on the disk with zeros. The theory is that whole lots of zeroes would be very compressible and therefore reduce actual disk space usage to a minimum. Additionally, if it is used on an `xpkdisk`, if a whole track is not in use it deletes the file containing it, thereby eliminating all disk usage for that track. `xdClear` only works if you are using the normal Amiga filesystem.

Usage: `xdClear <devicename>`

for example `xdClear XD0`. You must give the device name, not the volume name. It does not matter if you include the colon (:) in the name.

`xdClear` checks the bootblock for a value of "DOS\?", where \? may be anything, it calculates which block is supposed to be the file system root block, checks if its type is correct, checks the checksum, and finally sees if the bitmap is indicated as "valid".

`xdClear` scans the bitmap present on the indicated device, one track at a time. If a whole track is being unused, and the device is `xpkdisk.device`, then the the track file is deleted. Otherwise, the unused sectors are filled with zeroes. This is only written back to the disk if the sector wasn't all zeroes to begin with. This should save a lot of compression effort in case the disk was relatively clean already.

Since the format of the bitmap should be, but isn't, documented in the AmigaDOS manual, I had to reverse engineer this. I have tested this with the most complex bitmap structure possible according to what is being documented with a 10000-track (312 M) compressed disk. After I did this I compared my results with Ralph Babel's excellent "The Amiga

Guru Book", and fortunately they matched.

----- Footnotes -----

(1) xdclear requires system 2.04 or newer.

1.14 xpkdisk.guide/format of the bitmap

Format of the bitmap

This is an addition to the information on pages 336-338 of the 3rd edition of "The AmigaDOS Manual".

"Bitmap Block"

```

0: Balance to 0 checksum
1..SIZE-1: Longwords of flags indicating "available" (1),
           or "in use" (0) for each block.
           The bit for block #n is in longword 1 + n/32,
           bit number n mod 32 (bit 0 is the lsb).
```

The first 25 bitmap blocks are recorded in the root block, at longwords SIZE-49 .. SIZE-25. With the FFS, if more bitmap blocks are needed, they are recorded in a "bitmap extension block". The key of the first bitmap extension block is stored in rootblock longword SIZE-24.

"Bitmap Extension Block"

```

0..SIZE-2: Sector numbers (i.e. keys) of bitmap blocks,
           or 0 if nonexistent.
SIZE-1: Sector number of next bitmap extension block,
        or 0 if nonexistent.
```

Note that bitmap extension blocks don't have a checksum.

1.15 xpkdisk.guide/Partitioning

Partitioning

=====

You can, if you wish, put multiple "partitions" on a single XpkDisk unit. This might be useful if you think that 8 units isn't sufficient for your needs. Of course, all option settings will be the same for all partitions.

Basically, the same rules apply as for partitioning real disks, with the following extra rule:

- * For real disks you can usually cheat with the disk geometry. As long as you make sure partitions don't overlap you can claim different values for BlocksPerTrack and Surfaces for different partitions. Not so for XpkDisk. All partitions on a single unit must have the same values for these parameters.

There is not even a reason why you should start your first partition with track 0, apart from the disk usage of unused "Group_????_??" directories.

1.16 xpkdisk.guide/Limitations

Limitations

- * There is a provision for disk-full conditions of the underlying file system, but this can't be perfect. This means that disasters may still happen if you make your compressed disk too large for the space that is actually available. This is only functional if you checked "Safe write" in the xdPrefs program. (See General Usage and xdPrefs.)
- * There are only 8 units available. Since each unit in general requires a lot of cache memory, this should be plenty. However, nobody keeps you from using multiple partitions per device. Keep in mind then, that you need to have the same track size (BlocksPerTrack) for all partitions.
- * When a unit of xpkdisk.device is opened, it scans the list of mounted devices to find out its track size. It just looks for its name and unit number and uses the first match. If not found, the track size defaults to 64 blocks. This means that if you ever intend to use a different track length for a unit, it must always be mounted before accessing it.

This is not so bad as it seems, because specifying Mount = 0 costs almost no memory.

1.17 xpkdisk.guide/Implementation

Implementation

How are all the tracks stored?

=====

Since version 37.3, each track of xpkdisk.device is stored in a file with a name like XPKD:Unit1/Group_0000_HL/Track_001d_KE.

Why such a funny name? That is simple: names like these minimise the number of disk accesses needed to find the file. For example, the file header of this file can be retrieved in exactly 3 disk accesses. The same is true for all other tracks (as long as you have at most $72 * 72 = 5184$ tracks; this equals 162 megabytes of uncompressed disk space). This works as follows.

Each unit of xpkdisk.device changes its current directory to `XPKD:Unit<number>`. Then, when this track is requested, AmigaDOS looks up directory `Group_0000_HL`. These directories each group (at most) 72 tracks, and as long as there are at most 72 directories, all directories have the a unique "hash value". Each directory block can store 72 pointers to contained files or directories, and the hash value determines in which of these slots the pointer should go. So if each track hashes uniquely, this means that the directory block can be found in a single disk access. (If the file or directory found at the location in the hash table is not the desired one, a chain is followed which means more disk accesses are needed.)

The number in the directory name is the hexadecimal representation of the first track in it.

The same is true in each directory: the names of the tracks are constructed such that each has a different hash value. In fact, the hash values in each directory neatly range from 0 for the lowest track to 71 for the highest track.

Compare this with the old situation (in version 37.2), where all tracks were stored in a single directory. Even if you have a modest disk of 20 megabytes, this means there are 640 tracks. On average, this would mean that $640 / 72 = 9$ tracks would hash to the same hash table entry, which in turn would mean $1 + 4.5$ (average) accesses to find a track, and $1 + 9$ accesses worst case.

In reality the worst case was even worse, since the hash values were not evenly distributed. The longest hash chain would be 13, and the shortest 4. This makes the worst-case number of accesses 14, which is pretty bad.

This improvement in access speed comes at a small price: one extra disk block per 72 tracks: 9 extra blocks in the example 20 M case.

A note on track size
=====

Since file header blocks can store pointers to at most 72 data blocks, it is recommended that you make tracks not larger than 71 blocks. This leaves one block for expansion of uncompressible tracks.

`CMD_RESET`
=====

The `CMD_RESET` standard device command is used by the preferences program to let the device know to re-initialise the settings. Additionally, the current directory (`XPKD:Unit0-7`) is re-established, so you can change the location of your tracks on the fly. For this to work, the cached tracks are pushed first. It is highly recommended

that you perform a DiskChange command both before and after such a trick.

1.18 xpkdisk.guide/License

License

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1.19 xpkdisk.guide/Index

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