ftape-HOWTO

Kevin Johnson, <kjj@pobox.com> v2.0, 15 March 1997

This HOWTO discusses essential do's and dont's for the `ftape` driver under Linux. The `ftape` driver interfaces to QIC-40, QIC-80, QIC-3010 and QIC-3020 compatible drives. The QIC-3010 and QIC-3020 standards are also known as 'Travan' (TR-2 and TR-3). These drives connects via the floppy disk controller (FDC). It **does not** cover SCSI or QIC-02 tape drives. DAT tape drives usually (always?) connect to a SCSI controller. This is but one of the Linux HOWTO documents. You can get an index of the HOWTOs from *the Linux HOWTO index* <http://sunsite.unc.edu/mdw/HOWTO>, while the real HOWTO's can be fetched (using `ftp`) from `sunsite.unc.edu:pub/Linux/doc/HOWTO` (this is the "official" place) or via the World Wide Web from *the Linux Documentation Project home page* <http://sunsite.unc.edu/mdw/linux.html>.

Contents

1 Legalese **3**

2 Revision History **4**

3 The preliminaries **5**

3.1 What is `ftape` . . . 5

4 Getting and installing `ftape` **6**

4.1 Getting `ftape` . . . 6

4.2 Installing the driver . . . 6

4.3 Following the development of the `ftape` driver . . . 7

4.4 Mixing `ftape` and floppies . . . 7

5 The Care and Feeding of Tape and Tape Drives **8**

5.1 Formatting . . . 8

5.1.1 Can I format my tapes under Linux? . . . 8

5.1.2 Which formatting programs can I use under DOS? . . . 8

5.2 Retensioning . . . 9

5.3 Drive Cleaning . . . 9

6 Hardware support **9**

6.1 Supported tape drives . . . 9

6.2 Supported special controllers . . . 12

6.2.1 Iomega Ditto Dash and other 2Mbps controllers . . . 13
6.3 Unsupported tape drives . . . 13
6.4 Using an external tape drive with `ftape` . . . 13
6.5 PCI motherboards and `ftape` . . . 14

7 Backing up and restoring data 14
7.1 Writing an archive to a tape . . . 15
7.2 Restoring an archive . . . 15
7.3 Testing the archive . . . 15
7.4 Putting more than one backup on a tape . . . 16
7.5 Appending files to an archive . . . 17
7.6 Mount/unmounting tapes . . . 17

8 Creating an emergency boot floppy for `ftape` 17

9 Frequently Asked Questions 18
9.1 Does `ftape` support the Iomega 2GB tape drive? . . . 18
9.2 How fast is `ftape`? . . . 18
9.3 How do I change the trace-level? . . . 19
9.3.1 Using insmod to change trace-level . . . 19
9.3.2 Using mt to change trace-level . . . 19
9.3.3 Recompiling to change trace-level . . . 19
9.4 Can I exchange tapes with someone using DOS? . . . 20
9.5 How do I '....' with `tar`? . . . 20
9.6 `ftape` DMA transfers gives ECC errors . . . 20
9.7 `insmod` says the kernel version is wrong . . . 20
9.8 What is this versioned symbols stuff anyway? . . . 20
9.9 `insmod` says that kernel 1.2.0 and 1.2.0 differ . . . 21
9.10 `ftape` says "`This tape has no 'Linux raw format'`" . . . 21
9.11 Where can I find the `tar/mt/cpio/dd` binaries/sources/manpages? . . . 21
9.12 Where can I obtain the QIC standards? . . . 21
9.13 What block-size should I use with `tar` . . . 22
9.14 `ftape` detects more bad sectors than DOS on QIC-3020 tapes . . . 22
9.15 Syslogd works overtime when running ftape . . . 22

9.16 'Shoeshining' 23
9.17 Trying to compile `ftape` gives me the error '"modversions.h: no such file or directory' 23
9.18 How does 'mt eom' work when you've started overwriting a tape in the middle? 23
9.19 Help! I'm getting 'dmaalloc() failed' in my syslog file. 23
9.20 Is it ok that I'm not hearing the tape move when I do a fsf or a bsf with mt? 24

10 Debugging the `ftape` driver **24**
10.1 The kernel/`ftape` crashes on me when I do '...' - is that a bug? 24
10.2 OK, it's a bug ...ehhh... feature - How do I submit a report? 24

11 Contributions **25**

1 Legalese

Linux ftape-HOWTO may be reproduced and distributed in whole or in part, subject to the following conditions:

```
Copyright (c) 1993-1996 by Kai Harrekilde-Petersen
Email: khp@dolphinics.no

Copyright (c) 1996-1997 by Kevin Johnson
Email: kjj@pobox.com
```

Linux ftape-HOWTO is a free document; you may reproduce and/or modify it under the terms of version 2 (or, at your option, any later version) of the GNU General Public License as published by the Free Software Foundation.

This howto is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU General Public License for more details.

The author encourages wide distribution of this document for personal or commercial use, provided that the above copyright notice remains intact and the provisions of the GNU General Public License are adhered to. The summary is that you may copy and distribute this document free of charge, or for a profit. No explicit permission is required from the author for reproduction of this document in any medium, physical or electronic.

Note that derivative works and translations of this document must be placed under the GNU General Public License, and the original copyright notice must remain intact. If you have contributed new material to this document, you must make the source code (e.g., SGML source) available for your revisions. Please make revisions and updates available directly to the author: Contact kjj@pobox.com via Internet e-mail. This will allow the author to merge updates and provide consistent revisions to the Linux community.

The author encourages distributors of Linux software in any medium to use the howto as an installation and user guide. Given the copyright above, you are free to print and distribute copies of this document with your software. If doing so, you may wish to include a short "installation supplement" for your release, or modify the relevant sections of this book to reflect your product.

The author would like to know of any plans to publish and distribute this howto commercially. In this way, we can ensure that you are kept up-to-date with new revisions. And, should a new version be right around the corner, you might wish to delay your publication of the howto until it is available.

If you are distributing this howto commercially, donations, royalties, and/or printed copies are greatly appreciated by the author. Contributing in this way shows your support for free software and the Linux Documentation Project.

If you have questions or comments, please contact the author at kjj@pobox.com.

2 Revision History

version 2.0 (March 15, 1997)

- Updated to ftape v2.11 and v3.xx
- Lots of updates.

version 1.9 (September 20, 1996)

- New maintainers of ftape and the HOWTO.
- A few minor formatting and spelling fixes.
- Updated for Linux v2.0.
- Started to integrate some of Andrew Martin's ftape info.

version 1.8 (May 22, 1996)

- Copyright policy changed to GNU GPL v2
- The maintainer's email address has changed.
- Updated to ftape-2.08
- `ftape` is now a part of the kernel distribution.

version 1.7.1 (February 13, 1996)

- Updated to ftape-2.06b

version 1.7 (January 28, 1996)

- Updated to ftape-2.06 and modules-1.3.57

version 1.6.2 (January 23, 1996)

- Connor TST3200R drive added

- Updated 2Mbps fdc information.

version 1.6.1 (January 16, 1996)

- minor corrections

version 1.6 (January 10, 1996)

- New maintainer of `ftape`
- updated to v2.05
- added new drives

3 The preliminaries

The maintainer of the source for ftape is Claus Heine <claus@momo.math.rwth-aachen.de>. He has a web page at http://samuel.math.rwth-aachen.de/ LBFM/claus/ftape/ftape-page.html.

If you have a problem or questions about ftape, try posting to the `linux.dev.tape` newsgroups. This is a Usenet group that mirrors the traffic on the mailing list `linux-tape@vger.rutger.edu` (see 4.3 below). It is recommended that the newsgroup be used in preference to the mailing list, since the `vger` machine is overburdened with the load of the Linux mailing lists.

I use `ftape` (it is my sole means of backing up on my linux box :-). I hesitate to make recommendations on what hardware to buy. I use an Iomega Ditto Tape Insider 3200 and it seems to work OK for me, but I won't even try to tell you not to buy something else. See the section 6.1 and 6.3 for a list of supported and unsupported drives.

You should try to post a summary of your problems and its solution(s), after you've got it working, even if you only got it partially working. Please also send me (<`kjj@pobox.com`>) a copy of your solution or post it to the `linux.dev.tape` newsgroup so that I can add it to the HOWTO.

I generally read my mail several times a week, I try to respond to everyone, but I cannot guarantee that I will respond immediately. I usually read the newsgroups (`linux.dev.tape` and the `kernel` list).

If you receive this as part of a printed distribution or on a CD-ROM, please check out *the Linux Documentation home page* <`http://sunsite.unc.edu/mdw/linux.html`> or ftp to <`ftp://sunsite.unc.edu:/pub/Linux/doc/HOWTO`> to see if there exists a more recent version. This could potentially save you a lot of trouble.

If you email me, please include the string `ftape` in the subject line. This will help ensure the mail doesn't inadvertently get buried.

3.1 What is `ftape`

`ftape` is a driver program that controls various low-cost tape drives that connect to the floppy controller.

`ftape` is not a backup program as such; it is a device driver, which allows you to use the tape drive (just like the SoundBlaster 16 driver let you use your sound card) through the device files `/dev/[n]rft[0-3]`.

ftape was originally written by Bas Laarhoven <bas@vimec.nl>, with "a little help from his friends" to sort out the ECC (Error Correcting Code) stuff. ftape is copyrighted by Bas under the GNU General Public License, which basically says: "go ahead and share this with the world, just don't disallow other people from copying it further".

ftape is quite stable, and has been that for some time now. It is reliable enough for critical backups (but it's always a good idea to check your backups, so you won't get a nasty surprise some day).

ftape supports drives that conform to the QIC-117 and one of the QIC-80, QIC-40, QIC-3010, and QIC-3020 standards.

ftape supports neither QIC-02, IDE (ATAPI), nor SCSI tape drives. SCSI drives are accessed as /dev/[n]st[0-7] and are supported by the kernel through the SCSI drivers. If you look for help on SCSI tape drives, you should read the SCSI-howto. ATAPI tape drives are supported by the kernel since 1.3.46. See section 6.1 and 6.3 for a list of supported and unsupported drives.

4 Getting and installing ftape

4.1 Getting ftape

The v2.0.X versions of the kernel have version 2.08 of ftape already. I recommend, however, that you grab the latest version of the full source code package for ftape. It is a newer version, includes files that are not included in the kernel distribution, and includes much better documentation about how to install ftape.

Version 2.11a or newer of ftape is available from
http://samuel.math.rwth-aachen.de/ LBFM/claus/ftape/ftape-page.html. At the time of writing this version of the HOWTO document, v3.xx is available. I recommend sticking with v2.xx unless you are ready, willing, and able to use a development release with bugs.

4.2 Installing the driver

The following sections provide some useful information to get you going with the installation of v2.11a.

Once you've downloaded the source code (probably ftape-2.11a.tar.gz), untar it. You can do this by determining what directory you want the source code to be located in. I recommend /usr/src/ or ~/src. When the tar file is extracted, it will dump everything into a ftape-2.11a subdirectory, so that you'll end up, in the example I've given, with something like /usr/src/ftape-2.11a or ~/src/ftape-2.11a. It is possible to drop the entire ftape distribution into the /usr/src/linux/drivers/char/ftape directory, but untar the file into a location like I've suggested first, read through the documentation, then decide how you want to proceed.

Read the README file. The README is required reading. It's the top of the tree, so to speak. If there are specific files that the README tells you to read then read them. It will make the process much less complicated.

Do NOT proceed with compiling the package until you have read the appropriate README files and the Install-guide.

The README mentions that the linux-tape mailing list. I recommend subscribing to the linux.dev.tape newsgroup instead. The machine serving the mailing list is overburdened.

There are two ways that ftape support can be added to the kernel.

- Compile it directly into the kernel.
- Compile it as a kernel module.

Of these two methods, the first has fewer potential problems. The second has the benefit of only consuming memory while the driver is loaded. The original author of ftape (Bas Laarhoven) has pointed out that ftape was not originally designed to be used with modules.

I compile ftape directly into the kernel on my computer. In general, fewer difficulties or complications are reported when it is done this way. A good rule of thumb is to compile it into the kernel unless you both have a good reason not to and are willing to accept any of the complications that can arise from doing otherwise. If you do compile it into the kernel, please keep in mind that you cannot use zftape instead of ftape because the two use the same major device number.

If you are compiling the driver directly into the kernel, you can generally ignore the instructions regarding modules.

If you have a v1.2 kernel, you should use the modules-1.3.57 package, not the modules-1.2.8 package (Bjørn Ekwall, maintainer of the modules package, encourages this).

If you are using v1.3.x of the kernel, you should consider moving to v2.0.x. v1.3.x was the development release prior to the production release v2.0.x.

4.3 Following the development of the ftape driver

If you want to follow the development of the ftape driver, you should read the Usenet newsgroup linux.dev.tape. This is really gatewayed from the mailing list linux-tape@vger.rutgers.edu, but since vger is brought to it's knees due to the load of the various Linux mailing lists, I recommend everyone to read the newsgroup instead.

If you are unable to read news, you can subscribe to the TAPE mailing list by sending a mail saying '`subscribe linux-tape`' (*in the body*) to majordomo@vger.rutgers.edu. When you subscribe, you will be sent a greeting mail, which will tell you how to submit real mails and how to get off the list again.

Please note that I do not, repeat **DO NOT**, have any special powers with regard to this mailing list. If you're stuck on the list, don't bother to tell me that. I can only shrug and send you my sympathy (but that won't get you off the list).

4.4 Mixing ftape and floppies

Since both the floppy driver and ftape needs the FDC (and IRQ6), they cannot run concurrently. Thus, if you have mounted a floppy and then try to access the tape drive, ftape will complain that it cannot grab IRQ6 and then die. This is especially a problem when designing a emergency disk for use with ftape. This

solution is to either load the boot/root disk into a ramdisk and then unmount the floppy, or have two floppy drive controllers.

5 The Care and Feeding of Tape and Tape Drives

5.1 Formatting

Before a tape can be used, it must be formatted. The formatting process lays out sector information onto the tape. Other tape interfaces don't typically require formatting. The reason floppy tapes do is that they need to look like a floppy (kinda gross, but what the hey - it works :-).

5.1.1 Can I format my tapes under Linux?

Not yet, but it's being worked on.

Until formatting becomes available under Linux, you'll have to use MessyDOS (arghhh!) instead or buy preformatted tapes. However, some of the preformatted tapes are *not* checked for bad sectors!. If the `ftape` driver encounters a tape with no bad blocks, it will issue a warning. If `ftape` barfs at your preformatted tapes, try out your DOS software. If both the DOS software *and* `ftape` barfs on your tapes, a reformat will very probably cure the problem.

Note that to be able to use your newly formatted tapes under ftape, you must *erase* the tape first:

```
# mt -f /dev/nftape erase
```

5.1.2 Which formatting programs can I use under DOS?

The following are known to work:

- Colorado Memory System's software (`tape.exe`)
- Conner Backup Basics v1.1 and all Windows versions
- Norton Backup
- QICstream version 2
- Tallgrass FileSecure v1.52
- Escom Powerstream 3.0 (`qs3.exe` – QICstream v3?)

These programs are known to be more or less buggy:

- Conner Backup Basics 1.0
- Colorado Windows tape program

- CP Backup (wastes tape space, but is OK apart from that)

As a general rule, most software under DOS should work. The Conner Backup Basics v1.0 has a parameter off by one (someone could not read the QIC-80 specs right!), which is corrected in version 1.1. However, `ftape` detects this, and will work around it. Dennis T. Flaherty (<`dennisf@denix.elk.miles.com`>) report that Conner C250MQ owners can obtain the new v1.1, by calling Conner at 1-800-4Conner (in the US) and ask for an upgrade (for a nominal fee for the floppy). The Windows versions should work fine. Some versions of Colorado's tape program for windows, has an off-by-one error in the number of segments. `ftape` also detect and work around that bug.

Central Point Backup can be used, but it wastes precious tape space when it encounters a bad spot on the tape.

NOTE: If you are running a formatting software under DOS, which is not mentioned here, please mail the relevant info to me (<kjj@pobox.com>), so I can update the list.

5.2 Retensioning

QIC tapes are particularly sensitive to tape stretch. The reason is that floppy tapes are pre-formatted with sector information, whereas other tape types have their sync information written as the data is written to the tape. If the floppy tape stretches and the sync fields get out of sync the result will be read errors. The problem is worse with longer tapes.

It is a good idea to retension new tapes a few times before using them and before formatting them. You should also try retensioning the tape if you are start getting read errors. It might also be a good idea retension the tape before a backup.

5.3 Drive Cleaning

The coating on the tape is an oxide compound. As the tape is dragged across the tape head it has a tendency to leave tiny amounts of residue on the head. You should periodically use a tape cleaner - following the specs for the drive in question. Tape cleaners should be available from any distributer of tapes.

One more additional note about tape cleaning. You might want to clean the drive after the first use of a brand new tape. A brand new tape will typically leave quite a bit of residue the first time it's used.

Thanks to Neal Friedman for the explanation and suggestion that this information be included in the HOWTO.

6 Hardware support

6.1 Supported tape drives

All drives that are both QIC-117 compatible *and* one of the QIC-40, 80, 3010, and 3020 standards should work. QIC-WIDE and Travan drives are also supported (TR-1 is just QIC-80 with 8mm tapes, while TR-2

and TR-3 is a.k.a QIC-3010 and 3020 respectively).

Currently, the list of drives that are known to work with `ftape` is:

Alloy Retriever 250

Archive 5580i, XL9250i

Colorado DJ-10, DJ-20 (aka: Jumbo 120, Jumbo 250)

Colorado 1400

<kosowsky@bellini.harvard.edu> reported a problem doing a 1G backup using taper.

HP Colorado T1000

Works with 3M Travan 400M (TR-1) tapes with 120M tapes. Also reported that mt dies, but with backups using tar it works ok. With cpio, ftape is recommended rather than zftape. (<millner@millner.bevc.blacksburg.va.us>)

Problems have been reported with the drive continually stopping and starting with zftape (<75104.1756@compuserve.com>). This appears to be a problem with the tape going too fast for the computer; the DMA buffers are getting flushed beforee getting filled again. Newer versions of zftape don't do this any more is a suitably fast backup program or large DMA buffers are used (<millner@millner.bevc.blacksburg.va.us>).

Conner C250MQ(T)

The 250Q is reported to generate write error and frequent repositioning. (Frank Stuess at Nacamar Data Communications)

Conner TSM420R, TSM850R

The 400 and 800 models only work with TR-1 tapes.

Conner TST3200R

Works with TR-3 tapes at 1Mbps (ie. 1600M capacity only). Wirks with QIC-WIDE 400M tapes (Sony 5122's?) (<chris@cs.wmich.edu>). Works with TR3, QIC-3010, and QIC-3020 tapes. Comes with a 2MB FDC which the Promise 2300+ 1Mbps controller works (<kjh@pollux.usc.edu>). Works with ftape 2.05; NOTE: ftape 2.03, 2.04, and zftape 1.03 don't work. Booting problems reported with ftape-2.06 and QIC-3020 with the CTC-2MB controller (<merkel@def.gmpt.gmeds.com).

Supposedly works fine with ftape 2.06 using a fast controller to support QIC-3020. Reported that the floppy disk can no longer read low-density floppies. May have to fiddle with IRQ/ports/dms channels (<chris@yakkocs.wmich.edu>).

Conner TST800R

The TST800R works with TR-1, Sony QW5122F (210M) and DC2120 tapes. Reported to work with ftape 2.02e (not 2.03b). It works with ftape 2.05 (<khp@pip.dknet.dk>). Requires the length patch. Reported that you may need to nodify the Makefile to ensure ftape talks to the PRIMARY floppy drive controller (>jzc@primenet.com>). Also, a "Timer expired" error reported (using TR-1 tapes with ftape 2.05-2.07) (<les@amc.uva.nl>).

Conner CTT3200

The CTT3200 is supposedly identical to the Iomega Ditto 3200. It works with the supplised 2Mbps controller (but at 1Mbps), but reported not to work under DOS on some machines. (<jmorris@dtx.net>)

Conner 1.7G Tapestor (TSM1700R)

Works with QIC-WIDE tapes (<pschmidt@slip.net>). Partially works with QIS-3200. Using the HSC-2 controller, the DMA channel needs to be changed (incremented by 1, channel2?, Modify the Makefile). You then need to modify the ftape Makefile to reflect this change. However, ftape seems to be a bit flaky with this (no version number supplied) (<ttait@tiac.net>). It may not work at 2Mbps (QIC-3020) with the HSC controller. The tape died with a messages like "dumb tape stop" and has since been unreliable (<ttait@tiac.net>).

Escom or Archive (Hornet) 31250Q

Exabyte EXB-1500

Work with QIC-3010 tapes. Requires the length patch.

Exabyte TR-3

Irwin 80SX, Insight 80Mb

Iomega 250

Iomega Ditto Tape Insider 420, 1700

Iomega Ditto Tape Insider 3200

This is the unit, that I use. The default jumper settings don't work. Leave the irq and ioport address at the default (6 and 0x370, respectfully), but change the DMA from 3 to 2.

May require the having `{0x08882, 80, wake_up_colorado, "Iomega 3200"},` added to `vendors.h` on older versions of `ftape`.

Problems reported with ftape 2.07 and kernel 1.12.13. With all sorts of combinations of accelerator, etc, the drive may (on some systems) only be accessed once (<erwin@box.nl>). Also, after the first access, the next use of the tape says it is write protected (<erwin@box.nl>, <M.J.Ammerlaan@dutiwy.twi.tudelft.nl>).

There has been one report of a problem where the tape got wound off the end of the spool.

Another problem has been reported with writing archives (with dd) to the tape. It may start fine, but when the driver catches up with dd, it stops the tape and rewinds it to the beginning. Then it starts winding on through the tape ad infinitum. It appears to occur when the driver asks the tape to pause which should cause the tape to move back by 3 segments, but instead is moves back to the beginning of the tape. A bug fix submitted is reported to not solve the solve the problem.

Iomega Ditto 800 Insider

Work with Travan TR1, TR2, or DC2120 tapes (<klein@informatik.uni-rostock.de>). Requires the length patch.

Mountain FS8000

Reveal TB1400

Reported not to work with kernel 1.3.79 and ftape (no version given) or with kernel 1.2.13 and zftape 1.04 (<colin@colina.demon.co.uk>).

Summit SE 150, SE 250

Tallgrass FS300

If you have a Tallgrass FS300 and an AHA1542B, you need to increase the bus-on / bus-off time of the 1542B. Antti Virjo (<klanvi@uta.fi>), says that changing `CMD_BUSON_TIME` to 4 and `CMD_BUSOFF_CMD` to 12 in `linux/drivers/scsi/aha1542.c` will do the trick.

Teac 800

Memorex tape drive backup system

Wangtek 3040F, 3080F

You can always check out the newest list of drives that are recognized by `ftape`, by looking in the file `vendors.h` in the `ftape` distribution.

Although I do not want to endorse one drive type over another, it has been reported that the Colorado DJ-20 drive is rather noisy, when compared to, say, a Conner C250MQ drive ('tis said that the Colorado is 5-10 times as noisy as the Conner drive. Since I have neither, I can't tell for sure).

NOTE: If you have a drive that works fine, but it is not listed here, or if you have corrections to the above information, please send a mail to the HOWTO maintainer (<kjj@pobox.com>).

6.2 Supported special controllers

These dedicated high-speed tape controllers are supported by `ftape`:

- Colorado FC-10, FC-20
- Mountain MACH-2
- Iomega Tape Accelerator II
- 2Mbps controllers (using the i82078-1 fdc)

Support for the FC-10 controller has been merged into the `ftape` driver in version 1.12. See the `RELEASE-NOTES` and the `Makefile` files in the `ftape` distribution. Since of version 2.03 of `ftape`, the FC-20 controller will work (but do check the Release notes!).

The support for the MACH-2 controller was added in `ftape-1.14d`.

To use the Iomega Tape Accelerator II, use `-DMACH2`, and set the right settings for I/O base, IRQ and DMA. This works (by the empirical testing of Scott Bailey <sbailey@xcc.mc.xerox.com>), with at least `ftape-2.02`.

6.2.1 Iomega Ditto Dash and other 2Mbps controllers

The Iomega Ditto Dash, and all other known 2Mbps controllers, use the Intel 82078-1 chip, which can run at 2Mbps. Support for the 82078-1 is currently under development. It is hoped that the support will be completed during January or February.

Current status is that it will work at 1Mbps, with 2Mbps support coming soon (I hope!).

6.3 Unsupported tape drives

- All drives that connect to the parallel port (eg: Colorado Trakker)
- Irwin AX250L / Accutrak 250. (not a QIC-80 drive)
- IBM Internal Tape Backup Unit (identical to the Irwin AX250L drive)
- COREtape light

Generally, ALL drives that connect to the parallel port are NOT supported. This is because these drives uses (different) proprietary interfaces, that are very much different from the QIC-117 standard.

The Irwin AX250L (and the IBM Internal Tape Backup Unit) does not work the `ftape`. This is because they only support QIC-117, but not the QIC-80 standard (they use Irwin's proprietary "servoe (Rhomat)" format). I know nothing about the Rhomat format, nor where to get any info on it. Sorry.

The COREtape light does not accept the initialisation commands, we're feeding it. This pretty much leaves the drive unusable.

The Iomega 2GB Ditto drive does not work with ftape. That particular tape uses a proprietary format that the Claus has not been able to get information on.

6.4 Using an external tape drive with `ftape`

If you have a floppy controller which has a female DB37 connector on the bracket (and some means of delivering power to the drive), you can use it with `ftape`. OK, that sentence was not very obvious. Let's try it this way: Some FDC's (the very ancient one's), have a DB37 connector on the bracket, for connecting to external floppy drives.

If you make a suitable cable from the DB37 connector (on the FDC) to your external tape drive, you can get `ftape` to control your tape drive.

This is because that from a program's view there is no difference between the internal and the external connectors. So, from `ftape`'s point of view, they are identical.

- Pins 20-37: GROUND
- 1: +12 Volt (POWER)
- 2: +12 Volt return (GROUND)

- 3: +5 Volt return (GROUND)
- 4: +5 Volt (POWER)
- 5: 2
- 6: 8
- 7: 10
- 8: 12
- 9: 14
- 10: 16
- 11: 18
- 12: 20
- 13: 22
- 14: 24
- 15: 26
- 16: 28
- 17: 30
- 18: 32
- 19: 34

The power connector is of the "mini" type, sitting on 3.5" floppy drives. The idea appears to be that you plug one of the power connectors from the PSU to this connector on the board. If you want to use just a single cable, you might want to get a 50 wire cable, and use multiple wires for the power lines (and ground, for that matter).

I have received no confirmation from anyone that this works. Let me know your results if you try it.

6.5 PCI motherboards and `ftape`

Unfortunately, some PCI motherboards cause problems when running `ftape`. Some people have experienced that `ftape` would not run in a PCI based box, but ran flawlessly in a normal ISA based 386DX machine. If you have such a problem, please read the `README.PCI` file in the `ftape` distribution.

7 Backing up and restoring data

This section describes some simple uses of `tar` and `mt`.

7.1 Writing an archive to a tape

You can use '`tar`', '`dd`', '`cpio`', and '`afio`'. You will need to use '`mt`' to get the full potential of your tapes and the `ftape` driver. For a start I'd recommend using '`tar`', as it can archive lots of directories and let you pick out separate files from an archive. `cpio` creates smaller archives and is more generally more flexible than `tar`, but is missing some features like volume labels. '`afio`' creates backups where each file is compressed individually and then concatenated. This will allow you to access the files "after" the point of the error. If you use `gzip`ped `tar` files, all data after the point of the error is lost! (to me, this is a pretty good reason for NOT using compression on backups). The choice of which is most appropriate depends on the situation and the features and malfeatures of each of the packages. I recommend taking a look at each package at reviewing the options that each provides. It's possible that this HOWTO may provide more detail on this subject at some point in the future.

To make a backup of your kernel source tree using `tar`, do this (assuming you have the sources in `/usr/src/linux`):

```
# cd /usr/src
# tar cf /dev/ftape linux
```

This will not compress the files, but gives you a smoother tape run. If you want the compression (and you've got `tar` 1.11.2), you just include the `-z` flag(*), eg: '`tar czf /dev/ftape linux`'

For further instructions on how to use `tar`, `dd` and `mt` look at the man pages and the texinfo files that comes with the respective distributions.

(*) `tar` assumes that the first argument is options, so the '`-`' is not necessary, i.e. these two commands are the same: '`tar xzf /dev/ftape`' and '`tar -xzf /dev/ftape`'

7.2 Restoring an archive

OK, let us restore the backup of the kernel source you made in section 7.1 above. To do this you simply say

```
tar xf /dev/ftape
```

If you used compression, you will have to say

```
tar xzf /dev/ftape
```

When you use compression, `gzip` will complain about trailing garbage after the very end of the archive (and this will lead to a 'broken pipe' message). This can be safely ignored.

For the other utilities, please read the man page.

7.3 Testing the archive

tar has an option (`-d`) for detecting differences between two archives. To test your backup of the kernel source say

```
tar df /dev/ftape
```

If you do not have the man page for `tar`, you are not lost (yet); tar has a built-in option list: try '`tar --help 2>&1 | less`'

7.4 Putting more than one backup on a tape

To put more than one backup on a tape you must have the `mt` utility. You will probably have it already, if you got one of the mainline distributions (eg. Slackware or Debian).

Programs like `tar` and `cpio` generate a single Tape ARchive and know nothing about multiple files or positioning of a tape, it just reads or writes from/to a device. `mt` knows everything about moving the tape back and forth, but nothing about reading the data off the tape. As you might have guessed, combining `tar` or `cpio` with `mt` does the trick.

By using the `nrft[0-3]` (`nftape`) device, you can use '`mt`' to position the tape the correct place ('`mt -f /dev/nftape fsf 2`' means step over two "file marks", i.e. `tar` files) and then use `tar` or `cpio` to read or write the relevant data.

The most common use of the non-rewinding device is to append another backup to an existing tape. Here are the specific steps with a little explanation thrown in for good measure.

- Insert a tape into the drive. On some devices this may cause the tape to be rewound.
- Issue an End-of-Tape command to the NON-rewinding device.

  ```
  mt -f /dev/n???? eof
  ```

  The tape should now be positioned at the End-of-Tape (EOT), which is actually between to End-of-File (EOF) marks. The tape won't move unless a program opens the device, closes the rewinding device, removes the device driver from kernel memory (rmmod) or ejects the tape. Using '`mt eof`' may be faster on QIC tapes.
- The next tape operation will start at the End-of-Tape (EOF) mark. If you perform a write, it will append a new 'file'. If you perform a read it will fail with EOF. The EOT mark on mast tape formats is actually two consecutive EOF marks. When appending to a tape the second EOF mark is overwritten with new data, leaving a normal EOF. If the second EOF is present, it is interpreted as a logical EOF. Writing the EOF marks is handled by either the device driver or the hardware when a close() is performed.
- Here's where you write the actual data to the tape.
- Here's the important part. **Now rewind the tape**. Both `ftape` and `zftape` cache some information that belongs in the header segments on the tape and update those header segments **only when the tape is rewound**. This caching is necessary because rewinding the tape and updating the header segments takes a conspicious amount of time. The drawback of this caching is that you will lose information if you have written to the tape and not rewound the device.

7.5 Appending files to an archive

"Is there a way to extend an archive – put a file on the tape, then later, add more to the tape?"

No. The `tar` documentation will tell you to use '`tar -Ar`', but it does not work. This is a limitation of the current `ftape` driver.

7.6 Mount/unmounting tapes

Since a tape does not have a "filesystem" on it, you do not mount / unmount the tape. To backup, you just insert the tape and run your '`tar`' command (or whatever you use to access the tape with).

8 Creating an emergency boot floppy for `ftape`

This section was written by Claus Tøndering <`ct@login.dknet.dk`>.

Once you are the happy owner of a tape drive and several tapes full of backups, you will probably ask yourself this question: "If everything goes wrong, and I completely lose my hard disk, how do I restore my files from tape?"

What you need is an emergency floppy disk that contains enough files to enable you to boot Linux and restore your hard disk from tape.

The first thing you should do is to read "The Linux Bootdisk HOWTO" written by Graham Chapman <grahamc@zeta.org.au>. That document tells you almost everything you need to know about making an emergency floppy boot kit. The paragraphs below contain a few extra pieces of information that will make your life a bit easier when you follow Graham Chapman's procedures:

- You don't really need `/etc/init`, `/etc/inittab`, `/etc/getty`, and `/etc/rc.d/*` on your floppy disk. If Linux doesn't find `/etc/init`, it will start `/bin/sh` on your console, which is fine for restoring your system. Deleting these files gives you extra space on your floppy, which you will probably need.
- Find a small version of `/bin/sh`. They are frequently available on the boot floppies that come with a Linux distribution. This again will give you extra space. I'd suggest `ash`, which is extremely small (approx 62Kbytes), and yet very `bash` compatible.
- The `/etc/fstab` you include on your floppy disk should look something like this:

```
/dev/fd0        /               minix   defaults
none            /proc           proc    defaults
/dev/hda        /mnt            ext2    defaults
```

  Once you have booted from your floppy, give the command:

```
mount -av
```

- Make sure your floppy drive is not mounted when you access the streamer tape! Otherwise you may get the following error message:

  ```
  Unable to grab IRQ6 for ftape driver
  ```

  This means that you **MUST** load the floppy into a RAMDISK.

  This has the unfortunate consequence that the programs needed to restore the files from the tape can not be located on a separate floppy disk. You have two options here:

  1. You place `tar` (or `cpio` or `afio` or whatever other backup program you use) on your root floppy disk. (This is where you'll need all the extra space created in the steps above.)
  2. Before you start restoring from tape, copy `tar` (or `cpio` or `afio` or whatever) to your hard disk and load it from there.

- Apart from your backup program, you will probably need `mt` on your root floppy as well.
- Make sure your ftape device (typically `/dev/nrft0`) is present on your boot floppy.
- Finally: **TRY IT OUT!** Of course, I don't recommend that you destroy your hard disk contents to see if you are able to restore everything. What I do recommend, however, is that you try booting from your emergency disks and make sure that you can at least make a file listing of the contents of your backup tape.

9 Frequently Asked Questions

This is a collection of questions that get asked once in a while, which could fall into the category of FAQ's. If you feel that there is some question that ought to be added to the list, please feel free to mail me (but do include an answer, thanks!).

9.1 Does `ftape` support the Iomega 2GB tape drive?

Sorry, no, it doesn't. Iomega uses a proprietary data format on their 'Ditto 2GB' tape cartridges. The maintainer of `ftape` has been unable to get the necessary information to include support from the vendor.

9.2 How fast is `ftape`?

You can achieve quite respectable backup and restore speeds with `ftape`: a Colorado DJ-20 and an Adaptec 1542CF controller, has been measured at 4.25Mbyte/min sustained data transfer rate (no compression) across a 70Mbyte tar archive, while comparing the archive on the tape with data on an IDE disk. The speed of `ftape` is mostly dependent on the data transfer rate of your FDC: The AHA1542CF has a "post-1991 82077" FDC, and it will push 1Mbit/sec at the tape drive. If you have an FDC which can only deliver 500Kbit/sec data rates, you will see half the transfer rate (well, roughly).

9.3 How do I change the trace-level?

There are three ways you can do this (in order of personal preference).

While we're at it, here are the meanings of the various trace levels.

- 0 Bugs
- 1 + Errors
- 2 + Warnings
- 3 + Information
- 4 + More information
- 5 + Program flow
- 6 + FDC/DMA info
- 7 + Data flow
- 8 + Everything else

9.3.1 Using insmod to change trace-level

If you are using the modules mechanism to load the `ftape` driver, you can specify the tracing level as an option to the insmod command.

```
/sbin/insmod ftape.o tracing=<tracing-level>
```

9.3.2 Using mt to change trace-level

The `ftape` driver has a hack in it that allows the `fsr` option in `mt` to be used to set the tracing level. `zftape` does not have this hack.

```
mt -f /dev/ftape fsr <tracing-level>
```

The use of the `fsr` command in `mt` is a *hack*, and will probably disappear or change with time.

9.3.3 Recompiling to change trace-level

The file `tracing.c` contains a line `int tracing = 3;`. Change the 3 to whatever is appropriate and recompile.

9.4 Can I exchange tapes with someone using DOS?

No. The DOS software conforms to the QIC-80 specs about the layout of the DOS filesystem, and it should(?) be a small problem to write a program that can read/write the DOS format. In fact, I'd bet that creating a nice user interface would be a bigger problem.

9.5 How do I '....' with `tar`?

These are really `tar` questions: Please read the `man` page and the `info` page. If you have not got it either, try '`tar --help 2>&1 | less`'.

If your version of `tar` is v1.11.1 or earlier, consider upgrading to v1.11.8 - This version can call `GNU zip` directly (i.e.: it supports the `-z` option) and has an elaborate help included. Also, it compiles right out of the box on Linux.

9.6 `ftape` DMA transfers gives ECC errors

Sadly to say there are some SVGA cards and Ethernet cards that do not decode their addresses correct. This typically happens when the `ftape` buffers are in the range `0x1a0000` to `0x1c0000`. Somehow, the DMA write cycles get clobbered and every other byte written gets a bad value (`0xff`). These problems are reported to happen with both SVGA and Ethernet cards. We know of at least one (bad?) ATI 16bit VGA card that caused this.

The easiest solution is to put the card in an 8bit slot (it is often not enough to reconfigure the card to 8bit transfers). Moving the `ftape` buffer away from the VGA range is only a partial solution; All DMA buffers used in Linux can have this problem! Let us make this one clear: This has nothing to do with the `ftape` software.

9.7 `insmod` says the kernel version is wrong

The `insmod` program can check the kernel version against the version that `ftape` was compiled for in two ways: It can directly compare the kernel version number recorded in the ftape module against the version of the running kernel, or, if both the kernel and `ftape` is compiled with versioned symbols, compare the version of the used kernel symbols.

If you have upgraded your version of GCC to v2.7.0 or later, you must recompile the modules utilities with gcc v2.7.x.

Newer versions of `insmod` allows you to "force" insertion of a module into the kernel, even though the version string is incorrect.

9.8 What is this versioned symbols stuff anyway?

When you say 'yes' to CONFIG_MODVERSIONS during '`make config`', all the symbols exported by the kernel, i.e: the symbols that the loadable modules can "see", are augmented to include a checksum across

the types of the call/return parameters. This allows `insmod` to detect whether the definition of a variable or function in the kernel has changed since the time when `ftape` was compiled.

This ensures a high degree of safety, such that you do not crash the kernel because you used an outdated module with your kernel.

If you enable CONFIG_MODVERSIONS in the kernel, make sure you have '-DMODVERSIONS -include /usr/include/linux/modversions.h' uncommented in the MODULE_OPT line in the `ftape` Makefile. Conversely, if you do not have CONFIG_MODVERSIONS enabled, make sure you have it commented out.

9.9 `insmod` says that kernel 1.2.0 and 1.2.0 differ

Did you remember to apply the `ksyms.c` patch to the kernel? If not, read the `README.linux-1.2` file in the source distribution.

9.10 `ftape` says "`This tape has no 'Linux raw format'`"

You get this complaint if you haven't *erased* your freshly formatted tape. This is because `ftape` expect a "magic header" on the tape, to be able that it is allowed to interpret the header segment in its own way (eg: file marks). To remove the problem, say '`mt -f /dev/nftape erase`'

9.11 Where can I find the `tar/mt/cpio/dd` binaries/sources/manpages?

All of these tools have been developed by the GNU project, and the source (and man page) can be fetched from just-about any ftp site in the world (including `ftp.funet.fi`, `tsx-11.mit.edu`, and `sunsite.unc.edu`). In any case they can be fetched from the official GNU home site: `prep.ai.mit.edu [18.71.0.38]:/pub/gnu`. The latest versions (as of September 12 1996) are:

```
cpio:   2.4.2 (cpio-2.4.2.tar.gz)
dd:     3.13 (fileutils-3.13.tar.gz)
mt:     2.4.2 (cpio-2.4.2.tar.gz)
tar:    1.11.8 (tar-1.11.8.tar.gz)
gzip:   1.2.4 (gzip-1.2.4.tar.gz)
```

They all compile out of the box on Linux `v1.0.4` / `libc v4.5.19` / `gcc v2.5.8`.

9.12 Where can I obtain the QIC standards?

If you wish to help developing `ftape`, or add some utility (e.g. a tape formatting program), you will need that appropriate QIC standards. The standard(s) to get is: QIC-80, -117, -3010, and 3020. QIC-117 describes how commands are sent to the tape drive (including timing etc), so you would probably never need it. QIC-80/3010/3020 describes higher level part, such as tape layout, ECC code, standard filesystem. You can get the QIC standards from the following address:

```
Quarter Inch Cartridge Drive Standards, Inc.
311 East Carrillo Street
Santa Barbara, California 93101
Phone: (805) 963-3853
Fax:   (805) 962-1541
```

Note: They are registered as 'Freeman Associates, Inc' in the phone book.

9.13 What block-size should I use with `tar`

When using compression, and in all general, it can be a benefit to specify to `tar`, that it should block the output into chunks. Since `ftape` cuts things into 29Kbyte blocks, saying '`-b58`' should be optimum.

"Why 29Kbyte?", I hear you cry. Well, the QIC-80 standard specifies that all data should be protected by an Error Correcting Code (ECC) code. The code specified in the QIC-80 standard is known as a Reed-Solomon (R-S) code. The R-S code takes 29 data bytes and generates 3 parity bytes. To increase the performance of the ECC code, the parity bytes are generated across 29 1Kbyte sectors. Thus, `ftape` takes 29Kbytes of data, adds 3Kbytes of ECC parity, and writes 32Kbytes to the tape at a time. For this reason, ftape will always read and write 32K byte blocks to be able to detect (and correct) data errors.

If you are curious, and wish to know more, look in the `ecc.c` and `ecc.h` files, for an explanation of the code and a reference to a textbook on Reed-Solomon codes.

9.14 `ftape` detects more bad sectors than DOS on QIC-3020 tapes

If you look at the difference, you will notice that `ftape` always detects 2784 sectors more than DOS.

The number that ftape reports is correct (of course `:-)`. Each correctly formatted QIC-3020 tape has 2784 sectors at fixed positions that are marked in the bad sector map. To quote from the specs:

"Tracks 5,7,9,11,13,15,17,19,21,23,25 and 27 within 4 segments of either EOT or BOT are prone to increased error rates due to hole imprints. Therefore, these regions shall be mapped as bad at format time and entered in the bad sector map by indicating that all sectors within the identified segments are bad."

This gives 12 tracks * 2 * 4 segments * 29 sectors == 2784 sectors.

So ftape choose to report the real number of sectors that cannot be used on the tape, while DOS gives a more optimistic number giving a better indication of tape quality. (ftape's behavior might change in the future to detect correct formatting and display the separate numbers. It has rather low priority though).

QIC-3010 are alike QIC-3020 tapes regarding this.

9.15 Syslogd works overtime when running ftape

The compile-time options NO_TRACE and NO_TRACE_AT_ALL in ftape control the amount of system logging. Add whichever is appropriate to the FTAPE_OPT line in the Makefile and recompile.

9.16 'Shoeshining'

There been a few reports of 'shoeshining'. This is when the tape just seems to run back and forth endlessly. This has been seen on a Jumbo 250 (74407.3051@compuserve.com) and on an Iomega 250 Ditto Insider (tom@opus.cais.com). In the latter case it has been narrowed own to using an ELF Linux and running off a SCSI hard disk (connected to an Adaptec 1542cf). Please contact me if you have an update to this problem.

9.17 Trying to compile `ftape` gives me the error '"modversions.h: no such file or directory'

The `modversions.h` file is created when the kernel is compiled with the configuration item `CONFIG_MODVERSIONS` turned on. With this option enabled, the file will be created during the `make dep` step.

One more handy tip is that a `make mrproper` will remove `/usr/include/linux/modversions.h`. You will need to reconfig the kernel and do a `make dep` to get the file back.

9.18 How does 'mt eom' work when you've started overwriting a tape in the middle?

(EOM is "End Of recorded Media", the position right after all data already recorded to the tape)

One cannot use tape "files" like files on an ordinary file system.

In principle, a tape doesn't allow anything but appending new data at EOM. However, if one positiones just in the middle of the already recorded data AND starts writing, then the driver first deletes all following files (thus moving the EOM to the actual position) and then starts writing.

Thus, the new EOM after finishing the write process, is then after the newly recorded data.

One of the consequences of the above is, of course, that writing to the tape in the middle of the already recorded area, is destructive in the sense, that it not only overwrites the "file" the tape is positioned at, but also deletes all following files.

9.19 Help! I'm getting 'dmaalloc() failed' in my syslog file.

You should only see this is you are trying to `insmod` the `ftape.o` module. Try running `swapout` first. It is provided with the standalone `ftape` source. It doesn't appear in the `ftape` source that's provided with the kernel.

Here's an example of how you can set your rc.local file to use it.

```
# Install the Floppy Tape Driver
if [ -f /boot/modules/`uname -r`/misc/ftape.o ]; then
    echo Installing ftape for Linux `uname -r`
    swapout
```

```
        insmod /boot/modules/`uname -r`/misc/ftape.o
fi
```

Please note that you won't have this type of problem if you compile the `ftape` driver into the kernel.

9.20 Is it ok that I'm not hearing the tape move when I do a fsf or a bsf with mt?

Yes. The driver merely updates an internal counter when those commands are issues. The tape should move to the proper location on the next read or write access to the tape drive.

10 Debugging the `ftape` driver

10.1 The kernel/`ftape` crashes on me when I do '...' - is that a bug?

No, that is a feature `;-)`

Seriously, reliable software do not crash. Especially kernels do not or rather **should** not crash. If the kernel crashes upon you when you are running `ftape`, and you can show that it is `ftape` that is messing things up, regard it as a Bug That Should Be Fixed. Mail the details to the maintainer (<`kjj@pobox.com`>) and to the tape list.

10.2 OK, it's a bug ...ehhh... feature - How do I submit a report?

First, make sure you can reproduce the problem. Spurious errors are a pain in the ass, since they are just about impossible to hunt down `:-/` This is a quick check list:

- Kernel version, and patches applied
- `ftape` version
- tape drive model / manufacturer
- Expansion bus type (EISA, ISA, PCI, or VL-bus)
- What you did to expose the problem
- What went wrong on your system.
- Do not delete the kernel and the `ftape.o` file. I might want you run try some patches out or run a different test on your system.

Increase the tracing level to 7 (just below maximum tracing) and run the offending command again. Get the tracing data from the kernel log or `/proc/kmsg`, depending on where you harvest your error messages. Try to look at what `ftape` spews out at you. It may look in-comprehensible to you at first, but you can get

valuable information from the logfile. Most messages have a function name prepended, to make it easier to locate the problem. Look through the source, don't just cry "WOLF!", without giving it a try. If your version of the kernel (or `ftape` for that matter), is "old", when compared to the newest version of the kernel, try to get a newer (or even the newest) kernel and see if the problem goes away under the new kernel. When you post your problem report, include the information about ftape version, kernel version, expansion bus type (ISA, VL-bus, PCI or EISA), bus speed, floppy controller, and tape drive. State exactly what you did, and what happened on your system. Some people have experienced that `ftape` would not run in a PCI based box, but ran flawlessly in a normal ISA based 386DX machine (see section 6.5 on PCI machines above)

Also, please think of the poor souls who actually *pay* the their Internet access (like me): avoid posting a (huge) log from the `ftape` run, without reason. Instead, you could describe the problem, and offer to send the log to the interested parties.

Send your bug report to <`linux-tape@vger.rutgers.edu`>. You might also want to mail the bug to <`claus@momo.math.rwth-aachen.de`>.

11 Contributions

The following is a list of notable folks that have contributed to `ftape` and it's HOWTO document. This is a recent addition added by someone coming in midstream. My sincerest apologies if I've inadvertently left someone important off the list.

`Kai Harrekilde-Petersen` <khp@dolphinics.no>: The previous maintainer of `ftape` and the HOWTO.

`Andrew Martin` <martin@biochemistry.ucl.ac.uk>: Many additions to the HOWTO.

`Bas Laarhoven` <bas@vimec.nl>: The original author of `ftape`.