

User Manual - XTC Tape System

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Acknowledgements

Special thanks to our customers for requesting this product and for cooperation as alpha and beta test sites during its creation.

System software by Lance Norskog and Bob Glossman, user level software by Lance Norskog, Bob Glossman, and Dimitri Rotow.

About The Authors

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1. Introduction

Thank you for selecting the Bell Technologies Tape System. Your new Tape System is designed for maximum reliability and easy installation. All components are factory tested and guaranteed to be error-free under DOS or Xenix. With proper care your unit will serve you for many years.

You have purchased a fine piece of equipment to enhance the utility of your computer. Your cartridge tape unit will provide convenient backup capability for an immense amount of data. No more backing up on stacks and stacks of floppy disks!

We suggest that you become familiar with the creation and use of subdirectories as described in your DOS or Xenix manual. With the huge amount of information storage provided by your hard disk, subdirectories are invaluable in organizing and grouping your software. Programs and data files which are kept organized by directories or disk partitions are also much easier to backup in a systematic way.

In the various sections of this manual, we will explain how to install your Bell Technologies Tape System in your computer and how to maintain the unit. This manual discusses Xenix only; for DOS use, please consult the DOS manual supplied with your XTC DOS software.

While we have attempted to make our installation and operation instructions as clear and simple as possible we know at times questions will arise. Bell Technologies stands behind its products and we encourage you to contact us if you have a problem not covered in this manual. We will be pleased to help you.

Your Tape System is made up of high quality components. It is our corporate goal to have the name Bell Technologies connected with quality and satisfaction in our customers minds. However, even the finest components can fail. As with most delicate electronic equipment, rough handling is the biggest contributor to premature failure. We therefore suggest that you transport your Tape System as gently as possible.

A copy of our warranty is enclosed at the end of this document. In the unlikely event you should ever need warranty service, please follow the directions specified by the warranty policy to obtain help in correcting any operational problem in your tape unit.

NOTE: You must return the warranty registration card enclosed with your unit to validate the warranty. Returning this card also allows us to keep you aware of enhancements or items of interest as they become available.

Please take the time to backup your files regularly. Your Tape System tape unit can only be effective if you take the time to backup. A good rule of thumb is to set forth a regular schedule for disk image backups and for file-by-file backups for really important data. Most installations will do a disk image backup every Friday at the close of the business day, and do a file-by-file backup of important files at the end of every day.

By backing up all your valuable information onto a tape cartridge you are protecting yourself from many hours, days or even weeks of reconstruction of lost data in the event your fixed hard disk fails to operate.

One final note: This hardware installation manual is oriented towards PC AT users; however, the

Bell Technologies Tape Cartridge System when used with Bell's DOS software system is compatible with a very wide variety of IBM PC, PC XT, and PC AT compatibles.

1.1 Checklists

This manual is full of checklists. Read the entire manual first, then as you actually go through the hardware and software installation procedure, check off each item with a pencil. This will help you avoid mistakes.

Some checklist items do not call for action on your part. These are to be checked anyway to make sure you have read important information.

2. Installation

The Bell XTC Tape System is extremely easy to install. The XTC is available in both internal and external units. This manual should be used for installation and operation of both. If you've installed a Tape System before you should be able to do the whole procedure in under 15 minutes. If this is your first time, set aside a half-hour. Installation is in five easy steps:

- 1) **Unpack the Tape System. Save all shipping materials.**
- 2) **Prepare for Installation. This covers safety measures like unplugging your PC before you remove the cover.**
- 3) **Install the Tape System controller circuit board in your PC. This is just like plugging in any other option board.**
- 4) **Install the tape drive in your PC, if it is an internal unit, or plug in the external enclosure if you have an external XTC unit.**
- 5) **Install the Tape System software on your PC AT.**

Each procedure has several parts, but please keep in mind that there really are only five steps to installing a Tape System. If you only read this page and then proceed to pop in your new Tape System, you would probably have no trouble at all. However,

PLEASE READ THIS ENTIRE MANUAL

BEFORE

INSTALLING YOUR TAPE SYSTEM !

Might as well be safe than sorry!

NOTE: It is usually a good idea to run your PC AT's diagnostics prior to installing your Tape System, just to make sure your PC AT is healthy.

2.1 Unpacking Your Bell Technologies Tape System

Your Tape System comes packaged in a specially designed, cushioned container. Please use care in handling this container and the tape unit while unpacking the components of your Tape System. We strongly urge you to save this container and the packing materials. You will need them should it be necessary to return the Tape System to us for repair.

Carefully remove all components from the package and inspect each for possible shipping damage. If the container or any of the components appears to have received damage during shipping, immediately contact the shipper who delivered your package and request they come out and inspect the damage. The Bell Technologies warranty does not include damage due to shipping.

Therefore, it is very important that any such damage claims be made against the shipper to prevent any further expense on your part. Even if the outside of the container has sustained some minor shipping damage, it is unlikely that the Tape System has been harmed.

Please Verify The Following Items are Present:

- ___ Internal Mount Tape Drive or External Tape Subsystem Unit
- ___ Tape System Tape Controller Circuit Board
- ___ Controller to Tape Drive Interface Cable
- ___ PC AT Mounting Rails & Screws (Internal Mount Only)
- ___ Tape Subsystem Power Cord (External Mount Only)
- ___ DC600A 60 Megabyte Tape Cartridge.
- ___ Tape System User Manual
- ___ Warranty Card and Information
- ___ Miscellaneous Inspection Notes
- ___ Miscellaneous Sales Literature

If any of the standard items are missing please contact Bell Technologies.

Be sure to record the serial number from the side of the Tape System tape drive. You will need this number for your warranty registration card. You may also wish to record the serial number someplace handy in case you require assistance from our customer service staff.

2.2 Prepare for Hardware Installation

After verifying that all of the proper components have been received, you can get ready to install your Tape System hardware.

- ___ The instructions included here are to be used in addition to installation instructions available from your computer manufacturer. Please read the appropriate sections of your computer "Guide to Operations" for proper installation of option cards in your computer.
- ___ The only tools you should need to install your Bell Technologies Tape System are a regular flat blade screwdriver and a small phillips screwdriver.
- ___ If you ever need to remove the cables from the controller board or from the tape unit, do not pull on the cable. Instead, grasp the CONNECTOR firmly and pull straight out (wiggle SLIGHTLY if necessary). Take extreme care to make sure that the ribbon cable is correctly aligned when plugged into the controller or into the tape unit.

2.2.1 Gaining Access to the Inside of Your Computer

First, make sure your computer is powered off and the power cord is disconnected. Serious damage can result to your computer and to you from working on your PC AT with power applied.

Before you start:

- _____ Remove all floppy diskettes.
- _____ Turn off all peripherals.
- _____ Turn off system power to your PC AT.
- _____ Unplug ALL cables from the base unit.
- _____ REMOVE THE POWER CABLE from the system unit.
- _____ Follow your manufacturer's instructions for removal of your PC AT's cover. Remove the cover GENTLY, as there may be cables resting just underneath the cover which could snag if the cover is removed too quickly.

2.3 Installing the Tape Controller Board

Your Bell XTC tape controller card has several option and switch settings which should be correctly set at the factory. Figure 1 shows the location of the DIP switch array and jumpers.

NOTE: Bell Technologies ships XTC products using long controller cards and short, half-sized controller cards. The DIP switch settings for the two cards are different. The illustrations in the main body of this manual *refer to the long controller card only*. The Appendix at the end of this manual provides illustrations of DIP switch settings and option jumper settings for the short card. All other operational and installation details are the same for short and long controller cards.

Please take a moment to verify that your controller card's options have been correctly set:

- _____ Refer to Figure 2 for the settings of the DIP switch array for the long controller card. Note that some DIP switch units may have a slightly different appearance. "OPEN" means the same as "OFF". Switches 1 through 7 should be ON and switches 8 through 10 should be OFF or OPEN.
- _____ If you have a short controller card, positions 1 through 8 should be ON, with positions 9 and 10 OFF. Option jumpers for the short controller card are position 5 for IRQSL, and positions 1 for DA and DR.
- _____ If you have a long controller card, refer to Figure 1 and Figure 3 for the settings of the option jumpers. Please take a moment to double check the settings of the jumpers illustrated in Figure 3.

- _____ If you are familiar with use of the XTC in the DOS environment, please note that the position of the jumpers as illustrated in Figure 3 is different in Xenix than in DOS.

- _____ Please verify that jumpers are in fact inserted at the various positions marked on the controller card:
 - _____ W1 Jumper in.
 - _____ E3 Jumper in.
 - _____ E8 Jumper in.

- _____ Before installing the controller card, if you have an internal mount XTC unit, plug the flat cable supplied with your unit into the controller card, with the stripe on the flat cable topmost. See Figure 4. When plugging the cable into the controller card, be careful not to offset the plug by one row of pins up or down or back or forth.

- _____ If you have an internal unit, verify that you plugged the flat cable in with the stripe topmost.

- _____ The controller board installs like any PC AT option card. It may be installed in any slot.

Figure 1: Location of Option Jumpers and Dip Switch Array

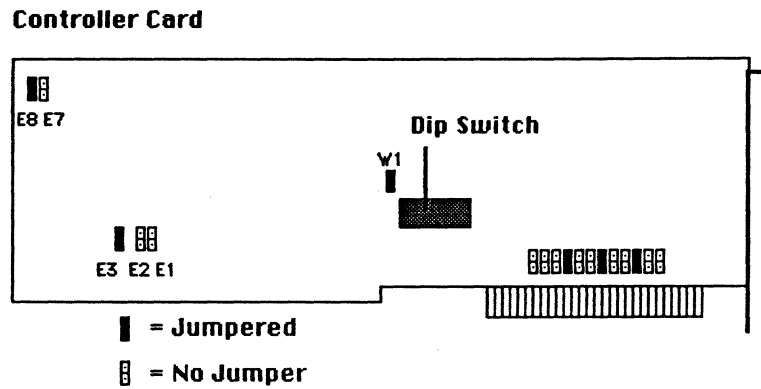


Figure 2: Dip Switch Settings

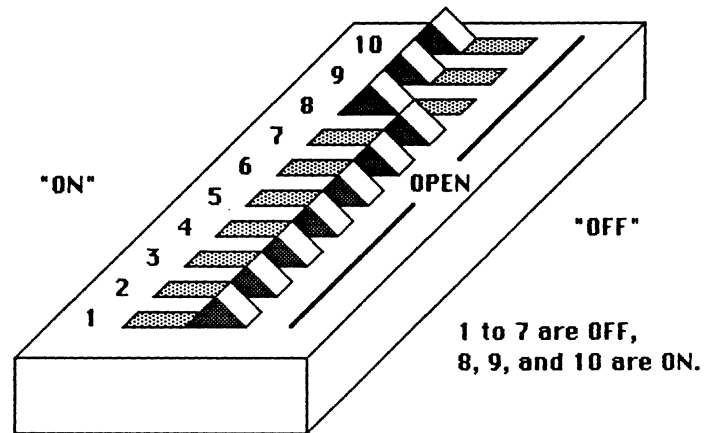


Figure 3: Main Jumper Block Jumper Settings (Near Card Edge Connector)

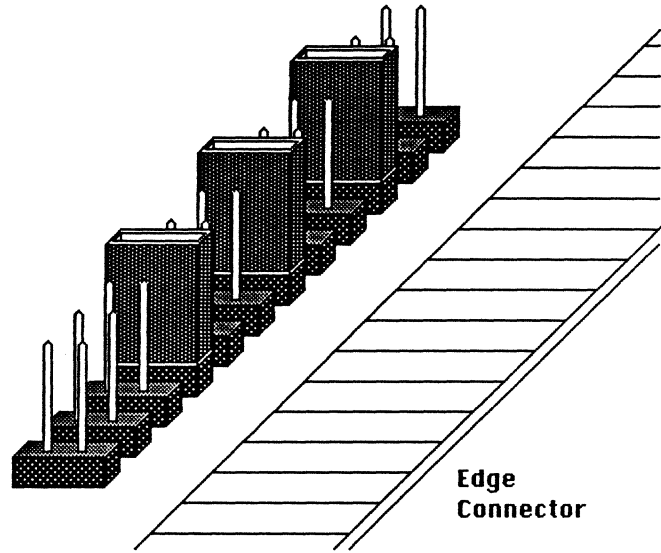
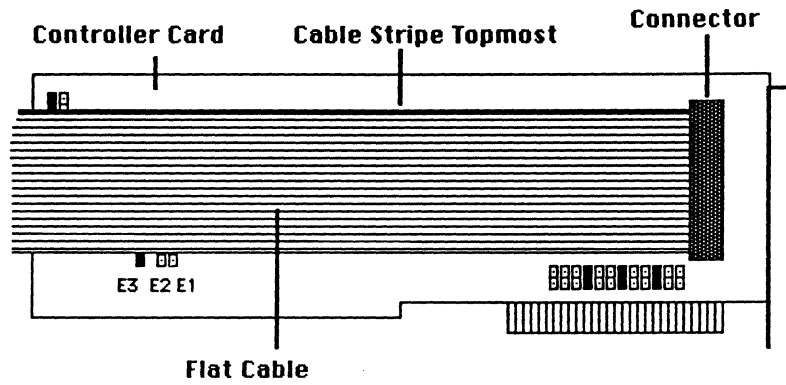


Figure 4: Cable Connection To Tape Controller Card



_____ Slide the controller board into the slot and card guide so that the fingers on the bottom of the controller board fit snugly into the connector.

_____ Replace the screw in the slot cover attached to the controller board and tighten it down to secure it.

2.4 Installation of Tape Drive - External Units

Bell Technologies tape products are sold in internal as well as external configurations. The internally mounted product is designed to fit inside your PC AT. It is mounted in the device bay provided for additional floppy or hard disk devices.

Externally mounted units are provided in an external chassis that contains its own power supply. Use this section for installation if your Bell Technologies tape unit is an external chassis unit.

_____ After installing the tape controller board, you may close up your AT.

_____ Installation of the external tape unit consists of plugging it into the tape controller card and into a standard wall 110 volt AC power socket.

_____ Do not place the external tape cabinet where it is subject to sources of heat such as direct sunlight or on top of radiators or other heating elements. Do not pile office junk on or about the tape unit as it needs to breath in order to keep cool.

This concludes the hardware installation procedure for External Mount Bell XTC Tape System units.

2.5 Installation of Tape Drive - Internal Units

Bell Technologies tape products are sold in internal as well as external configurations. The internally mounted product is designed to fit inside your PC AT. It is mounted in the device bay provided for additional floppy or hard disk devices.

Please use this section for installation if your Bell Technologies tape unit is an *internally* mounted unit.

_____ Please refer to Figures 5 and 6. These figures give the location of the serial number plate and mounting holes for the mounting rails.

_____ Please take a moment to copy down the serial number of your tape drive. You will need this number for your records.

_____ Attach the PC AT drive mounting rails to the side of the tape drive with the screws provided (two sets of different sized screws are provided since some devices using the mounting rails require different sized screws). The rails mount on the side of the drive just like the mounting rails used on the floppy disk in your PC AT.

_____ Some units have an insulating paper sheet taped to the bottom of the drive for additional protection during shipment. This insulating paper sheet may be removed.

_____ Most people install the tape drive in the half-height device drive bay just below the standard 1.2 Megabyte floppy disk drive.

- _____ If you have large hands, you might find it convenient to remove the mounting clips holding the floppy drive in place while installing the tape drive. This will enable you to slide the floppy drive back and forth a bit and give you lots more room to fool around with the cables in the back of the tape unit.

- _____ Before installing the tape drive, please take a moment to inspect the sensor plug. To locate this item, turn the drive upside down so that the circuit card is upward. At the right rear corner of the circuit card immediately next to the large round motor assembly is a "Molex" plug with two wires coming out of it. Please make sure this plug is correctly plugged in. Note that the sensor plug is "keyed" so that it correctly plugs in only one way.

- _____ Be careful when installing the tape drive not to catch this plug on anything while sliding the tape drive into the PC AT. If it catches on anything, it is very easy to slide the sensor plug off and then the tape unit will not function. While this will not harm the tape unit, it will require your disassembling your PC AT once more to get at the loose plug.

- _____ Slide the tape drive into the PC AT drive bay. The circuit card goes down. Do not tighten the mounting clips on the PC just yet, as it will be easier to attach the cables to the tape unit if it is free to slide back and forth a bit.

- _____ Route the flat ribbon cable from the controller card to the tape drive. Fold neatly in right angle and 45 degree turns to route cable.

- _____ Please refer to Figure 8 for connections made to the tape drive. **The flat cable supplied with your unit may differ slightly from the cable illustrated: when correctly inserted, the cable may run upwards or down.** Orient the cable so that the stripe on the cable is closest to the power plug.

- _____ Attach the flat cable to the tape drive. **Make sure the stripe on the cable is closest to the power plug.**

Figure 5: Tape Drive Components

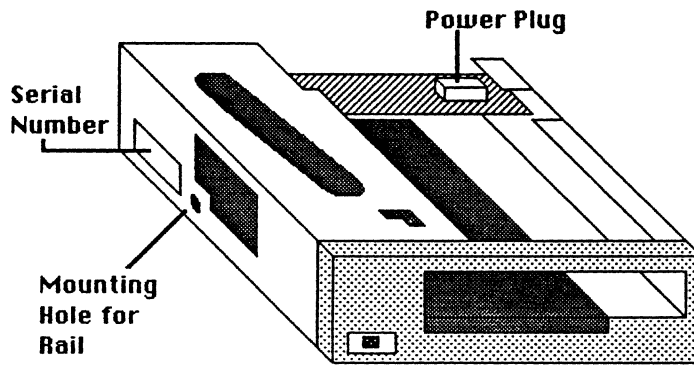


Figure 6: Attaching Mounting Rails to Tape Drive

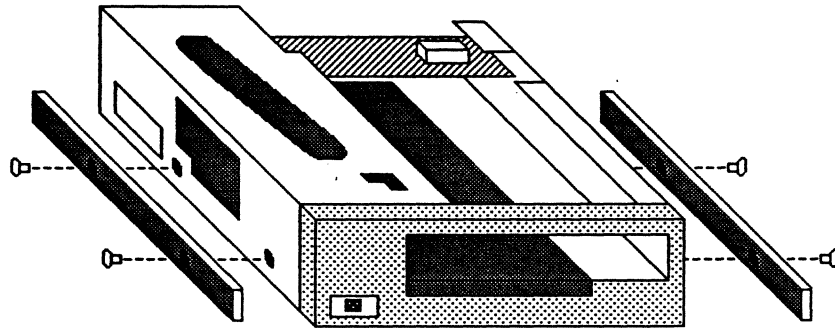


Figure 7: Location of Sensor Plug (View of drive from below)

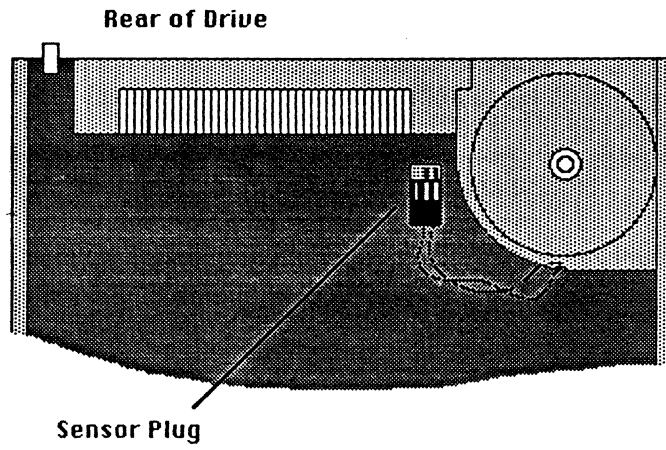


Figure 8: Connections to Tape Drive

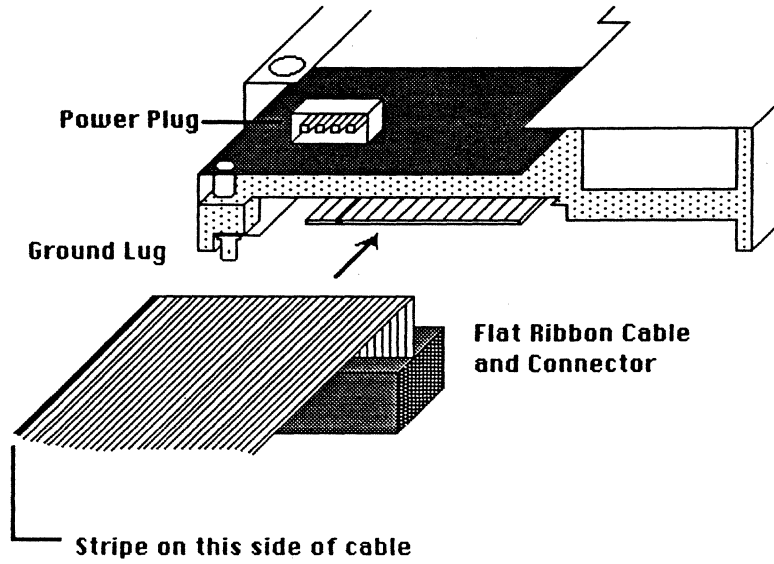


Figure 9: Inserting the Power Plug

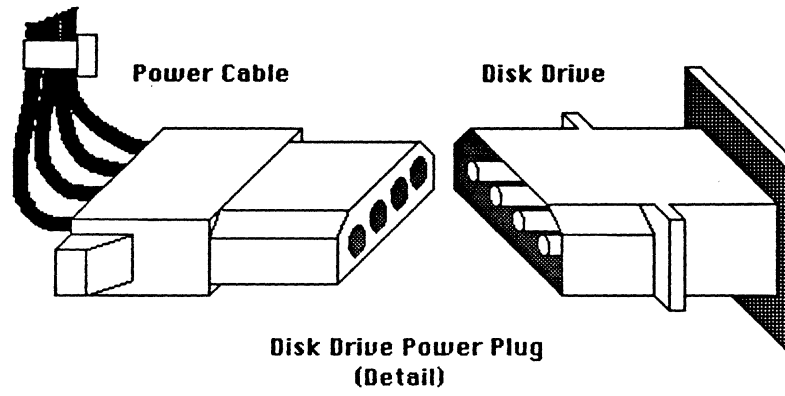
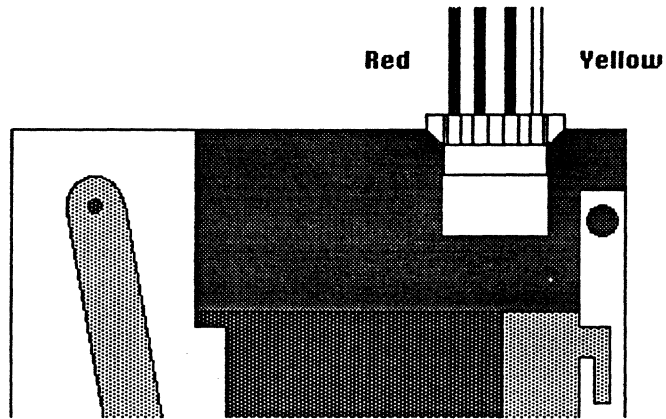


Figure 10: Correct Insertion of Power Plug (View from Above)



- _____ Attach one of the AT's device power plugs (the red, yellow, & black four wire cables) to the tape drive's power plug (see Figures 9 and 10).
- _____ **Please Note:** As illustrated in Figure 9, the PC AT power plug has diagonal bevels on two corners which fit into matching recesses in the tape drive's power plug. This design makes it extremely difficult to plug the tape plug in backwards without a major amount of jimmying and very excessive force. Please do not attempt to force the power plug in backwards.
- _____ As a second check, note that the yellow wire in the power plug connector ends up on the right when the installed unit is viewed from above (Figure 10). Note that this is different from how the floppy disk's power cable attaches to the floppy disk drive.
- _____ Attach one of the AT's grounding wires (the black wires terminating in a screw on the top of the drive bay rack) to the tape drive's grounding lug. The grounding lug is next to the flat ribbon cable connector on the tape drive (see Figure 8).
- _____ Install the front drive clips to retain the tape drive in place and tighten screws. If you loosened the floppy drive's clips to facilitate installation, tighten them now.
- _____ Check the following before re-installing the cover to your PC AT:
 - _____ DIP switches and jumpers have been checked according to Figures 1, 2, and 3.
 - _____ Tape controller card firmly seated, screwed in place.
 - _____ Flat ribbon cable firmly seated into tape controller card.
 - _____ Cable stripe topmost where cable plugs into tape controller (Figure 4).
 - _____ Flat ribbon cable neatly run to tape drive.
 - _____ Flat ribbon cable attached to tape drive.
 - _____ **Stripe on cable closest to tape drive power plug.**
 - _____ Tape drive power plug firmly inserted. A.in-3.5m
 - _____ **Yellow wire on power cable on right when viewed from above.**
 - _____ PC AT grounding wire firmly attached to tape drive grounding lug.
 - _____ Floppy drive, if moved, correctly reinstalled. Verify drive is connected to edge connector "A" on floppy drive cable.
- _____ The internal hardware installation is now complete. replace the PC AT's top cover and all peripheral cables that were disconnected in the previous instructions.

- _____ Attach the power plug to the PC AT. Before plugging the unit into power make sure that the power switch is in the OFF position.
- _____ Check all connections and plug the PC AT power cord into a 110 VAC power outlet.

You are now ready to prepare the Tape System for use with DOS or Xenix.

3. Xenix Tape Software Installation

The following sections of this manual discuss all software related issues of the Bell XTC Xenix Tape Cartridge System.

This manual describes use of the Bell XTC with Xenix only. Should you wish to operate your XTC in the DOS environment, consult the User Manual shipped with the DOS Software Utilities for the Bell XTC (Part Number SYSW-DOS, "DOS Software for Bell Tape Cartridge System," Price \$75).

The Bell XTC Tape System may be used with either of the current IBM releases or with SCO's System V Xenix release. We now ship distribution diskettes for both SCO and IBM Xenix with each XTC unit.

If you are working with SCO System V Xenix, please proceed immediately to the manual section titled "Software Installation - SCO System V Xenix."

3.1 IBM Xenix 1.0 Software Installation

CAUTION: This section applies to IBM Xenix 1.0 and 1.1. Both of these releases have been superseded by IBM Xenix 2.0 series releases. This IBM Xenix installation procedure applies to IBM Xenix 1.0 and 1.1 only.

IBM now has two Xenix 1.x series releases in the field: the original 1.0 release of Xenix for the PC AT, and the 1.1 Update release which IBM quietly has made available to people who scream loud enough about bugs in the 1.0 release. The IBM Xenix diskette works with both the 1.0 and the 1.1 releases.

Xenix is distributed by IBM in three packages: the basic Xenix software, the development utilities, and text processing tools. If you have not purchased and installed the Development Utilities package, you have what is known as a "Xenix Run Time" installation.

While the XTC is capable of running on a Run Time installation, note that as IBM does not in general allow adding device drivers without access to a machine that is loaded with the Development Utilities, should you plan to add other third party devices (multi port cards, etc) you should gain access one way or another to the Development Utilities.

You need the Development Utilities because of the way device drivers are added in Xenix (or, for that matter, in any major release of Unix). In DOS one adds a device driver by adding a "device=" line to the CONFIG.SYS file. DOS will then bind the device driver to itself on boot-up. In contrast, Xenix must have any new device driver or other user-written routines **compiled** into the "kernel." The kernel is the actual /xenix program itself. The software programs and libraries needed to effect this recompilation are sold in the Development Utilities package. AIf you have access to a machine which has the Development Utilities, you can reconfigure xenix kernels to support your use of various combinations of third party cards. It is legal to reconfigure a kernel on one machine using the Development Utilities and then run the kernel on another machine which is licensed for Xenix but which does not have the Development Utilities installed.

Our Run Time install procedure will allow you to run the XTC even if you do not have the Development Utilities package, but it cannot allow you to add a variety of other devices in addition to your Tape System.

3.1.1 Software Preparations

Use the following procedure to install the Xenix Tape System software. Unix gurus who wish to see what the tape installation script is doing may read the install script on the floppy (/mnt/install) after mounting the floppy. As you complete each step, check it off on the space provided.

_____ Login as root. If you login as some other super user, make sure your PATH includes /etc.

_____ Check to make sure your PATH includes /etc with:

```
echo $PATH
```

Make backup copies of xenix and relevant system configuration files as follows:

```
_____ cp xenix xenix.orig
_____ cd /usr/sys/conf
_____ cp master master.orig
_____ cp xenixconf xenixconf.orig
_____ cd /
```

NOTE: If you have a 2 Megabyte RAM card (or other expansion RAM) installed, make sure your Xenix kernel is configured to take advantage of the extra RAM. In particular, your process size should be increased. If you have extra RAM, the Bell XTC software will use it to make your tape system run faster during backups and restores.

3.1.2 Check for Software Conflicts

As shipped, the automatic installation script utilizes major device number 48. No standard IBM parts utilize this major device number, and it is highly unlikely any third party vendor might utilize this number. However, just to make sure please take a moment to see if your system includes any devices with this major device number. In addition, your new tape system uses the following names for devices:

```
/dev/tpnrne, /dev/tprne, /dev/tpnre, /dev/tpre, /dev/tar, /dev/tape
```

_____ The following command will provide a list of all filenames in your /dev directory. Check carefully for any potential conflicts.

```
ls -l /dev | more
```

There will be no conflicts with a standard, unmodified Xenix system as shipped by IBM. If you have conflicts, see the README file on the installation diskette, which describes the steps to be used for manual installation of the software (recommended for experienced users only). If that does not help you, please contact Bell Technologies Technical Support at 415-659-9097.

3.1.3 Execute Installation Script

_____ Mount the floppy disk by inserting it in the floppy drive and entering:

```
/etc/mount /dev/fd0 /mnt
```

_____ Determine if you have a Xenix Run Time installation. If you have purchased the Development Utilities optional IBM Xenix package and have installed it, you do not have a Run Time only system.

_____ If you have a Run Time Only system, execute the run time install script as follows:

```
/mnt/install.rt
```

_____ If you have the Development Utilities package, execute the installation script with:

```
/mnt/install
```

_____ The installation script will display a screen describing what it is about to do, and advising you to make backups, check files, etc, before proceeding. After reading the screen and reassuring yourself that your original files are backed up and there will be no conflict with major device number 48 or with the names of the tape devices, press <Enter>. The script will run through to completion. If you have any second thoughts or would like to check some files before proceeding, press the key to terminate the installation script.

3.1.4 Configure New Xenix to Support Bell Hard Disks

You can skip this step if you have a Run Time only Xenix system: the `install.rt` script automatically sets up to run the B86.

If you are running your system on Bell Technologies supplied hard disks, at this point you **must** run the `xpatch` utility supplied with your hard disk system. This utility configures your new Xenix kernel to support your high performance, high capacity Bell Technologies disk. This is an optional step, and does not apply to you if you have not purchased a Bell Technologies disk. Please note that if you are using a non-IBM disk other than those provided by Bell, your disk manufacturer may have some steps which must be undertaken if you ever reconfigure your Xenix kernel. Now is the time to do them.

3.1.5 Reboot the System

The system should now be shut down and then rebooted in order to make the new tape-capable Xenix system fully installed.

_____ Unmount the floppy with:

```
sync; /etc/umount /dev/fd0
```

_____ Shutdown the system with:

```
haltsys
```

_____ Reboot the system by pressing <Enter>, and then continue with the default start up. Your new xenix kernel is now tape capable.

3.2 Xenix Installation - SCO Xenix

The Bell XTC unit supports Santa Cruz Operation System V Xenix using our SCO System V diskette software.

To install the XTC under SCO System V, please complete the hardware installation as described in the hardware installation manual. Make sure the option switch and jumper settings on the controller card are correct. Then procede as follows:

- _____ Login as root.
- _____ Insert the XTC System V Installation diskette.
- _____ Type `install /dev/fd096ds15`
- _____ Follow the prompts given you by the install script.
- _____ When the installation script is over, remove the floppy diskette, do a haltsys, and reboot the system. This completes the System V software installation.

4. Using the XTC System

The following sections describe how to use your Xenix Tape Cartridge backup system.

4.1 Quickstart for Experienced UNIX Users

This section is for experienced Unix users who are familiar with working with tape devices in general and have had some experience with streaming tape devices. If you are new to tape devices and Unix, please proceed immediately to the next section. If you jumped immediately to this section of the manual (bypassing Installation) please use the Installation checklist to install the software even if some of the checklist items seem a bit trivial; after all, it is easy to forget a minor item.

We support **tar** and the other standard Xenix "tape" backup utilities. However, it is much more efficient to use the Bell analogs of the Xenix programs. These programs, **star**, **stdump**, and **stream** provide much better performance than **tar**, **dump**, and **dd**. See the man page for deltas.

The default device, **/dev/tape** or **/dev/tar** always rewinds the tape on close. When opened for writing, this device will erase the tape on open. When opened for reading, this device will not erase on open. Like all true streamers, the Bell XTC is opened for reading or for writing but not for both simultaneously.

To use **cpio** or **dd**, pipe them through **stream** using **stream**'s ability to read stdin or write stdout. Use **/dev/tape** in this case.

While this will get experienced Unix users started, please take a few minutes to read through this manual since streaming tape cartridge devices differ from 1/2" nine track start/stop devices used on most minicomputers and mainframes.

4.2 Introduction

The Xenix Tape System is implemented on QIC02/36 compatible streaming tape hardware and software. Although very similar to the start/stop reel to reel tape drives used on large Unix systems, 1/4" cartridge streamer tapes require some tradeoffs in exchange for their high speed, low cost, and high reliability.

The principal difference between streamer tapes and start/stop nine track devices is that streamers are unable to rewrite tape blocks at random. This implies that each time a streamer tape volume is written, it is written anew with fresh data. As a practical matter, it means that the "append" and similar options for **tar** do not exist on streamer tape based systems.

Other than this difference, the tape streamer device provides essentially all of the functionality of nine track devices costing four, five, or even ten times as much money. Streaming performance on the Xenix Tape System is equivalent to tape streamer performance on MS-DOS, even though DOS is much more real-time oriented than Xenix.

Tape system usage is oriented towards use of the standard **tar** and **dump** utilities. On IBM Xenix machines, a special **backup** utility (which is actually a version of the standard **dump** utility) is also utilized. Bell Technologies has provided compatibility with these standard utilities as part of the Tape System product.

tar may be used unmodified with the Tape System, subject to the limitation described above (see man page on **tar**, enclosed). In addition, Bell Technologies has provided a high-speed version of **tar**, **star**, which utilizes an advanced buffering strategy to run four or five times faster than the plain vanilla **tar** with our XTC System.

The new program, **stdump**, should be used instead of the Xenix **backup** utility. **stdump** is a high-speed, streaming version of **dump** which utilizes the Xenix **backup** utility to ensure consistency with the standard IBM Xenix way of doing things. See the man page on **stdump**.

Finally, we provide a special high speed utility, **stream**, that is capable of making a direct image copy of any disk partition on tape. **stream** is the fastest possible way of backing up an entire disk partition. **stream** is also used as a buffering filter when using Xenix **cpio** (see the man page on **stream**) or other Xenix programs.

4.3 A Note on Tape Devices Installed in /dev

In general, for reading and writing data out to the tape, use **/dev/tar** or **/dev/tape**. These devices are identical and are provided for compatibility with traditional unix software. This device erases the tape when the device is opened for writing, and rewinds the tape when the device is closed. It will not erase the tape when the device is opened for reading. **/dev/tar** is the default device used by **star**, as in most "tar" style programs, while the **/dev/tape** device name was provided for more intuitive reference to the XTC tape system.

To be on the safe side, **write protect** all tape cartridges you want to protect from inadvertent erasure! You can do this by rotating the small write protect cylinder on the tape cartridge so that the arrow points at "safe." The cylinder may be rotated with a screwdriver.

The installation script creates several other tape-oriented devices in /dev. These are special purpose devices providing rewind/no-rewind combinations for tape control. See the section of this manual on advanced use of the XTC.

4.4 Multiple Volumes on a Single Tape Cartridge

It is possible to write multiple "volumes" of information to the tape cartridge. This technique treats a single physical tape cartridge as more than one logical tape cartridge. See the section on advanced use of the XTC for more information.

5. New Man Pages

The following pages provide man pages for **tar**, **star**, **stdump**, **stream**, and **restore**. These commands should be used for all interaction with the tape device.

Note that the **tar**, **backup**, and **restore** commands provided as part of Xenix are the genuine Unix articles in that they are designed to work on a very wide variety of magnetic storage devices, including floppy disks, fixed and removable hard disks, and a plethora of different tape sizes and formats. As such, these commands offer a wide variety of options; many of these options only make sense on a particular class of device and are useless for the other devices. In keeping with Unix tradition, syntax in the standard utilities is inconsistent and often confusing.

Note also that in **tar**, the **n**, **k**, and **e** options are provided for non-magnetic tape media and therefore are not applicable to any magnetic tape system. The **0-7** options are relevant only for multiple tape installations and are not supported in the XTC product. The **r** and **u** options are usually allowed on start/stop devices only and are not supported by streamers.

In general, all of the Bell utilities will use as much RAM as can be gotten for buffer space to improve the performance of the tape while writing. More system RAM will improve tape performance up to about 2 Megabytes of buffer, at which point further addition of RAM does not continue to yield dramatic gains.

When used in the simple, default way, the tape utilities write data to tape and then rewind the tape cartridge. All of the utilities rewind the tape cartridge "off line." When the utility is finished and the command prompt reappears the tape will still probably be rewinding for a few tens of seconds. Take care, therefore, not to remove the tape cartridge while it is still being rewound. In addition, it is a good policy not to remove the tape cartridge while the tape drive's activity light is still turned on.

5.1 TAR, STAR

You should always use **star** rather than **tar** because it offers vastly improved performance. Use these commands just as in the standard Xenix man pages for **tar** with the following differences when used with the streaming tape device:

Options Not Supported or Not Applicable:

-r, -u, -e, 0-7, -F, -k, -n

NOTE: You must use the **b** option with **tar** when using the **c** option. The blocking factor must be an even number greater than 0 and less than 20. We recommend use of 20 as the blocking when using **tar** and no blocking factor when using **star**.

star interprets the **-b** option blocking factor as the number of kbytes of RAM to use for buffer space, if you wish to set this buffer space manually. If no **-b** option is supplied with **star**, it will use as much RAM as it can get from the system for buffer space.

If **/dev/mt1** is not linked to **/dev/tar**, you should use the **-f** specifier with **tar** and the filename **/dev/tar**, since the standard Xenix **tar** is set up to use **/dev/mt1** as the "tape" device. Note that the blocking factor specification comes after the **-f** option filename on the **tar** command line.

Examples of use:

To save some files and directories called "myfiles," "ccode*," and "src":

```
star cv myfiles ccode* src
```

To examine a list of what is archived on a specific cartridge:

```
star tv
```

To extract only those files from the above tape which were archived from the directory **src**:

```
star xv src
```

To extract all of the files archived on the tape:

```
star xv
```

To backup all files in **/bin** in a high speed way using 2 Megabytes of RAM buffer space (assumes machine has at least 2.5 MB of RAM installed):

```
star cvb 2000 /bin
```

To read the above archive using the streaming tar utility:

```
star tv
```

To extract all files from the tape using star:

```
star xv
```

COMMENTS

When used with very large buffers, the system will appear to pause for a few seconds when just starting to write to tape: this is normal and simply reflects the amount of time it takes to get megabytes worth of data from disk into RAM.

When used with very large buffers, the `tv` and `xv` options to `star` will only report their status at the conclusion of the operation. If you would like to get a `v` report more in "real time" use a low blocking factor, like 40 or so, as in the following example:

```
star tvb 40
```

5.2 STDUMP, RESTORE

stdump is a replacement utility for Xenix backup for use with the XTC System. Restores are accomplished using standard Xenix restore. Use the **stdump** utility just like Xenix backup with the following differences:

Options Not Supported or Not Applicable:

-k, -d

Note on using **s** option: In the streaming tape environment, the **s** option is used just as the **k** option is used in Xenix backup. Use **35000** as the number of blocks on the short tape, and **50000** for the long tape cartridges.

Additional Option

stdump will use as much RAM as it can get from the system in order to buffer writes to tape. You can specify the amount of RAM to be used manually with the **-b** flag. Syntax then is:

```
stdump [flags][-b] [Source] [Target] [#KbytesRAM]
```

Examples of use:

To backup the entire /root partition of your hard disk in a "zero level" backup:

```
stdump 0f /dev/tape /dev/root
```

Perform the above example using no more than 2 Megabytes of RAM for buffers:

```
stdump 0fb /dev/tape /dev/root 2000
```

To restore the entire /root partition of your hard disk from a "zero level" backup:

```
restore rf /dev/tape /dev/root
```

COMMENTS:

Use of **dump** style programs like backup is a traditional Unix task which requires some skill and planning. Bell Technologies is preparing a tutorial manual on how to use these programs for novice Xenix users.

In keeping with Unix tradition, restoring an entire disk partition from a 0 level **stdump** takes an unbelievably long time. It is wise to go to lunch when restoring a 20 Meg partition and to allow 72 Meg restores to happen after hours. We are working on a proprietary Bell utility to replace **restore** which will cut the time required tenfold.

5.2.1 Restoring From a Catastrophic Disk Failure

Backing up the `/dev/root` partition doesn't gain much given the way Xenix is set up. In the event of a catastrophic disk failure, you will have to bring up the system off the basic Xenix floppy diskettes anyway. A practical administrative strategy is to install all local commands, programs, data, etc. in the `/dev/usr` partition and to backup that partition faithfully using **stdump**. You may also want to backup any "personality" information (contents of `/etc/passwd` and so on) either onto floppy diskette or onto tape using **star**.

In the event of catastrophic disk failure, follow this procedure:

- 1) Bring up the new disk using the normal floppy-based Xenix installation procedure.
- 2) Install all the stock Xenix options using the distribution floppies.
- 3) Install the Bell Xenix Tape Cartridge software from Bell's distribution diskette.
- 4) Restore the "personality" information for `/dev/root` from whatever medium was used to save it.
- 4) restore the user partition from tape.

5.3 STREAM

Synopsis

stream [Kbytes of buffer] [source] [destination]

Description

stream is a bidirectional, high speed utility for transferring large amounts of data to and from tape using large RAM buffers. It will use as much RAM as is available in the system, up to any process size limit imposed by your configuration of Xenix, or up to the optional number of bytes specified for the buffer.

stream may be used either for making "disk image" copies of files or disk partitions, or as a filter to enable standard programs like **cpio** or user written programs to access the tape device.

Options

[Kbytes of buffer]	The number of kbytes worth of buffer RAM desired. By default, stream will use as much as it can get from the system.
[source] or [destination]	Any file or partition. Use /dev/tar or /dev/tape to refer to the tape device as a source or destination. use - to refer to stdin or stdout as a source or destination.

Examples of use:

To save **/dev/root** to tape using 2 megabytes of buffer:

```
stream 2000 /dev/root /dev/tape
```

To restore **/dev/root** from tape (default RAM size):

```
stream /dev/tape /dev/root
```

To backup **/dev/hd12** on the second disk drive to tape using 250K of buffers:

```
stream 250 /dev/hd12 /dev/tape
```

To restore the above using as much RAM as is available in the system:


```
stream /dev/tape /dev/hd12
```

To archive the entire contents of a directory and lower subdirectories to tape using the Xenix **cpio** utility:

```
find . -print | cpio -ov | stream - /dev/tape
```

To do the above task with no more than 200K of RAM buffers:

```
find . -print | cpio -ov | stream 200 - /dev/tape
```

To recover the above archive using **cpio**:

```
stream /dev/tar - | cpio -iv
```

Files

/dev/tape

use this tape device or **/dev/tar** with **stream**

COMMENTS:

cpio will do funny things sometimes when allegedly legal **cpio** syntax is used. Before you get mad at the XTC unit, try using the **cpio** command that makes funny things happen with a redirect into a plain Unix file.

5.4 REWIND

Synopsis

rewind [tapedev]

Description

rewind rewinds the tape cartridge. It is useful when working with multiple volumes on a single tape cartridge. In the default use of **star**, **stdump**, and **stream** with **/dev/tape** a single volume is written to tape and then a rewind occurs automatically when the tape device is closed. If writing multiple volumes to tape using the other tape devices, **rewind** can be used to rewind the tape from a command line, a shell script, or a program.

Examples

rewind

Files

/dev/tprne Special tape device used for rewind.

Comments

Rewinds are done "off line". You will get the command prompt back immediately after issuing a **rewind** command, even though the tape may spend tens of seconds thereafter rewinding. Do not attempt to yank out a tape cartridge while it is being rewound or while the drive's activity light is turned on.

5.5 VOLUME

Synopsis

volume [Vol#] [#Kbytes of buffer]

Description

volume rewinds the tape cartridge and then positions the tape at the beginning of the desired data volume number. Volumes are numbered from 1 for the first volume. **volume** steps through data volumes on its way to the target volume by opening each volume and reading through it. **volume** will use as much RAM as it can get for the scan process unless the optional Kbytes of buffer parameter has been specified, in which case it will use only that much RAM, if it can get it. Attempts to step past the last volume of data will result in the tape being positioned just after the last valid file mark.

Examples

volume 3 200 Steps tape to the beginning of volume 3 using no more than 200K of RAM buffers.

volume 1 A null operation equivalent to **rewind**.

Files

/dev/tpnrne Special tape device used for rewind phase of volume.

/dev/tpnrne Special tape device used for scanning forward through the volumes.

Comments

volume can only go as fast as it can read through the tape. The more RAM, the merrier.

While "**volume 99**" may seem like a quick way to get to the end of the data section of tape in preparation for appending a new volume onto a set of existing volumes, in the current implementation of **volume** it will take a while and cause the driver to repeatedly complain about stepping past the data area. However, despite the complaints it will leave the tape positioned just past the last existing volume, ready to have a new volume written to the tape.

6. Advanced Use of the XTC System

This section describes the technical nature of streaming tape hardware in more detail and discusses multi-volume operation.

Streamer tapes differ from start/stop tapes in that there is no sense of absolute positional reference: one cannot step to an nth "block" of data on a streamer tape. All positioning on a streamer tape is done relative to a limited number of reference points. The reference points are the physical beginning of the tape, the end of the tape, and any file marks, magnetic markers which might be planted on the tape by controlling software. The areas of tape between file marks are called volumes.

A tape cartridge is logically viewed as a beginning of tape marker followed by data, a file marker, another volume of data, another file marker and so on until the file marker at the end of the last volume of data. After this last file marker comes blank tape extending to the end of tape marker.

Operations on data existing on the tape relative to these positional marks are limited compared to operations possible on start/stop tape mechanisms. Data may be read from the tape in swaths from one positional mark to another, but the tape mechanism cannot seek to one absolute byte position and read only that byte.

Writing to the tape is even more limited: one can erase the entire tape and write no data, erase the entire tape and write data starting from the beginning, or add a volume of data after the last file mark present on the tape. Thus, when desiring to write data to a tape, one has a choice of either re-writing the entire tape from the beginning, or of writing a new volume onto the tape following the last existing volume on the tape without altering any data in the preceding volumes.

6.1 Bell XTC Implementation

The Bell driver controls the tape via access through four special device files. In general, when new tape cartridges are first written they are automatically erased when writing commences. Data is then written to tape to create the first volume of information. In the usual course of events, the first volume of information is the only volume on the tape. When the software stops writing to tape, a file marker is written to that position of the tape, the tape special device is closed, and the tape rewound. Whenever a tape is written or read without being rewound, the tape is left positioned immediately after the last file marker written or read.

In many applications, however, one might want to write multiple volumes to the same tape cartridge. The presence of the file mark together with the above characteristics of streamer tape devices is exploited in the XTC device special files to allow writing multiple volumes to the same tape cartridge.

The driver supports several tape oriented character device files in /dev, the characteristics of which may be summarized as follows:

Device Name	Major	Minor	On Close
/dev/tpnrne	48	0	no rewind
/dev/tprne /dev/tar /dev/tape	48	1	rewind
/dev/tpnre	48	2	no rewind
/dev/tpre	48	3	rewind

TABLE 1. Device Characteristics for XTC /dev special files

In general, these devices will erase when opened for writing and will not erase when opened for reading. The devices **tpnrne** and **tpnre** are equivalent and the **tpre**, **tprne** devices are also equivalent. They are created only for compatibility with various OEM controllers and software created by Bell Technologies.

To create and manipulate multiple volumes on a single tape cartridge, we need to control when the tape is rewound to the beginning. This function must be coordinated when the device special file representing the tape is closed. For example, sometimes we wish to rewind the tape after software has finished using the tape device, and sometimes we do not want to rewind the tape cartridge.

The **/dev/tpxxxx** device special files provide two different combinations of rewind/no rewind capability to control the XTC as desired. They are named so that an "nr" means no rewind on close, and a "r" only in the name means a rewind on close. The "ne" and "e" in the names do not indicate any difference in function on IBM PC AT's running Xenix and are preserved only for compatibility with other Bell software releases.

For example, if the tape is opened for reading or writing via the **/dev/tpnrne** device and then closed, no rewind will occur. This particular device would be utilized in cases where we desire to read through a particular volume on our way to a subsequent tape volume.

In the default usage of the tape device using utilities like **star** or **stdump**, a single set of data is written to a single tape cartridge. The data set either fully occupies the tape or an entire tape is utilized for the data set. This common usage (in the Unix world, anyway) of one data volume per tape cartridge occurs because of the relatively low cost of tape cartridges and the convenience of maintaining a one-to-one relationship between tape cartridges and volumes.

The **/dev/tpnrne**, **/dev/tape**, and **/dev/tar** files (all really the same device file) have the right rewind characteristics to support use of the tape in the default, simple form. When these devices are used to write to the tape, they erase the tape. If they are opened for reading only, they will not erase the tape. When closed, they rewind the tape to the beginning of the tape cartridge. When used with utilities like **tar**, **star**, **stdump** or **stream** they automatically perform the correct rewind/no rewind functions.

The same end could be accomplished by manual use of the other devices. For example, a `star cvf /dev/tpre` to archive to tape with a `star xvf /dev/tpre` to extract from the archive would accomplish exactly the same function. The principal role of the other devices, though, is to support multiple volume use of the tape and other custom applications.

6.2 Multiple Volume Use

Let's say we would like to copy both our root partition and our usr partition out to the same tape cartridge (space permitting, of course) using `stdump`. The first archive should be written using a tape special device that does not rewind on close. The second archive should be written using a tape device that rewinds on close.

We proceed as follows:

```
stdump 0f /dev/tpnre /dev/root, followed by
```

```
stdump 0f /dev/tpre /dev/usr
```

The first command erases the tape and writes out an `stdump` of `/dev/root` to the tape. When the command is finished, the device driver writes a file mark at the end of the `stdump` data and closes the tape device without rewinding the tape.

The second command will result in the tape device being opened for writing. As the writing occurs, the tape is erased. As `stdump` dumps out the `/dev/usr` disk partition to tape, the second data volume will be created. When this command is completed, the device driver closes the tape device and rewinds the tape cartridge back to the beginning of the tape.

Since the tape hardware has no way of writing a "directory" to the beginning of the tape to reflect the addition of subsequent volumes, the only way to determine what volumes are on a tape is to read all the way through the tape. It is far quicker to take a moment to note on the tape label what volumes have been written to the tape.

There are three main ways in which we might use the newly created tape archive:

- 1) To restore the root partition only.
- 2) To restore the usr partition only.
- 3) To restore both the user and the root partition only.

The third case is analogous to the creation of the tape:

```
restore rf /dev/tpnrne /dev/root, followed by
```

```
restore rf /dev/tprne /dev/usr
```

The first command restores the root partition without erasing the tape and without rewinding it. The second command restores the user partition without erasing the tape and then rewinds the tape so we may place it back into storage for use on another day if need be.

To restore the root partition only is also simple:

```
restore rf /dev/tpnrne /dev/root
```

In this case we restore the partition without erasing the tape, and then the tape is rewound.

To restore the usr partition only, we need to step through the root partition without actually restoring it. A convenient way of doing this is to read through the partition using `stream` while discarding the data into `/dev/null`:

```
stream /dev/tpnrne /dev/null
```

We can then follow this with:

```
restore rf /dev/tpnrne /dev/usr
```

to restore the usr partition. (We could have also used a `volume 2` command to get out to the volume with `/dev/usr` on it).

Any commands may be used on any volume of the tape. For example, we might `star` several collections of files to several tape volumes followed by a `stream` to a volume followed by an `stdump`. When writing many volumes to tape using a mixture of commands it is prudent to keep track of what commands were used to create which volumes. This simplifies extraction.

A typical use of multiple volumes is to set up a `cron` task that archives out a data file to tape. For example, we might want to copy an inventory database file out to tape on a daily basis. The cron job would go as follows:

```
(Monday night):          stream /dev/tpnrne dbms.file
(Other nights):          stream /dev/tpnrne dbms.file
(Friday night):          stream /dev/tpre dbms.file
```

If the "dbms.file" were less than about 10 Megabytes we could write an entire week's worth of backups onto a single tape cartridge which could be left inserted in the machine. Each Friday we could do an end-of-week backup onto a second tape cartridge, and then re-insert the running backup cartridge. The next Monday, the tape would be erased automatically and the daily running backup process would start again.

Suppose our system crashed Thursday afternoon. We would then want to restore the dbms file from the last backup, on Wednesday night (In a real system, of course, we would also have some sort of daily transaction log to restore right up to the last transaction before the crash). According to our schedule, the tape has three volumes on it and is positioned immediately after the last volume's file mark.

We need to

- 1) Rewind the tape.
- 2) Skip through two volumes, and position tape at beginning of the third volume.
- 3) Restore from the third (Wednesday night) volume.
- 4) Leave the tape positioned ready for Thursday night's backup.

Step one we accomplish using **rewind**.

Step two we accomplish with a **volume 3**.

Step three consists of **stream /dev/tpnre dbms.file**, which also fulfills step 4 as well.

6.3 Other Notes

Here are some notes which will help out when approaching the tape devices as standard unix character raw devices:

Since streaming tape devices can either read at a session or write at a session but not both, when opening the `"/dev/tpxxxx"` devices from within a program you should open either for reading or for writing, but not both. Programs which attempt to open for reading and writing will fail unless piped through `stream`.

Since the tape devices are character special devices, they should be written in multiples of 1024 (1K) bytes. Avoid, therefore, odd numbered blocking factors in `tar` since when these are divided by two (`tar` thinks in terms of 512 byte blocks) the result is not an even division by 1024 bytes.

The amount of data which can actually be stored on a tape cartridge varies according to the format employed. `stream` does the best, while `tar` is probably the worst. Like disk drives, tapes which have a raw capacity of 60 Megabytes actually store much less when formatted. In typical use, a 60 Megabyte tape cartridge will only be able to store 52 Megabytes of data. Similarly, a 45 Megabyte tape will actually store much less depending on the format. 35 Megabytes is always safe with the 45 Meg tape.

Use DC300XL tapes for 45 Megabyte capacity, and DC600A tapes for 60 Megabytes capacity. Tapes are good for over 1000 passes. Most businesses can use and reuse the same tape for over a year; however, it is probably a good idea to get a new tape every six months or so if the tape is used more than once a day. See the XTC hardware manual for more information.

7. Maintenance

The following sections address topics in maintaining your XTC system. Correct preventative maintenance is the most important step in assuring trouble-free usage of your XTC system over the years.

7.1 Preventative Maintenance

The amount of preventive maintenance required for satisfactory performance of the Tape System is extremely small. Except for the cartridge tape drive head and tape guides, which should be cleaned approximately once a month or every 8 hours of use, no other parts of the subsystem should require preventive maintenance.

To clean the read/write head, soak a cotton swab with isopropyl alcohol which is 98% alcohol (usually available as cleaning fluid sold for floppy disk drive cleaning), and gently rub it against the head and tape guides. If new cassettes are being used for each backup, the cartridge tape drive head should be cleaned more often to avoid a buildup of oxide particles which tend to flake off the new tapes.

Bell Technologies offers a tape cleaning kit for your new XTC. You may find it more convenient to use this kit than to utilize cotton swabs.

For XTC units used in unusually dusty environments, it is important to clean the End of Tape (EOT) sensor hole to prevent dust from accumulating. If you look inside the opening into which the tape cartridge is usually inserted, on the inside left approximately one inch into the opening is a small hole or holes. This hole should be kept clear of obscuring dust. We have found that "spray air" cans sold in photography stores and used by photographers to blow dust off of negatives are perfect for cleaning out any dust in this hole.

If the tape device starts eating tapes (ie, the tape runs off the end of the cartridge), you know an EOT hole-cleaning session is long overdue. It takes but a moment to clean the EOT hole.

7.2 Cartridge Care and Life Expectancy

Always store the tape cartridges in a cool, dry place away from magnetic fields.

Never turn the Tape System power ON or OFF while the cartridge is in the cartridge tape drive, as the tape could jam or your data on the tape could be damaged.

The cartridge can normally be used for at least 1000 passes, or one year's worth of regular use. If the system driver experiences an excessive number of rewrites when trying to write data to the tape, it will complain and suggest you try a new tape cartridge. Excessive rewrites may also be caused by dirty read/write heads. If a new cartridge still results in complaints about excessive rewrites, try cleaning the heads.

8. General Troubleshooting

The following is a guide for troubleshooting Tape System units. If you encounter any error messages or other problems, please record the symptoms and sequence of events which led to the problem as precisely as possible, and report them to your dealer.

There are no user-servicable components inside the Tape System drive; however, the following guide may prove useful in diagnosing problems should they occur. If your tape fails to operate correctly, try the following procedures:

- _____ Is a cartridge in the tape drive?
- _____ External Units: Is the power switch turned on?
- _____ Check tape cartridge write-protect selection setting.
- _____ Is the tape cartridge inserted upside down? Turn the cartridge over and try again.
- _____ The quality of your tape may be degrading. Try another tape.
- _____ Clean the read/write head as described in the section on Maintenance.
- _____ Check all power cords plugged in, all power switches correctly turned "ON".
- _____ Confirm that power is available in the wall outlet used by plugging in a light.
- _____ Verify controller board to tape drive cable is correctly plugged in all the way at both ends.
- _____ Remove all cards from PC except the Tape System controller card, disk controller card and the video card; verify problem still occurs. If problem no longer occurs, check the removed cards.
- _____ Remove Tape System controller card from PC, press firmly down on all chips to make sure they are seated in the Tape System controller card's sockets and then reinsert card.
- _____ Verify DIP switch and jumpers correctly set on card.
- _____ Try running Tape System controller card in a different PC AT expansion slot (the connector in the slot may be broken).

8.1 Interrupts and Memory Map

Your XTC tape controller card uses interrupt level 5. This is the same interrupt level used by the secondary parallel port and was selected to provide you with maximum performance.

I/O addresses used are 0x300 and 0x301. These are the standard Wangtek addresses used in nearly 100,000 tape installations in the DOS market.

We use DMA channel 1.

8.2 Conflicts with Other Devices

The biggest problem in Xenix on the IBM PC AT today seems to be the incredibly bad quality of some of the multiport serial cards available on the market.

We do not suggest you procure a serial card which is mapped to i/o space with more than two or eight bytes of i/o space required. If the serial card is designed to map into i/o space within that limit, the designer can always drop the card's i/o space into the i/o locations reserved for the primary or secondary IBM serial port. In contrast, some of the serial card designs consume vast quantities (64 bytes!) of i/o space outside the primary or secondary serial port reserved areas and thus seem to be begging for trouble.

If you have a card which insists on using 0x300 or 0x301 you cannot run the standard XTC drivers. Please call us if this is the case, as a special OEM version of the XTC unit may be available with a map to 0x338 and 0x339.

If you have a peripheral that uses interrupt level 5 unintelligently, you may have a conflict with the XTC. Occasionally one runs into drivers which are written under the assumption that they will be the only device utilizing a specific interrupt channel. This is a rather unfortunate assumption to make in IBM architectures and will almost always cause trouble on a fully populated system. Bell's XTC drivers are designed to assume they will share everything except the two basic i/o locations.

9. Customer Service Procedures

If you have any problems following the directions in this manual, our customer service staff is available to you. Please be prepared to describe the problem in detail to our staff. Our customer services exist to help you resolve problems with the equipment we sell.

As much as we would like to help you with other problems, we cannot teach you to use your computer or its operating system. To avoid the need to spend time discussing procedures that are outlined in this manual, please review the entire manual before calling us.

If you have a question or are unclear about the installation or operation of your tape unit, please call us at:

(415) 659-9097

Ask for Customer Service. Service hours are between the hours of 9 a.m. and 5 p.m. Pacific Standard Time. If our lines are busy, please keep trying. It is possible that when you call, all of our customer service representatives may be unavailable. If you leave your name and number your call will be returned in sequence within a short period of time.

9.1 Missing or Damaged Components

If you have determined that you are missing some of the components from your Tape System or that some of your components have been damaged, please call our customer service number. Tell our representative about the missing or damaged components. We will do what we can to quickly replace the missing component or to help you resolve the damage problem.

9.2 Warranty Service

Our warranty repair procedures are available for units which have been registered using the warranty registration card enclosed with your tape unit and which have malfunctioned during the warranty period. If you have determined that your unit is not functioning correctly and must be returned for repair, please follow these procedures:

_____ Have the serial number of the unit and the date of purchase available. The serial number is on the side of the tape drive.

_____ Call our customer service representatives at:

1 (415) 659-9097

_____ Tell them your unit is not functioning and you wish to return it for warranty repair. Please be ready to discuss the problem.

_____ You will be given an RMA number (Returned Material Authorization). **UNITS WILL NOT BE ACCEPTED FOR REPAIR WITHOUT THIS NUMBER.**

_____ After receiving your RMA number, package the unit in its original container. Please include all components which may be malfunctioning (you should not include manuals or diskettes). If your customer service staff has instructed you to include just a specific component, you need only include that component.

_____ Include your name, complete SHIPPING address and your phone number in the package. Also include a written description of the problem with any printouts or other items that might help us find the problem. If we do not have your warranty registration card on file you must enclose a copy of your invoice.

_____ Ship the unit to the Bell Technologies service location provided to you along with the RMA number by your customer service representative. Include "Attention Warranty Repair" and your RMA number in the lower left corner of the package. Your RMA number **MUST** be visible or our receiving group will refuse the package.

_____ We suggest you ship the unit UPS Blue Label or, if time is of the essence, Federal Express. Please make sure you insure your package.

Your unit will be repaired or replaced at the discretion of Bell Technologies and returned to you promptly. We will ship the unit pre-paid via UPS or similar service to anywhere within the continental USA. If for some reason you need the unit more rapidly, we will ship Federal Express or similar service if you provide us with your account number. We will not pay Federal Express or any other accelerated shipping charges.

10. One Year Warranty Policy

Bell Technologies Incorporated ("Bell") warrants to the original purchaser that each of its hardware products, and all components thereof, will be free from defects in materials and/or workmanship for one year from the date of purchase. Any warranty hereunder is extended only to the original consumer purchaser and is not assignable.

In the event of a malfunction or other indication of failure attributable directly to faulty workmanship and/or materials, Bell will, at its option, repair or replace the defective products or components, to whatever extent it shall deem necessary to restore the product or component to proper operating condition, provided the consumer purchaser sends with the defective product proof of the date of purchase of the product. Please note that Bell may replace the defective product with a new or remanufactured functionally equivalent product of equal value, at the option of Bell. Before returning a product for repair, the customer must call Bell Technologies customer service at 1-(415)-659-9097 for a Returned Material Authorization (RMA) number. This number should be included with the customer's mailing address and telephone number when the product is returned.

During the first year after the date of purchase, all labor and materials will be provided without charge. There shall be no warranty for either parts or labor after the expiration of one year from the date of purchase. This warranty does not apply to damage which occurs while the product is in transit between Bell and the customer site. This warranty does not apply to units which have been mishandled, dropped, or used in any way not in accordance with the purposes outlined in this manual. This warranty does not apply to intentional or unintentional damage occurring to the product or to the equipment in which it is installed by any outside cause. This warranty does not apply to damage resulting from faulty operation of other components installed in the same chassis as the product.

Units must be returned to Bell in the original shipping carton with all protective shipping materials properly installed. If the original shipping container is not available, Bell will provide a replacement for a nominal charge. This warranty will be voided for units received in unauthorized containers. Units must be returned postage or shipping prepaid. It is recommended that the unit be insured when shipped. Units returned without proof of date of purchase or out-of-warranty units will be repaired or replaced at the option of Bell Technologies and the customer will be charged for parts and labor. By returning any unit to Bell for repair, customer grants Bell a security interest in the unit for unpaid parts, labor, and shipping charges.

Products will be returned to the customer after repair or replacement has been completed by carrier and method chosen by Bell to any destination within the continental U.S.A. If the customer desires other conveyance or is located beyond the borders of the continental U.S.A., the customer must bear the cost of return shipment. This warranty is contingent upon proper use of the product. This warranty will not apply if adjustment, repair or parts replacement is required because of alteration, accident, unusual physical, electrical or electro-mechanical stress, neglect, misuse, failure of electric power, air conditioning, humidity control, transportation, or operation with media not meeting or not maintained in accordance with Bell specifications.

EXCEPT FOR THE EXPRESS WARRANTIES STATED HEREIN, THERE ARE NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND ALL SUCH WARRANTIES ARE EXPRESSLY AND SPECIFICALLY DISCLAIMED. IN NO EVENT SHALL BELL OR ITS AGENTS, EMPLOYEES,

DIRECTORS OR OTHER AFFILIATES BE RESPONSIBLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOST PROFITS TO YOU OR ANY OTHER PERSON OR ENTITY REGARDLESS OF THE LEGAL THEORY, EVEN IF WE HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Bell is not liable for damages resulting to other equipment occupying the same chassis as this product, due to failures of this product. Bell is not liable for damages or consequential losses resulting from the unavailability of this product or the inability of this product to perform its stated purpose.

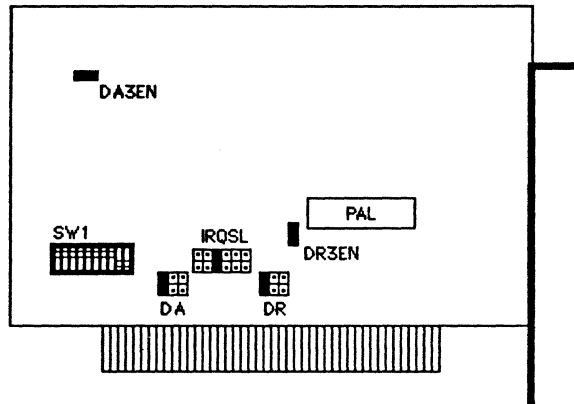
Some states do not allow the limitation on implied warranties or on how long they last, or the exclusion or limitation of liability for incidental or consequential damages, so these limitations or exclusions may not apply to you.

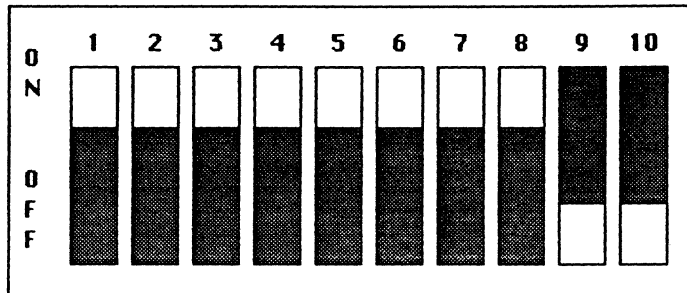
No dealer, company or person is authorized to expand or alter these warranties; any such representation will not bind Bell.

11. Appendix on Short Card Controllers

Bell Technologies XTC tape products sold with a short, half-card sized controller should utilize the following settings for DIP switches and option jumper selections.

Short Controller Card



DIP Switch Settings for Short Controller Card (1-8 are N, 9 and 10 are OFF)

Note: Slide switch style DIP is illustrated. If your board uses rocker style switch, push rocker DOWN on "ON" side to select "ON".

Option Jumper Settings for Short Controller Card