Utilizing 5.25" or 3.5" media on your Tandy/Radio Shack computer system.
by Frank Durda IV

Disclaimer: In developing the solution for the Tandy 16A/16B/6000 XENIX systems, I have only tested the Sony MP-F73W-70D and the MF504B-347UA, and I have had no problems using these two drives together or separately. Your results may vary. This information is provided on an "AS IS" basis, and should not be considered supported by anybody, nor is it guaranteed to identify all changes that must be made or all incompatibilities that may arise. I am not responsible for anything that doesn't work, or if something fails or malfunctions or if there is any data loss resulting from changes made based on any of the information given here. Use this information at your own risk.

This page is still being completed. Excuse the dust.

If you own one of the non-IBM-compatible Tandy or Radio Shack computers made during the 1970s or 1980s, undoubtedly you have noticed that good media for these drives is becoming hard to find. You may also be having troubles because these older 8" and 5.25" drives are wearing out. If you would like to migrate to 5.25" or even 3.5" drives, then these pages can help you.

The following information will allow you to add or substitute 5.25" high capacity floppy drives in place of 8" double sided drives in your 16A/16B/6000 XENIX system. For certain computer systems and operating systems, you can also change from 8" or even 5.25" drives and switch to 3.5" drives. These drives can be used with the original drives, or you can get rid of the original drives entirely.

What is the advantage of switching drives?

Reliability is the biggest advantage. Just about everybody will agree that the 5.25" and 3.5" floppy diskette drives and the media sold for them these days are far superior to anything ever available for the 8" or older double- or single-density 5.25" floppy diskette drives.

The next advantage is availability. The 8" floppy diskette drives are getting pretty rare and you don't want to get in a situation where you don't have at least two 8" drives remaining before you have migrated all of your important data to newer media. If your only 8" drive fails completely and you haven't migrated your important data to newer media, you will be forced to obtain another 8" drive before you could even consider migrating to 5.25" or 3.5" drives.

Chances are, you have software on your existing 8" or low-capacity 5.25" floppies that you want to preserve. Moving data on 8" media over to 5.25" media and maintaining most if not all of your diskette-based software on 5.25" media will prevent you from being trapped by having your data on a diskette size that you can't find media for anymore and that you can't find replacement drives for. In my case, all the important 8" diskettes I own are copied onto 5.25" media (at minimum), and the 5.25" diskettes are used whenever possible. Typically I only have to use the 8" diskettes if I have to boot from floppy on an unmodified system, and if that 8" boot diskette becomes damaged, I can always make a replacement one from the safe-copy I have on stable 5.25" media.

Another key advantage of migrating to newer drives and media is the cost-savings. Pull out your handy Radio Shack catalog (I used the 1998 edition as a price reference). Ten 5.25" HD DS disks cost $7.99, (about 79 cents each, and you can probably find them for quite a bit less elsewhere). I can't even find anyone selling 8" diskettes anymore, but the last price I did locate in a 1994 catalog showed ten 8" diskettes costing $39.95, or nearly $4 each. If you buy all of your diskettes at those prices, it will take buying about four boxes of 5.25" diskettes instead of 8" diskettes to

completely pay for a 5.25" drive, and a quality drive can be purchased for $40.

The general rule-of-thumb is that if the computer system came with 8" drives, you can replace them with 5.25" 1.2Meg floppy diskette drives without the operating system being aware of the change. Similarly, the 5.25" 150K, 180K and 360K floppy diskette drives can be replaced with 3.5" 720K or 720K/1.44M floppy diskette drives without making any software changes. For Model 16A/16B/6000 (or upgraded Model II/12) systems running XENIX, it is possible to use 3.5" 1.44 Meg floppy diskette drives in addition to 5.25" 1.2Meg floppy diskette drives, but the XENIX operating system and utilities must be altered to support 3.5" drives. (There are no equivalent modifications for other Tandy/Radio Shack operating systems for the Model II/12/16A/16B/6000 family that would allow those systems to utilize 3.5" floppy diskette drives, but 5.25" 1.2Meg floppy diskette drives can be used on these operating systems transparently.)

Depending on the system that you are trying to attach newer drives to, you may need to obtain additional hardware or software components. Here is a table of what systems can accept alternate drives and what major items will be needed.

Computer Model(s)	Operating System	Original Manufacturer Drives	Alternate Drives possible?	Data Pin-out Conversion Cable needed?	Software changes needed?
II/12/16A/16B/6000	TRSDOS 2.0	8" SSDD (620K) or DSDD (1.2M)	5.25" DSHD (1.2M)	Yes	TRSDOS 2.0B "Thinline" patches
II/12/16A/16B/6000	TRSDOS-II 4.1.x/4.2.x and TRSDOS-16	8" SSDD (620K) or DSDD (1.2M)	5.25" DSHD (1.2M)	Yes	No
16A/16B/6000 and II/12+68K Upgrade	XENIX (3.x, 1.x Tandy Releases)	8" SSDD (620K) or DSDD (1.2M)	5.25" DSHD (1.2M)	Yes	No
16A/16B/6000 and II/12+68K Upgrade	XENIX (3.3 - unofficial version)	8" SSDD (620K) or DSDD (1.2M)	5.25" DSHD (1.2M) or 3.5" DSHD (1.44M)	Yes	Yes (only required if 3.5" drives are used)
I/III/4/4D/4P	TRSDOS 2.x, TRSDOS 1.3, LDOS 5.x, TRSDOS 6, LS-DOS 6 (and most third-party Model I/III OSes)	5.25" SSDD (180K) or DSDD (360K)	3.5" DSDD (720K)	No	No (TRSDOS 1.3 only utilizes 180K, others can use full 720K)

Getting the items you will need

If you want to add 5.25" or 3.5" drives externally, you should obtain an enclosure to mount the drives in. An external enclosure with its own power supply is absolutely required if you are trying to add drives to a Model II, 12, 16A, 16B or 6000, since none of these computers have the traditional four-prong power connectors used on 5.25" diskette drives.

Enclosures are available from stores that stock parts for people who wish to assemble their own computer systems, and from stores that custom-build systems from parts that they keep in stock. Frys, a California chain with two stores in the Dallas Fort Worth area of Texas sells this sort of enclosure, but there are many other sources as well. Such one- or two-drive external enclosures are usually built for external 5.25" SCSI drives (and overpriced accordingly), but they will work just fine in this application. Removing the SCSI connector from the enclosure provides a place for the external floppy cable to enter the enclosure. The power supply for a two-drive unit should be rated for at least 40 watts.

The type of data cable you need depends on the computer. If the computer uses 5.25" floppy diskette drives now, adding 3.5" drives is accomplished either by making or obtaining a cable that has both 5.25" edge and 3.5" DIP (dual-inline pin) connectors. Alternatively, some vendors sell an adapter that allows a 3.5" drive to be installed in a 5.25" drive bay, and these adapters frequently come with a small circuit board that converts the DIP connector that the 3.5" drive uses into an edge connector that matches what would be on a cable for a 5.25" drive. Some of these adapters even take care of converting the mini-power plug on the 3.5" drive into the type used on 5.25" drives. Using such an adapter would mean that a plain 5.25" cable could be used for both 3.5" and 5.25" drives. You may still have to make or obtain a longer cable, particularly if the drives are to be mounted in an external enclosure.

The cable used in IBM-compatible computers which contains folds and twists of some of the wires in the cable are not needed and might actually prevent these drives from working on these non-PC computers. These "twist" cables are not recommended for this application.

If the computer came with 8" drives, you have to do more work than if the computer originally had 5.25" drives. You have to make a custom cable that converts the 50-pin cable that the 8" drives use into a 34-pin cable that the 5.25" and 3.5" drives use. I am not aware of any place where you can order this cable pre-built. Instructions on how to build one of these conversion cables yourself are discussed later in this document.

Why any old 5.25" or 3.5" floppy diskette drive may not work

Finding modern 5.25" and 3.5" drives that can be used with the non-IBM-compatible Tandy computer models is a problem, entirely due to changes IBM (in conjunction with Western Digital) made in how the mini-floppy diskette drives communicated with the host diskette drive controller. (The term "mini-floppy" was used to identify 5.25" drives back in 1980, as compared to the full-sized, IBM 374x-compatible 8" drives.)

For both the 5.25" and the 3.5" drives, you *must* be able to disable a behavior that is the default for IBM-compatible computers but is alien to these older non-IBM-compatible computers. In particular, IBM-compatible drives use the READY line from the floppy drive to not only signal whether the drive has media and is spinning at the correct speed, but the drive also uses the READY signal to indicate if the diskette in the drive has been changed since the last drive operation was performed.

The 8" floppy drive 50-pin cable actually has a separate signal to report disk changes (called DISK CHANGE), but the mini-diskette cabling system that dates back to the mid-1970s did not include this signal. The drives used in the Tandy Model I, III, 4/4D/4P and color computer systems were all unable to report that diskettes had been changed, so the operating systems had to rely on fairly primitive and unreliable methods to detect when a diskette had been changed, and mainly had to rely on the human to not change diskettes unless the operating system or the application said it was time to do so.

When designing the IBM Personal Computer, IBM apparently wanted to utilize the mini-diskette drives already made by several vendors (including Tandon, eventual maker of the drives used in the original IBM PC and already a supplier and licensor of 5.25" drive designs to Tandy) and the established mini-disk cabling system, but IBM also wanted the operating system to be able to find out about media changes.

To accomplish this goal, drives made for the IBM PC (and subsequent models "compatible" with the IBM PC) will falsely return a NOT READY signal even if media is in the drive, in the event that the diskette has been removed and replaced recently. The operating system clears this false "NOT READY" indication by forcing the drive to reposition the heads by at least one track while ignoring the NOT READY status. If the drive was simply trying to report a media change, moving the heads causes the drive to now appear to be READY. If the drive really isn't ready, the NOT READY indication will persist even after the heads are moved.

This is why empty floppy drives in IBM PC (and compatible) computers make so much noise when there is no diskette in the drive if you tell the system to examine that drive. This noise is caused by the BIOS or DOS-compatible operating system disk driver ordering the heads to be moved back and forth several times when a NOT READY error is detected, hoping to clear any disk-change condition that may exist before finally giving-up and returning an error to the software that called the diskette driver.

Of course, none of the Tandy Model II/12/16A/16B/6000 operating systems are aware that they need to do this little dance with the drive heads to clear a false not-ready error, as they have this separate wire that is supposed to be reporting disk changes and the ready wire is used only for READY. Similarly, the Model I/III/4/4D/4P/CoCo computers assume that if the drive says it isn't ready, it really isn't ready and there isn't any point of doing anything else with that drive.

Fortunately, some manufacturers realized that IBM was creating yet-another incompatibility, and most drive manufacturers initially provided either a jumper option or a zero-ohm resistor on their drives that could be removed, added or repositioned to make the drives not use the READY line to report diskette changes as mini-disk drives had done previously. A similar option was made available on 3.5" drives when they came to market, since non-IBM-compatible computers remained on the market, such as the Apple Macintosh, one of the earliest adopters of 3.5" media.

In order to use a 5.25" or 3.5" drive on the Tandy non-IBM-compatible systems, you *MUST* be able to force the READY line to be used only for READY. Therefore, the drives must be able to adjust this behavior.

Unfortunately, most drives manufactured these days only provide you a set of drive select jumpers or a slide switch labeled 0, 1, 2, 3 or 1, 2, 3, 4, or sometimes DS0, DS1, DS2, DS3), as all the jumpers used by non-IBM-compatible computers have been cost-reduced out of floppy diskette drive designs over the years as essentially everybody is making IBM-compatible computers.

On some really-cheap drives, you don't even get a drive select control and the drive is permanently set to respond at DS1 (Drive 1), which is where the IBM PC always set its drive jumpers. To make one of the drives respond as Drive 0 in the IBM-PC, some of the wires are twisted-around in the drive cable on most IBM-compatible computers. In 1980, apparently the thinking in handling drive select via the cable was that the more expensive cable was less expensive in the long run than having to stock two types of drives in the IBM repair center inventories: those drives with the jumpers pre-set to be Drive 0 and those pre-set to be Drive 1. At the time, IBM thought that making their field techs change jumpers on a single type of drive would be a big support problem. (Tandy was also guilty of short-sightedness in this area, with their early 5.25" drives jumpered to respond to any drive select signal, and the floppy diskette drive data cable connectors had different pins pulled-out of each connector so that each was a different drive select number.)

All that means is that if the drive you are considering doesn't have any jumpers at all or just drive-select jumpers or option shunts, you cannot use that drive here.

If you do come across a drive with jumper options of one sort or another, you are looking for a jumper marked "DC", "READY" or something similar. You want this jumper set opposite of the way it is set for use in an IBM-compatible computer. For IBM compatible computers, it would usually be set to the "DC" or "DCH" position, so you want to set it to the "RDY" or "SR" or "READY" position. For example, on the MF504B-347UA (5.25" 1.2Meg) drive, the jumper PM2 has three pins, one marked SR (Standard Ready) and one on the opposite end of the set of three pins is marked DC. By moving the jumper to the SR position, the drive no longer reports diskette changes and can be used on non-IBM-compatible computers, like the Tandy 6000.

In researching how these alternate drives could be used with the 16A/16B/6000 systems, I used Mitsubishi MF504B-347UA for the 1.2Meg 5.25" drive, and I used a Sony MP-F73W-70D 1.44 Meg 3.5" drive. Both of these drives were used in Tandy computers in the mid to late 1980s. If you have old Radio Shack catalogs, you can find a picture of both in the 1988 catalog. The Sony 3.5" drive was used in the Tandy 4000 and is the type with the wide eject button under the diskette slot (not the model with the blue eject button used in later years. The Mitsubishi 5.25" drive was used over several years and can be found in photos of the 12MHz, Tandy 3000 and 3000HL in the 1988 catalog.

On the MP-F73W-70D (3.5" 1.44Meg) drive, on initial inspection it had only a slim drive select switch accessible from the side with no other jumpers. However, on the silk screen writing on the circuit board, I located a zero-ohm resistor in a position labeled "SL5 B READY". Next to it was an empty position for a component marked "A". By removing the zero-ohm resistor from the position "B" and installing it in the "A" position, the 3.5" drive stopped reporting disk change errors via the READY line. Like you, I didn't and probably could not get a manual that would have told me such an adjustment was possible, so depending on the drive you are able purchase, you may have to do

some research.

Obviously, both of the drives I studied are old now and not likely to be available at your local computer parts store. However, more modern drives are still available with the needed jumpers. A search through the odd drives I find around here turned-up the following drive models as ones that can potentially be used, but have *not* been tested unless the entry in the table specifically states that this type of drive was tested.

Drive type	Manufacturer	Model Number	What to change
3.5"	Sony	MP-F73W-70D	About 1.0" from edge connector, a zero-ohm shunt/resistor and an empty position marked "SL5" "A" "B". Position "A" disables disk change reporting via READY line. (TESTED)
3.5"	Newtronics/Mitsumi	D359T3	About .5" from edge connector, a zero-ohm shunt/resistor and an empty position marked "D.C/RDY/34" (Pin 34 is READY) Move the shunt/resistor to the RDY position.
3.5"	Panasonic	JU-257A213P	Under the head motor (round device on back) is a switch marked "RY or DC". Set the switch in the "RY" position.
3.5"	Panasonic	JU-257A135P	The blank side of the circuit board faces out, but a narrow slot marked "SW1" "RY" "DC" provides jewelers-screwdriver access to a slide switch on the component side. Move switch to the "RY" position. If the switch is absent, a zero-ohm shunt/resistor at R53 (DC) and R52 (RY) on the component side is installed by the manufacturer instead, and this part can be moved to the R52 position (RY) to obtain the desired setting.
5.25"	Mitsubishi	MF504C-347UA	Along the head track is a row of jumpers. Move the jumper in DC and put it in SR. (TESTED. Jumper settings were TD MS SR-PM2 RI SB DSx)
5.25"	Newtronics/Mitsumi	D509V3	On top of drive is an opening allowing access to a block of jumpers near the edge connector. Move jumper from the CH to RDY position (horizontal). Tweezers needed.
5.25"	TEAC	FD-55GFV-07-U	Next to terminating resistor pack, locate three pins and one jumper marked "DCRY". Move jumper to "RY" position.
5.25"	TEAC	FD-55BR-114-U	Next to terminating resistor pack, locate an "L-shaped" configuration of jumper pins with (as you view from the edge-connector side) RY written horizontally and DC written vertically. Add jumper to RY position (existing jumper may not be present as the DC staking pin may be absent. Not having a jumper apparently defaults to DC.)

The Drive Select jumpers or switch (may be labeled DSx) should be set as you prefer.

For Model I/III/4/4D/4P systems, once you have identified a compatible drive, altered the jumpers as needed and provided any 3.5" to 5.25" cable or cable adapter, your work should be complete, as the new drive can be treated exactly the same as the drive you replaced. If you switched from a single-sided drive, you can now format new media double-sided. It is suggested that you make exact copies of critical and master software diskettes in the same format as you originally got them, even if you are only using a fraction of the storage on the newer diskettes.

Chances are that the new drives are 80 track drives and the ones you replaced were 35, 40 or 77 track drives, and most third-party Model I/III/4/4D/4P operating systems allow you to format the full 80 tracks and utilize the full 720K of storage. The Tandy operating systems (TRSDOS 2.x and 1.x) typically do not allow you to specify drive sizes other than those originally sold with that operating system. These systems will work with these new drives without change, but won't be able to use all the space on each new diskette.

If you can't locate 720K 3.5" media any more (as even some office supply stores now only carry them as a special-order item), 1.44Meg 3.5" media can be used on Model I/III/4/4D/4P systems, provided that you cover the media

density hole with electrical tape or duct tape (opaque) on both sides of each diskette used. This hole is located opposite of the write-protect switch. Since most 1.44Meg diskettes come pre-formatted, you should completely erase the 1.44Meg media before trying to use it at the lower recording capacity, and a bulk-eraser made for diskettes, audio or video tapes will erase diskettes. These devices are sold at most electronics stores.

For the Model II/12/16/16B/6000/6000HD systems, you have more work to do, so keep reading.

Model II/12/16/16B/6000/6000HD Drive select choices

On a Model 12, 16B and 6000 drive 0 may not be selected on the external connector. If you have two internal drives on a 12/16B/6000 and want to keep using them, your external drives must be DS2 and DS3. The last external drive must contain a terminating resistor pack.

If you only have one internal drive, you may have three 5.25" external drives. Set the strap DS1 for the first drive, DS2 for the second, and DS3 for the third.

If your 12/16B/6000 has two internal 8" drives and you wish to disable one of them, it will be necessary to disassemble your 12/16B/6000, and disconnect power and data cables going to your second internal drive. If the terminating resistor pack is installed on the drive you are disconnecting, you must move the resistor pack to drive 0. By disconnecting the power, you will reduce the power consumption and heat load on your system. You must also add a jumper at E40-E41 on the 12/16B/6000 main CPU board (under the card cage). This moves the DS1 signal to the external connector.

If you have a Model II or 16A, you can have at least two external drives and as many as four if you decide to disable the internal drives. Initially it is suggested that you leave drive 0 as an 8" drive until you can copy your installation floppies onto 5.25" media.

On the Model II, 12, 16A, 16B and 6000, it is advised that you leave one internal drive connected to power even if you decide to disconnect its data cables. This is to insure a minimum load on certain power supply voltages.

Constructing the Conversion Cable for Model II/12/16A/16B/6000 Systems

You must construct the cable between the Model II/12/16A/16B/6000 and the 5.25" drives. You will need a 50 pin DIP (Dual-Inline Pins) connector and at least one 34 pin edge connector (one per drive). You may use either 34 or 50 pin wire.

If you have an existing 50 pin cable and a 34 pin cable, you may simply wish to cut the connector off one end and splice the appropriate signals together. Just try to keep the total length to under six feet.

Because the cable you build may be delicate, you may want to build it as a short cable which can fit entirely inside your drive enclosure with the 50 pin connector mounted so that a longer standard 50-to-50 pin cable can connect between the computer and the drive enclosure by plugging into the "translation" cable.

Here is the wiring table. Keep in mind that the odd numbers are ground on both the 34 and 50 pin connectors. The new cable should re-route the wires in pairs to help simplify assembly and insure adequate ground. When an entire group of wires can be moved as a single section of ribbon cable, they are listed together.

Signal Name(s) - Number in Parens is the 50-Pin connector signal name	50 Pin Connector Pins	Tie To 34 Pin Connector (See Note 1)
Double Sided media detect(10)	9-10	No Connect - See Note 2
Side Select (14)	14-15	31-32
Index (20)	20-21	7-8

Ready (22),	22-23	33-34
Drive Select 1 (26), Drive Select 2 (28), Drive Select 3 (30)	26-31	9-14
Drive Select 4 (32)	32-33	5-6
Direction (34), Step (36), Write Data (38), Write Gate (40), Track 0 (42), Write Protect (44), Read Data (46)	34-47	17-30
Mini-disk Motor on (16)	No Connect - See Note 3	15-16
All other even-numbered pins on the 34 and 50 pin connector should not be connected to anything. All odd-numbered pins are ground.		

Notes:

1:    On both connectors, the odd numbered pins are ground and even numbered pins are the signals. Do not get the ground and signal reversed. For example, the Index signal line, pin 20 on the 50-pin connector, connects to pin 8 on the 34-pin connector. 21 on the 50-pin connects to 7 on the 34-pin. When dealing with a group of signals such as "26-31 goes to 9-14", you would have 26->10, 27->9, 28->12, 29->11, 30->14, 31->13.

2:    Pins 9 and 10 on the 50 pin connector must be tied together to produce the "double-sided" signal that the Model II/12/16A/16B/6000 requires. If you ever plan to use single-sided 8" diskettes, you will need to install a SPST (single-pole, single-throw) switch that makes or breaks the connection between pins 9 and 10 of the 50 pin connector. The connection should be open when formatting, reading or writing single-sided media *on any drive* and closed when using double-sided media. Almost all Model II/12/16A/16B/6000 operating systems use this signal to automatically select the media type and will get confused if the data on the media is organized as though this is a single or double-sided diskette and the electrical signal reports the opposite type of media is present.

      If you happen to use an external SCSI enclosure, the SCSI drive select switch that probably came with the case can be used for the single-sided/double-sided control.

3:    Pins 15 and 16 from the 34 pin drives should be connected together. This signal forces the motors on the 5.25" or 3.5" drives to run at all times. On the 8" drives, the selecting of the drive caused the motor to turn on. A few 5.25" drives can start their motor based on drive select or a combination of drive select and motor on, but rather than figuring this out for the type of drives you find that meet all the other requirements, simply connect these two wires together. The side-effect is that these drives will spin whenever they have media loaded, so don't leave diskettes in the drives when you aren't using them. Pins 15 and 16 from the 34-pin connector do not connect to anything on the 50-pin connector.

Once constructed, your cable can look like this:

```
    +---+                        +-----+           +-----+
    ! 5 !--------\        /------!  3  !--------!  3  !
    ! 0 !--------\ A miracle/-------!  4  !--------!  4  !
    !   !-N/C        occurs----------!     !--------!     !
    ! p !-----------here------------!  p  !--------!  p  !
    ! i !--------/          \-------!  i  !--------!  i  !
    ! n !-------/           N/C-!  n  !--------!  n  !
    +---+                        +-----+           +-----+
     DIP                          Edge              Edge
  (facing down)                (facing up)       (facing up)
```

Testing the Conversion Cable (Model II/12/16A/16B/6000 only)

Once you have built your cable, and applied power to your drive enclosure, connect the cable to your Model II/12/16A/16B/6000 external floppy connector (on the 12/16B/6000 it is behind the access door and in the lower right corner), and turn on your system. If the drive light immediately comes on and stays on, this usually indicates

that the data cable is plugged in upside down somewhere (check your pin 1 keying).

If the drive light does not light, XENIX users should run diskutil and attempt to format a new floppy in the new drive. (TRSDOS users can use the FORMAT program.) If the drive light does not come on when selected, check the drive select strap on the drive and make sure it is set to the drive number you tried to format. If the drive select settings are correct, the cable may be at fault.

If the drive light does come on but diskutil does not get past cylinder 0 or TRSDOS FORMAT aborts on track 000 or 0001 or reports almost immediately that the diskette is unusable, then the terminating resistor may not be installed or the cable is incorrectly wired. 3.5" drives may not be used with TRSDOS and can only be used with a special version of XENIX and diskutil. Attempting to run the Tandy-supplied diskutil on 3.5" drives will always fail.

If diskutil or FORMAT get all the way through formatting a floppy, and they behave as though they correctly formatted a double sided disk (check the external media-type switch if the media formats like a single-sided diskette), then you have a working cable.

If you use XENIX, some programs are hard coded to expect media in certain drives. You might consider renaming the device names (/dev/fdn, /dev/rfdn, /dev/fdbtn and /dev/rfdbtn) so that you can use 5.25" media instead of the remaining 8" drive 0. Be sure to rename all the floppy devs with the same drive number or else you can get into trouble.

Although the 5.25" 1.2Meg drives are 80 track drives, only 77 of the tracks are used under standard Model II/12/16A/16B/6000 operating systems, because they think they are talking to a 77-track 8" drive. However, because TRSDOS-II and XENIX write the correct number of sectors per track allowed for that transfer rate and motor speed (16 512-byte sectors at 360RPM), the TRSDOS-II and XENIX-usable storage will equal 1.224 meg (((76x2x16) +16)x512 = 1,253,376, which is 24K more than the IBM AT format allows. The full 80 tracks can be utilized by XENIX, but this requires changes to XENIX and diskutil, plus more operator intervention when performing tars dumps and file-system creation.

3.5" 1.44Meg drives - The 16A/16B/6000 XENIX Migration Route

When the time comes to migrate data off a Model 16A/16B/6000 XENIX system, using 3.5" diskettes is the way to go. The reason is that the format that can be generated on these diskettes is identical to that used on IBM-compatible systems using 3.5" drives. At that point, utilities like tar and cpio can be used to migrate data between these systems. Although this isn't as potentially fast as using Iomega cartridges, the Iomega format used on the 16A/16B/6000 isn't transparently readable by IBM-compatible systems, and Iomega cartridge drivers only exist for a few older operating systems.*

The biggest stumbling block in using 3.5" floppies as a transport medium is an incompatibility between the XENIX version of tar, and those commonly available in systems like FreeBSD that are largely based on GNUtar. In particular, the mechanism XENIX used to split files across multiple diskettes (or cartridges) is different from how GNUtar elected to handle the same problem. There are a couple of solutions. One solution is to avoid letting any files span floppies. That may or may not be practical, depending on the size of the data you wish to migrate.

Another solution would be to use cpio. However, the XENIX version of cpio is based on the one from AT&T V7 UNIX with a little tinkering from Microsoft and The Santa Cruz Operation thrown in, so it may not be compatible with GNUcpio, which is what is used in most of the modern operating systems.

Another alternative would be to port GNUtar or GNUcpio to XENIX. That may be difficult, since the XENIX compiler pre-dates prototypes and C++, things that GNU programs frequently use.

A final alternative is to use a port of XENIX tar utility to FreeBSD, which has been done. Not everything works in this port, but it does handle transfer files that span multiple diskettes.

Migrating Model II/12 TRSDOS-II (4.x) or TRDSOS 2.x data

If you happen a lot of material on TRSDOS-II diskettes that you want to migrate AND you have a working XENIX system, the easiest way to migrate the material is by using the XENIX "tx" utility to move files to XENIX, then use one of the above methods for getting the data onto 3.5" tar or cpio diskettes which can be read on a PC.

TRSDOS 2.x disks require one more step. TRSDOS-II has a utility to read TRSDOS 2.0 programs, so use that utility to get the data onto TRSDOS-II diskettes, and then use tx to get that data onto XENIX media, and then use XENIX to get the data onto 3.5" media. If you have only a small amount of data you wish to migrate, Kermit or some other RS-232 communication program that runs on TRSDOS 2.x/4.x might be a simpler, if slower, alternative.

In all cases, always dump the data out of these older programs in a flat ASCII format if at all possible using the native TRSDOS, TRSDOS-II or XENIX applications prior to migrating the data to 3.5" media on a PC. File formats from these older programs are not all known and few tools exist to read them. You will have much better chances with the data in flat ASCII, even if you do lose some of the formatting information in the process.

* For those who manage to find a compatible SCSI driver to use in migrating via Iomega cartridges (the 256 byte sector size is usually the killer), it is important to know that the first 128 256-byte sectors of a Tandy XENIX Iomega cartridge are always used for a boot area and the PVH data, and the real data starts after that point. The UNIX/XENIX dd utility can be used to skip over this area and then pipe the remaining drive content into a file, or directly to the tar or cpio utilities.

XENIX Operating System support for 3.5" drives.

As distributed by Tandy, XENIX only knows how to write the 16-sector, 77 track format utilized by 8" drives. 5.25" drives can use this format without change, but it isn't portable. For some unknown reason, IBM elected to ignore their own format specifications when developing the IBM PC and only write 15 512-byte sectors per track on 360RPM media, despite 16 512-byte sectors being completely valid and since 16 is an even number, it makes more sense to use. (Strangely, this makes Tandy more compatible with IBMs floppy diskette standards than the IBM-PC was.) In addition, XENIX as provided by Tandy doesn't know how to write the 18 512-byte sector format commonly used on 300 RPM 3.5" media.

A version of diskutil (the XENIX stand-alone format utility) has been modified to create the traditional Model 16A/16B/6000 XENIX and TRSDOS-II formats, and also create the 5.25" 15-sector format pattern used by IBM in the IBM-PC and compatibles, as well as the 3.5" 18-sector format also used on IBM-compatible computers. Diskettes can be formatted on PCs as well, but diskutil is much faster at formatting, and far better at detecting media defects than any PC formatter.

Similarly, a modified version of z80ctl has been created to recognize these formats and allow them to be used. Z80ctl is the program that runs on all Tandy Model 16A/16B/6000s on the z80-CPU while XENIX is running on the 68000 CPU. Z80ctl is responsible for all I/O operations, and communicates with XENIX via shared memory. Z80ctl informs XENIX of the type and size of media it detects each time a floppy device is opened within XENIX.

Caution to Model II/12/16A/16B/6000 systems with 5.25" or 3.5" drives

One final note: On systems where 8" drives are being replaced, the new 3.5" or 5.25" disk drives will not detect a diskette change as some of the older 8" half-height drives did. The original "thin-line" drives had square drive activity lights. The cost-reduced 8" drives Tandy used after 1983 usually had round lights and due to a flaw, these would only report a disk change if it occurred while the drive light was on. Many of the older full-height 8" single-sided drives from the Model II era also failed to report disk changes.

All this means is that you should always make sure that the diskette media isn't being accessed anymore before removing a diskette. If you happen to insert a new diskette, the operating system will not know about this and could write data it intended to write to the first diskette onto the second diskette. This is usually an issue only when diskettes are mounted as filesystems as I/O operations can be delayed by 30 seconds or more, but could also occur during dump, tar or cpio operations. For dump, tar and cpio, always wait for the "change disks" prompt or shell prompt to appear and for the drive light to go out before opening the drive. If a diskette is mounted as a filesystem, wait ten seconds after the umount command completes and until the drive light goes out before removing a diskette

that you just dismounted.

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