

Amiga_MO_FAQ

Mark Knibbs

COLLABORATORS

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WRITTEN BY	Mark Knibbs	July 8, 2025	

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Chapter 1

Amiga_MO_FAQ

1.1 Amiga Magneto-Optical (MO) Drive FAQ 1.1 (5.8.98)

Amiga Magneto-Optical (MO) Drive FAQ 1.1 (5-Aug-98) Copyright © 1998 by [Mark Knibbs](#)

This document uses some Amigaguide V40 features. It may not display properly under earlier Amigaguide versions.

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1.2 introduction

Introduction

The Amiga Magneto-Optical Drive FAQ contains information about using [magneto-optical \(MO\) disk drives](#) with the Amiga. It is freely distributable.

I hope the availability of this document will encourage more Amiga users to consider optical storage, instead of magnetic media like Zip, Jaz and SyQuest.

If you have any comments, suggestions or questions about this document or MO drives and disks, please [contact me](#).

1.3 What is a Magneto-Optical Disk Drive?

What is a Magneto-Optical Disk Drive?

Magneto-optical ("MO") disk drives are versatile removable storage devices, which use very robust and **inexpensive media**. You can use an MO disk just like a large floppy disk, or like a hard disk. The **How MO Drives Work** section explains how data is written to and read from MO disks.

Sony's increasing popular "MiniDisc" system uses a type of magneto-optical disk.

There are many advantages in using MO disks instead of other types of media:

- Media life is at least 30 years, which greatly exceeds the life of magnetic media like floppy disks, Zip and Jaz disks. Some manufacturers quote media life of 50 or even 100 years. Data can be rewritten at least 1 million times, and read at least 10 million times. This figure also exceeds that for magnetic media.
- MO drives are **backwardly compatible**, which means that if you upgrade your drive in the future, you will be able to read and write all your existing disks on the new drive.
- MO disks are not susceptible to magnetic fields.
- If you spill a cup of coffee on an MO disk, you can clean the disk surface and continue to use the disk. Cleaning kits are available for both MO drives and disks.
- MO disks are simple in construction, unlike some other kinds of removable media such as Jaz and SyQuest cartridges which contain moving parts. This is another reason why MO offers greater reliability than magnetic media.
- MO disks are available in several **different capacities**, which vary in **price**. Cost per megabyte is lower than all other kinds of random access removable media. MO disks are not proprietary, and they are made by many companies.
- There are no restrictions on writing and rewriting data to MO disks, unlike CD-R or CD-RW.
- MO drives normally automatically verify written data to guarantee data integrity. There is no such verification with CD-R and CD-RW, so to be assured that the data has been written properly when using these, you would need to manually compare all copied files.
- MO disks are convenient and compact. A 3.5" MO disk is the same size as two 3.5" floppy disks stacked on top of each other.

This quote is taken from an information sheet about Philips' 640MB MO drive: "ISO standard magneto optical disks offer virtually unlimited rewritability and are ideally suited whenever extraordinary data reliability is required. With its high resistance against external magnetic fields and the impossibility of 'head crashes' magneto optical storage technology is the better choice in terms of safety and reliability."

MO drives are available as internal or external, SCSI or IDE/ATAPI drives. MO "jukeboxes" are also available, but these are intended for business use as they are expensive, and few Amiga users need to store hundreds of gigabytes of data. Also, special driver software would be required, and none exists for the Amiga.

1.4 How MO Drives Work

How MO Drives Work

This section describes the theory of operation of MO drives. It is quite technical, and it is certainly not necessary to understand this in order to use a magneto-optical drive.

Magneto-optical drives use, as the name suggests, both magnetic and optical effects to read and write data. A layer within the media contains magnetically sensitive elements. When this layer is heated to its "Curie point", about 200°C, the polarity of the magnetic elements can be changed by an external magnetic field from the drive head.

To write data, the laser heats up the target areas of the disk, and the magnetic field is applied to record all 0s. On the next revolution of the disk, the magnetic field is changed, and the laser heats up those areas which are to have 1s recorded.

Because the written polarity is "frozen into" the disk, MO disks are not susceptible to magnetic fields as magnetic media are.

To read data from the disk, the laser is used at a low power. Depending on the magnetic polarity, the polarity of the laser light reflected from the disk is rotated a few degrees either way. This rotation is called the "Kerr effect". The drive detects this, and thus determines whether a 0 or 1 was read.

LIMDOW Media

Use of **LIMDOW media** can greatly improve write speeds. LIMDOW-capable drives can read and write to conventional MO disks.

When a LIMDOW disk is inserted, the drive detects this and enables additional control over the laser. LIMDOW disks have a different composition to normal media, which makes it possible to rewrite data in a single pass rather than the two passes required by conventional disks.

The drive records data by heating areas of the disk to their Curie point, as with conventional media. However, depending on the laser beam power, the magnetic element orients itself with either the external magnetic field or with a reference layer that is built into the disk. Thus data can be written in a single pass.

Data is read from LIMDOW media in the same way as from conventional media.

1.5 Types of MO Media

Types of MO Media

There are two physical media sizes, 3.5" and 5.25". This document concentrates on 3.5" drives and media, since 3.5" MO drives are cheaper than 5.25" ones, and I have only had experience with this type of drive and media. Please [contact me](#) if you have a 5.25" MO drive.

A 3.5" MO disk looks similar to a 3.5" floppy disk, except it is twice as thick. There is a metal shutter covering the disk surface, and a write-protect tab in the corner, just like a floppy disk. If you open the shutter, the disk inside has a similar appearance to the surface of a CD.

Whilst there are two physical disk sizes, there are several different disk capacities. 3.5" MO disks are currently available in the following capacities: · 128MB (512-byte sectors) · 230MB (512-byte sectors) · 540MB (512-byte sectors), 640MB (2048-byte sectors)

5.25" MO disks are currently available in the following capacities: · 600MB (512-byte sectors), 650MB (1024-byte sectors) · 1.2GB (512-byte sectors), 1.3GB (1024-byte sectors) · 2.3GB (512-byte sectors), 2.6GB (1024-byte sectors) · 4.1GB (512-byte sectors), 4.8GB (1024-byte sectors), 5.2GB (2048-byte sectors)

The only difference between 540MB and 640MB MO disks is the sector size. It is 512 bytes for 128MB, 230MB and 540MB disks, but 2048 bytes for 640MB disks. There is no real advantage to Amiga users in buying 540MB disks if you have a 640MB drive, unless you for some reason want to use an FFS version earlier than 40.1 (see the [Amiga Requirements](#) section), or use an operating system which does not support non-512-byte sector sizes, such as NetBSD. A similar thing applies to 5.25" MO disks, 600MB vs 650MB, 4.8GB vs 5.2GB, etc.

3.5" MO disks are single-sided. 5.25" ones are double-sided, and you only access half of the quoted capacity at a time. The disk is turned over to access the other half.

MO media can be bought as unformatted, or formatted for MS-DOS or Macintosh. If you're using a Mac emulator, you may wish to buy Mac formatted disks. For Amiga use it doesn't matter; you can just do a Format QUICK on the disk to make it ready for use, since the disks are low-level formatted at the factory.

MO disks are usually low-level formatted and certified at the factory. Certified disks have had their surface checked and any bad blocks are remapped.

More recent disk capacities (230MB, 540MB and 640MB for 3.5" disks) are also available in [LIMDOW](#) variants, also known as "direct overwrite".

In common with hard disk manufacturers, MO disk capacities are usually quoted in millions of bytes, as opposed to the usual computer terminology where 1 megabyte = $1024 \times 1024 = 1,048,576$ bytes. The quoted figure is the unformatted capacity. For example, the formatted capacity of a 640MB 3.5" disk is 635,600,896 bytes, which is just over 606 megabytes.

1.6 LIMDOW Media

LIMDOW Media

You may have heard of LIMDOW media. This is also referred to as "direct overwrite" media. LIMDOW stands for Light Intensity Modulation Direct OverWrite.

When using conventional MO disks, in order for the drive to write a block to disk, it erases the block, writes the new data, and then verifies the just-written data. (You can enable or disable verification by using a DIP switch on the drive, or by sending the appropriate command to the drive from the computer.) This requires three revolutions of the disk.

With LIMDOW media and a LIMDOW-capable drive, the new data can be written with no need for the old data to be erased first. This means that writing speed is increased by about 50%. Without verification, writing speed would be almost doubled.

The down side to this is that, at least for the moment, LIMDOW media is more expensive than normal media.

1.7 Backward Compatibility

Backward Compatibility

The first generation of 3.5" MO drives could only use 128MB disks. The second generation 230MB drives can read and write 128MB and 230MB disks. Current 640MB 3.5" drives can read and write 128MB, 230MB, 540MB and 640MB disks. (Earlier 640MB drives could only read from 128MB disks, however.)

This backward compatibility means that if in the future you buy a larger capacity MO drive, you can continue to read and write all your existing MO disks using the new drive. 1.2GB 3.5" MO drives are on the horizon, and when available you will be able to use all existing disks with the new drives.

1.8 Media Costs

Media Costs

Cost of MO media is very low compared with other removable media like Zip, Jaz and LS120 disks. **LIMDOW media** is more expensive, but still works out cheaper per megabyte than other types of removable media.

This section illustrates the relative price differences between MO disks and other types of removable media. It is not intended to be comprehensive or up-to-date or to cover all countries, just as a guide to how much cheaper MO disks are. Check a current computer magazine for up-to-date prices. Macintosh magazines are likely to have more adverts for MO drives and disks than PC ones.

Here are some typical costs for various types of MO media in the UK, excluding 17.5% VAT (sales tax), prices in pounds sterling:

Media type	Cost (£)	Cost/MB (p)	128MB 3.5"	4 3.13	230MB 3.5"	5 2.17	640MB 3.5"	12 1.88	640MB 3.5" LIMDOW	22 3.44
650MB 5.25"	15 2.31	1.3GB 5.25"	16 1.23	2.6GB 5.25"	25 0.96	5.2GB 5.25"	60 1.15			

Compare these prices with typical media costs for other storage devices:

Media type	Cost (£)	Cost/MB (p)	100MB Zip	8 8.00	120MB LS120	8 6.67	230MB SyQuest EZFlyer	15 8.70	1GB Jaz	50 5.00
1.5GB SyJet	51 3.40	2GB Jaz	70 3.50							

Unlike proprietary systems like Zip and Jaz, MO drives and media are made by several different manufacturers. This is partly why MO disks are so much cheaper. Unlike Zip and Jaz, where Iomega makes a large profit on the media (which allows them to sell the bare drives quite cheaply), different manufacturers of MO media are competing. MO disks are made by at least Dyan, Fujitsu, Imation (3M), Maxell, Philips, Sony, TDK and Verbatim.

1.9 Drive Costs

Drive Costs

Given the low media cost, the cost of the drive is not too high. Drives are commonly bundled with several disks, making the cost very competitive with other removable media.

For example, here are some MO drive prices in pounds sterling:

Fujitsu 230MB internal	100	Fujitsu 230MB with one 230MB disk	140	Philips Pegasus MO 230 with ten 230MB disks	200
Fujitsu DynaMO 640SE with one 640MB disk	215	Philips Galaxy MO 640 with five 640MB disks	300		

Fujitsu have recently released a new version of their 640MB external 3.5" drive, called the DynaMO 640SE. This is significantly cheaper than before, with a UK price of £215 (I am unsure whether that is the list price or estimated street price).

Unless stated, these prices are for external SCSI drives; internal models cost less, so if you have a tower case or a spare internal drive bay you can get one of them. But remember that with an external unit, you can easily connect the MO drive up to a Mac or PC.

In comparison, buying other types of drive with this amount of storage would cost significantly more. Some example prices are:

Zip 100MB with one disk	85	Syquest EZFlyer 230MB with one disk	100	Jaz 1GB with one disk	190	SyQuest SyJet 1.5GB with one disk	200
Jaz 2GB	230	Jaz 2GB with one disk	290				

1.10 Drive Specifications

Drive Specifications

MO drives are fast enough to be used as general storage or as a hard disk. However, if you are planning on using an MO disk for write-intensive applications, you may want to consider using **LIMDOW media**. For general backup, file storage and running applications/games from, normal non-LIMDOW disks are fine.

Figures for Fujitsu 640MB 3.5" MO drive mechanisms are as follows:

Disk Storage Capacity	128MB 230MB 540MB 640MB
Sector size (bytes)	512 2048
Data Transfer Rate (max)	Drive (3600rpm) 1.09MB/s 1.3-2.1MB/s 2.3-3.9MB/s Drive (4300rpm) 1.3MB/s 1.6-2.5MB/s 2.8-4.7MB/s
Interface	5MB/s async., 10MB/s sync.
Seek Time	Random Seek 28ms typical (35ms for M2513 drives) Full Stroke 60ms typical (not specified for M2513)
Average Latency Time	3600rpm drive 8.3ms 4300rpm drive 7.0ms
Rotational Speed	3600rpm or 4300rpm depending on drive model
Load/unload Time	7 sec./5 sec.
Buffer Size	2MB

Overall write speed will be about 1/3 of the maximum transfer rate for standard disks with verification enabled. It is about 2/3 of the maximum when using LIMDOW media with verification, or normal media without verification. Maximum write speed is achieved with LIMDOW media and verification disabled.

The drive has 2MB of buffer RAM which improves read and write speeds. Operation of the read-ahead cache can be seen when reading data from the drive; the drive's own activity LED only flashes occasionally (corresponding to when data is actually read from the disk), whereas the Amiga's SCSI activity LED is on constantly (corresponding to data being transferred from drive to computer). Earlier MO drives had less buffer RAM; the first 640MB drives had 512KB. Some 5.25" MO drives have 4MB.

There is also a **write-back cache**, which can speed up writes, especially small ones. You may wish to disable the write cache to guarantee data integrity. However, it should not be a problem if you are aware of how the write cache works.

The read speed of my 640MB drive easily outpaces the capability of my 1991-vintage GVP SCSI-1 controller.

For other types of drive, consult the manufacturer's web page.

1.11 Where To Get More Information

Where To Get More Information

MO drives and disks are not as widely advertised in PC-oriented computer magazines as things like **Zip and Jaz** drives. I suggest you read the adverts in Macintosh magazines. A drive sold for Macintosh use will come with Mac driver software, which can be used on the Amiga under Mac emulation.

Fujitsu make MO drives and media, including the DynaMO 640SE external SCSI drive, which I recommend as the current "best buy" MO drive. They are currently the only manufacturer of 640MB 3.5" drive mechanisms, as far as I know; all 640MB drives sold by other manufacturers will use a Fujitsu drive mechanism. See their web sites at: <http://www.fujitsu-europe.com/> <http://www.fcpc.com/> <http://www.fujitsu.co.jp/>

The Fujitsu Europe site includes extensive documentation for their drives in PDF format. See the **For Programmers** section for the URLs.

Philips PDO sell the Galaxy MO 640, though it is a rebadged Fujitsu DynaMO 640 unit. They also sell a 230MB drive, the Pegasus MO 230.

Olympus also sell a 230MB drive, the PowerMO 230. Their web site is at: <http://www.olympus.com/>

Other MO drive manufacturers or OEMs are Canon, Epson, IBM, Maxoptix, Mitsubishi, Pinnacle, Pioneer, Plasmon, Ricoh, Sharp, Sony, Toshiba and Verbatim.

The Plasmon and Maxoptix web sites contain some general information on optical storage which may be helpful, as well as information on their product ranges. The URLs are: <http://www.plasmon.com/> <http://www.plasmon.co.uk/> <http://www.maxoptix.com/>

Other manufacturers of 640MB 3.5" drives are LaCie and Verbatim. Their web sites are at: <http://www.lacie.com/> <http://www.verbatim.com/>

If you have contact/web site information for any other MO drive manufacturers, please [contact me](#).

If you have any Amiga-specific questions, feel free to ask me. Companies which sell MO drives will almost certainly not know anything about the Amiga.

1.12 Zip & Jaz Reliability Problems

Zip & Jaz Reliability Problems

If you are considering buying an Iomega Zip or Jaz drive instead of an MO drive, you should know that many people have reported reliability problems with these Iomega drives. You should investigate this before making a decision.

Iomega have apparently admitted to a 10% failure rate for Jaz drives, and the actual rate may be much higher. See <http://www.pinnaclemio.com/> for some information on this.

Information about the "Zip click death" syndrome can be found at the Unofficial Iomega Click Death Page: <http://www.thirdeyesp.com/jaz/>
You can find many more web pages about this by using a search engine such as Altavista (<http://altavista.digital.com/>), to find pages which contain the words: Zip click death

Some time ago Iomega had to recall thousands of faulty Jaz disks because of a manufacturing quality problem.

1.13 miscellaneous

Miscellaneous

If you ever have trouble reading disks on your MO drive, it may be that the drive lens needs cleaning. Or if the problem is specific to a certain disk, that disk may need cleaning. There are products available for cleaning the drive lens and MO disks. Fujitsu and Verbatim are two sources for these.

There are many products available for storing 3.5" floppy disks. MO disks come in individual hard plastic cases, though you could instead store them in a 3.5" disk box.

For portable storage, anything which holds an even number of 3.5" floppy disks on top of each other should hold a single 3.5" MO disk nicely. For example, the aidata "DiskToGo/2" product (model: 3502-4) is excellent for storing a single 3.5" MO disk. These are probably sturdy enough for sending MO disks by mail, but you should use a padded envelope in any case. A box for holding ten 3.5" floppy disks will hold five 3.5" MO disks.

1.14 Amiga Requirements

Amiga Requirements

This section describes what hardware and software you need to have in order to use an MO drive.

Hardware Requirements

You need a SCSI controller in order to use a SCSI drive.

There are MO drives available which use the IDE/ATAPI interface, for example Fujitsu's MCA3064AP 640MB drive. It is probably possible to use these with an A1200 or A4000's built-in IDE controller in conjunction with software like "IDEfix", but I have not tried this.

Software Requirements

No special software is needed.

For using media with a sector size other than 512 bytes, for example 640MB 3.5" disks, you will need to use FastFileSystem 40.1 or higher. This is available as part of AmigaOS 3.1. I have not tried formatting a 640MB 3.5" MO disk with an FFS block size of less than 2048 bytes, but it will probably not work.

FFS 40.1 is compatible with Kickstarts 1.2 & 1.3, so it is probably possible to use a 640 MB 3.5" MO disk under even these old operating systems. I have not tested this. It should definitely be possible to use 512-byte-per-sector MO media with these old OS versions and almost any FFS version.

You can download the latest beta versions of the FastFileSystem from the Amiga Inc. web site at: <http://www.amiga.de/>

I am currently using FFS 43.19 with my 640MB MO drive. The beta FFS versions require at least OS 2.x. Alternatively, you can use another filesystem such as PFS or AmiFileSafe. If using disks with a block size other than 512 bytes, make sure that whichever filesystem you use supports the correct block size.

For information on reading and writing PC and Macintosh-formatted MO disks, and using the drive under ShapeShifter, see the [Using MO Disks With Emulators](#) section, and also the [example mount files](#).

SCSI utility programs such as SCSIUtil can be used to eject the disk, instead of having to press the Eject button on the drive. You can prevent and allow manual disk ejection with the same program.

I have not tried using a large capacity 5.25" MO drive or disks with my Amiga. However, all current sizes are not likely to be a problem. Remember that 5.25" disks are double-sided, and you turn over the disk to access the other half capacity. So even with a 5.2GB MO disk, each side holds 2.6GB of data. There are none of the problems associated with hard disks larger than 4GB. Some programs including HDToolBox may get confused and report negative amounts of space free, but this should be harmless, and happens with any drive/partition over 2GB.

For use with alternative operating systems such as NetBSD, you may need to use media with 512-byte sectors, if the OS only supports this sector size. For example, you may not be able to use 640MB 3.5" MO disks under NetBSD, since they have 2048-byte sectors. You can use 540MB disks instead.

1.15 Drive Settings (DIP switches)

Drive Settings (DIP switches)

To set up an MO drive for use on your Amiga, you need to set the following options using the MO drive's DIP switches:

- Set the SCSI ID to one which is not currently in use.
- You may need to set the device type mode to "direct access device". My old GVP controller refused to work with the drive when the device type was set to "optical memory device". Apparently this is required with most Amiga SCSI controllers, except possibly those made by Phase 5. It may be possible to get around this if Amiga MO driver software is written, but it does not really matter anyway.
- Set "Macintosh mode" to OFF. I don't know what this setting means exactly, but my drive works okay with this switch OFF. I have not tried it when the Mac mode switch is ON. According to Fujitsu: "Because of the differing ways that both Apple Macintosh and PC hosts respond to the status of the drive, set this switch accordingly. Mac mode ON will disable the 'UNIT ATTENTION' reporting on power up and media change."
- Set the termination depending on whether your MO drive is the last device in the SCSI chain.
- I advise you to **DISABLE WRITE CACHE MODE**. See [About the Write-Back Cache](#) for more information.
- Set the verify mode. When disabled, the speed of write operations is improved by approximately 50%, however data integrity cannot be guaranteed. The improvement when using [LIMDOW media](#) is about 100%. I recommend you always enable verify mode.

1.16 About the Write-Back Cache

About the Write-Back Cache

MO drives have a write-back cache, which when enabled can speed up write times, because the drive does not wait for the data transferred to the drive's buffer memory to be written to disk.

It works like this:

- The Amiga sends a first block of data to the drive.
- This data is stored in the drive's buffer memory, and the drive immediately responds.
- Drive begins to write the first block of data to the optical disk. While it is writing the data, a second block of data can be sent from the Amiga to the drive's buffer memory.

But what if a write error occurs when the drive writes the first block of data to disk? The Amiga thinks that the first block of data has been written correctly. The drive will report the write error after the Amiga has sent the second block of data to the drive. Depending on the SCSI device in use (scsi.device, gvp SCSI device, etc.), the Amiga may incorrectly interpret the write error as referring to the second block of data.

So the Amiga will display a Retry/Cancel requester. If you click Retry, the computer may retry sending the second block of data. So the first block of data, which should be resent because of the write error, is not. Hence bad data remains on the disk. The first block of data may not even still be in memory; the program that wrote it could have since freed or altered the memory.

For this reason, I do not believe that it is possible to completely support the write cache under AmigaOS, though partial support should be possible. If you are concerned about data integrity, you should disable the write cache. However, it is possible to have the write cache enabled without too many problems. If ever a write error requester appears, just click on Cancel, delete the file affected, and re-copy it. Do not assume that clicking Retry will work properly, because the Amiga may resend a different block of data for which no write error occurred.

1.17 Using Different Disk Capacities

Using Different Disk Capacities

As mentioned in the [Types of MO Media](#) section, MO drives can use several different capacities of disk. Current 640MB 3.5" drives can read and write 128MB, 230MB, 540MB and 640MB disks. (Earlier 640MB drive models could not write to 128MB disks.)

Since there is currently no [special MO driver software](#) for the Amiga, it is not possible to access different capacity MO disks using the same device name (but see [Mounting and Using the Drive and Disks](#)).

On my Amiga, I mount the MO0: device to access 640MB MO disks. To access 128MB, 230MB or 540MB media, I would have to create other mount files, e.g. for devices MO128:, MO230: and MO540:, in order to access disks of these capacities. This is not a major problem, since you will probably mostly use disks of the highest capacity your drive can handle. See the [example mount files](#).

1.18 Mounting and Using the Drive and Disks

Mounting and Using the Drive and Disks

Using a mount file to mount the drive is the best option if you want to use the MO disk for general data storage, and not for booting from. This gives the maximum amount of free disk space, and disks formatted like this should be easily interchangeable between Amigas.

If you want to boot from an MO disk, you need to create an RDB (Rigid Disk Block) on the disk, just like you would with a SCSI hard drive. You can use HDToolBox or another hard disk partitioning program to do this. Using the RDB method, you can create several partitions on a single MO disk. You can adjust the values for Cylinders, Heads and BlocksPerTrack in HDToolBox if you want, as long as: $\text{Cylinders} * \text{Heads} * \text{BlocksPerTrack} = \text{total number of blocks on disk}$ If you reduce the (logical) number of blocks per track, the RDB will take up less space on the disk. Be careful not to make it too small though, in case you decide to add another filesystem in future; the RDB may be too small to hold it.

Mount files for PC-formatted disks (AT-HD type) may not use the entire disk space; see the [example mount files](#) for PC disks.

Here is a table of the number of usable blocks for each type of 3.5" MO disk: +-----+-----+-----+ | Disk |
 Number of | Block size | | type | blocks | (bytes) | |-----+-----+-----+ | 128MB | 248826 | | |-----+-----+ |
 230MB | 446325 | 512 | |-----+-----+ | 540MB | 1041500 | | |-----+-----+ | 640MB | 310352 | 2048
 | +-----+-----+-----+

There are several mount files in the DOSDrivers drawer which is part of the Amiga MO FAQ distribution. See the [example mount files](#).

TO CREATE SOME KIND OF STANDARD FOR AMIGA-FORMATTED MO DISKS, ALWAYS USE 2 RESERVED BLOCKS.

The exact numbers of Cylinders, Surfaces, HighCyl and BlocksPerTrack is not important, but you MUST ensure that: $\text{Surfaces} * \text{BlocksPerTrack} * \text{HighCyl} = \text{total number of blocks on disk}$

For 640MB 3.5" disks, this means that: $\text{Surfaces} * \text{BlocksPerTrack} * \text{HighCyl} = 310352$

This is to ensure that MO disks are easily interchangeable between different Amigas. If $\text{Surfaces} * \text{BlocksPerTrack} * \text{HighCyl}$ is less than the number of blocks in the disk, you waste disk space, and would need to send a copy of your mount file to the other person when sending an MO disk to them.

If you use a mount file to mount the drive, you can use MO disks just as you would floppy disks. Ejecting and inserting a new disk should be automatically detected by the Amiga.

If you insert an MO disk with RDB after booting your Amiga, you will need to use a program such as SCSIMounter in order to mount the partition(s) on that MO disk.

It is easy to format a new MO disk for use. If using a mount file, you can just insert the disk and type a command like: Format DRIVE MO0: NAME "My MO disk" NOICONS FFS QUICK (Replace MO0: with whatever drive name you have mounted MO disks of that capacity as.) The MO disk will be ready for use in a couple of seconds. It is not necessary to do a full format (i.e., not to use the QUICK option), but you can if you want.

1.19 Example Mount Files

Example Mount Files

Most of the example mount files for 3.5" MO disks given here are based on ones contributed by Goetz-Martin Bertelsmann. Drag the icons for the mount files you want to install to DEVS:DOSDrivers or SYS:Storage/DOSDrivers, and set the DEVICE and UNIT tooltypes, and the Mask and MaxTransfer values appropriately for your system.

NOTE: The only mount file which I have tested myself is the Amiga 640MB one.

Amiga FFS Amiga 640MB

Amiga 540MB Amiga 230MB

Amiga 128MB

After mounting an Amiga FFS volume, you can use the Format command to set the DosType just as you would a floppy disk or hard disk partition. For example: Format DRIVE MO640: NAME "My MO Disk" NOICONS FFS DIRCACHE

PC-compatible AT-HD FAT (MS-DOS/Windows) (requires CrossDOS) PC 540MB For AT-HD type MS-DOS-formatted 540MB MO disks PC 230MB For AT-HD type MS-DOS-formatted 230MB MO disks PC 128MB For AT-HD type MS-DOS-formatted 128MB MO disks

Apple Macintosh HFS (requires CrossMac, may work with MaxDOS with changes) Mac 640MB

Mac 540MB Mac 230MB

NetBSD (requires BFFS) BSD 540MB For NetBSD-formatted 540MB MO disks BSD 230MB For NetBSD-formatted 230MB MO disks

1.20 Using MO Disks With Emulators

Using MO Disks With Emulators

It is very easy to use an MO drive and disks with emulators. I will only talk about the ShapeShifter Macintosh emulator here.

There are two ways to use MO disks under Mac emulation: · You can use an MO disk as a "DeviceDisk". This is probably the quickest method. The disadvantage is that MO disks created like this will probably not be readable on a real Macintosh. Also, even if you buy a Mac-formatted MO disk, you may need to reformat it in order to use as a DeviceDisk. · You can use Macintosh MO driver software. It is a good idea to buy an MO drive that comes bundled with Mac driver software. However, if your drive did not come with any you can download Pinnacle Micro's Mac driver from: http://www.pinnaclemicro.com/files/fw_sw/mac/pmo33.hqx

My 640MB Philips Galaxy 640 drive came with Mac software called FormatterOne Pro. This can also be used to access many other types of SCSI device. FormatterOne Pro is a commercial product; see the Software Architects web site at: <http://www.softarch.com>

In fact, the free Pinnacle Micro software seems to have more features than FormatterOne Pro. It allows disks to be low-level formatted, something which is not otherwise possible on the Amiga, until someone writes an Amiga program to do this. However, the Pinnacle software is apparently incompatible with System 8. Also, I had some problems running it under System 7.0.1, though these may be partly due to my old SCSI controller.

If you use this or other Mac driver software, you can buy a Mac-formatted MO disk and use it immediately under the Mac emulation. There are other commercial Mac drivers, though I have not used them. CharisMac sell "Anubis Pro", which you can

buy as a competitive upgrade for US\$14.95. Presumably you could download the free Pinnacle Micro software and then upgrade to Anubis Pro. For more information, see CharisMac's web page at: <http://www.charismac.com/anubis.html>

Other Mac driver products are Silverlining, Disk Drive TuneUp and FWB Hard Disk Toolkit.

PC driver software is available from many manufacturers' web sites. The Fujitsu, Maxoptix and Pinnacle Micro sites are a good place to start. See the [Where to Get More Information](#) section for the URLs.

It is possible to mount PC-formatted (AT HD type) MO disks as Amiga devices, just like PC0: is used to access PC-formatted floppy disks. This requires CrossDOS (supplied with Workbench 2.1 and higher) or similar. It is probably not possible to format this type of disk without special software, so format disks on the PC first. To access PC disks which have been formatted to contain several partitions, you will need to create a mount file for each partition. It may be possible to use MountDOS to help with this. MountDOS is available on Aminet, in the disk/misc directory.

On a PC, it is also possible to format MO disks in "superfloppy" format. This is probably similar to using a mount file as opposed to RDB for Amiga-formatted disks. To access such disks on the Amiga may be very easy, just requiring a suitable mount file. However, since I do not have a PC or any PC superfloppy-formatted MO disks, so no superfloppy mount files are included in the Amiga MO FAQ. See the Information Wanted section.

Accessing Macintosh disks from the Amiga may require the commercial products CrossMac or MaxDOS. However, read-only access might be possible by using a CD-ROM filesystem which also supports Mac HFS CD-ROMs, such as AmiCDFileSystem or AmiCDF5. If you have created multiple partitions on a Mac-formatted disk, you will need to make mount files corresponding to each partition that you want to access.

See the [Example Mount Files](#) section if you want to experiment with reading PC or Macintosh-formatted MO disks.

1.21 Sharing the MO Drive Between an Amiga and PC or Macintosh

Sharing the MO Drive Between an Amiga and PC or Macintosh

For sharing large amounts of data, it may be possible to connect an external MO drive to both your Amiga's and (say) a PC's SCSI controller. To do this, you will need to set the SCSI IDs of the controllers so that they do not clash. Also, do not try and write to the disk from both computers at once, or read and write at the same time.

I do not know whether this is actually possible. More information would be welcome.

1.22 For Programmers

For Programmers

It is possible to support advanced features of MO drives on the Amiga by using custom driver software. No-one has written any such software yet, but here are some things which could be done:

- Support automatic media capacity detection. So regardless of whether a 128MB, 230MB, 540MB or 640MB disk is inserted, the drive could be accessed as MO0:.
- This would be similar to the way that both high and low density floppy disks are supported as DFx:.
- The block size can also change; it is 512 bytes for 128MB, 230MB and 540MB disks, but 2048 bytes for 640MB disks.
- Allow disks to be low-level formatted. This could be useful if you have a disk which has become very dusty. The drive map map out many blocks which it sees as bad. After cleaning the disk, many of these blocks may be accessible again. A low-level format would re-initialise the bad block table.
- Partial support for the write cache may be possible.
- Extended error detection. Detect when the MO drive has to use its error correction circuitry or retry reading a track. This does not result in data loss, but many such occurrences could indicate that the disk or drive needs cleaning. A requester could optionally alert the user to this.
- Allow various options to be changed in software, rather than having to change a DIP switch on the drive, such as spindle automatic stop mode, write cache mode and verify mode.
- Allow other options to be set, for which there are no DIP switches, such as spindle stop monitoring time and power save mode.
- Enable the device type reported by the drive to be set to "optical storage device" instead of "direct access device".
- A filesystem could be written to support NSR format disks, or UDF which is a subset of NSR. See the [About NSR and UDF](#) section.
- Reading "Super Floppy" MO disks (used with PC compatibles) may require extra software, or it may be possible with CrossDOS.
- It may be possible to "pre-erase" unused areas of an MO disk, to allow writing new data to non-LIMDOW media to be as fast as for [LIMDOW media](#).
- MO drives have their BIOS in Flash ROM. This means that it is possible to update the BIOS from the host computer. Software to do this exists for the PC; it would be useful to have an Amiga BIOS uploader program also. An archive

containing PC BIOS uploader program and BIOS for the Fujitsu M2513 640MB 3.5" drive is available from the Maxoptix web site.

I envisage an "mo.device" being written, that goes in between the filesystem and the underlying SCSI device (scsi.device, gvp-scsi.device, etc.). Multiple units of mo.device could access multiple MO drives on multiple SCSI controllers, if present.

Documentation

There is extensive documentation in PDF format for the Fujitsu M2513 640MB 3.5" SCSI and MCA3064AP IDE/ATAPI drive mechanisms available from the Fujitsu Europe web site at: <http://www.fujitsu-europe.com/>

You can print the PDF files on an Amiga using Ghostscript (on Aminet), or run Acrobat Reader under Macintosh emulation. The direct URLs for these files are as follows.

M2513S (DynaMO 640) Maintenance Manual; 1016015 bytes, 79 pages: <http://www.fujitsu-europe.com/home/support/mo/manuals/cat-640/m2513s.pdf>

M2513A OEM Manual - Specifications and Installation; 4594299 bytes, 182 pages: <http://www.fujitsu-europe.com/home/support/mo/manuals/m2513a.pdf>

M2513A OEM Manual - SCSI Logical Specifications; 1548914 bytes, 167 pages: http://www.fujitsu-europe.com/home/support/mo/manuals/m2513a_scsi.pdf

MCA3064 Optical Disk Drive Product Manual; 3927852 bytes, 227 pages: <http://www.fujitsu-europe.com/home/support/mo/manuals/mca3064.pdf>

If you are interested in the physical specifications of MO disks, there are some relevant ECMA standards. See the [About NSR and UDF](#) section for the URL of the ECMA web site.

1.23 About NSR and UDF

About NSR and UDF

NSR and UDF specify platform-independent file systems. UDF is a subset of NSR. NSR stands for Non-Sequential Recording, and UDF for Universal Disk Format.

They allow disks created on a wide variety of operating systems to be interchangeable between different OSes. Think of NSR and UDF as similar to the way the ISO 9660 standard allows any type of computer with a CD-ROM drive to read the files from a CD-ROM disc. With NSR or UDF support, it would be possible to read and write to NSR-formatted MO disks from a Macintosh, PC, Amiga, and other types of computer.

NSR is covered by ISO standard 13346 and an equivalent ECMA standard, ECMA-167 2nd edition. NSR is the international standard logical disk format. It is not restricted to optical disks.

ISO standards documents are not available free of charge. Information about ordering them can be found on the ISO web site at: <http://www.iso.ch/>

ECMA (European Computer Manufacturers Association) standards documents are available free of charge. They can be downloaded in PDF and Microsoft Word formats from the ECMA web site, where you can also order a free CD-ROM containing all ECMA standards. The URL is: <http://www.ecma.ch/>

UDF is a subset of NSR which is defined by the Optical Storage Technology Association (OSTA). You may have heard it mentioned in conjunction with CD-RW and DVD technologies. It is likely to be more commonly used as the standard interchange format for MO disks. UDF specifications are available in PDF format from the OSTA web site, at: <http://www.osta.org/>

If the Amiga is ever to support new technologies like CD-RW and DVD properly, an NSR or UDF filesystem needs to be written. The issue of NSR/UDF support is not just applicable to MO disks.

1.24 List of Amiga MO Users

List of Amiga MO Users

This is a new section. Its purpose is to list the names and email addresses of people who use MO drives with the Amiga, partly so that MO- and SCSI-related utility programmers can contact them if they want beta-testers for their programs. This will be particularly useful if the programmer does not own an MO drive, but wants to include support for MO-specific features.

If you would like to be added to this section, please [contact me](#).

Name	Drive type	Email address
Mark Knibbs	640MB 3.5"	mark_k@iname.com

1.25 Amiga MO Mailing List

Amiga MO Mailing List

I am thinking of creating a mailing list about using MO drives with the Amiga. MO users could exchange tips, mount files and other information using such a list.

If you would be interested in subscribing to an Amiga MO mailing list, please [contact me](#).

1.26 Information Wanted

Information Wanted

To improve future versions of the Amiga MO FAQ, I would like to get hold of the following:

- Mount files for PC superfloppy-formatted disks. If you have any disks like this, please [contact me](#).
- Disk information (number of blocks) for various types of 5.25" MO disk, so that I can create Amiga mount files for them.
- Information on using MO disks with non-512-byte sector sizes with operating systems like NetBSD and Linux.
- Information about using an IDE/ATAPI MO drive with the built-in controller of the A600, A1200 and A4000.
- Any other information which you think should be included.

1.27 Contacting the Author

Contacting the Author

I can be reached by electronic mail at the following addresses: mark_k@iname.com mark_k@letterbox.com

My web page is at this URL: <http://visitweb.com/mark> or if that does not work: <http://www.netcomuk.co.uk/~markk/index.html>

The latest version of the Amiga MO Drive FAQ should always be available from my web page, and on Aminet as: [docs/help/Amiga_MO_FAQ.lha](#)

1.28 Thanks To...

Thanks To...

This section is almost empty at the moment.

Thanks to the following people:

- Goetz-Martin Bertelsmann for sending various mount files and general help.
- Joachim Nink for contributing a PC 128MB mount file, and pointing out mistakes in the comments of some other mount files.

1.29 Version History

Version History

1.0 25-Jul-98 First public release. 1.1 5-Aug-98 Second public release. Updated many sections. Corrected mistakes in the comments of some mount files. Added mount files for Amiga and PC 128MB disks. Added [Zip & Jaz Reliability Problems](#), [Information Wanted](#), [List of Amiga MO Users](#) and [Amiga MO Mailing List](#) sections.
