**Kingston Technology
TurboChip 486
Installation Guide**

**Models: TC486/100
              TC486/75**

Kingston Technology's

TurboChip™ 486

Clock-Tripled 486DX4
100MHz and 75MHz
Processor Upgrades

For 486DX and 486SX
Desktop Computer Systems

Installation Guide

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Introduction

Congratulations on the purchase of your Kingston **TurboChip** 486DX4 clock-tripled processor upgrade for 80486 DX and SX computers. The two models, TC486/100 and TC486/75, add clock-tripling technology to run three times faster than your native processor speed. The TC486/100 upgrades your 33MHz (native speed approx. 33.3) system to a clock-tripled rate of 100MHz. The TC486/75 clock-triples the speed of your 16, 20, or 25MHz 486 system to run at three times the speed of the original processor. TurboChip processor upgrades feature 8KB internal cache, a built-in math coprocessor, and 32-bit internal and external processing. TurboChip is a high-performance solution to increase your computer's CPU speed 180% over its current 486 clock speed to give you the power and performance for today's most demanding software applications.

TurboChip is a small CPU-sized processor upgrade which installs directly into your existing processor socket, or an Intel® OverDrive™ socket if the original processor cannot be removed. Many 486 computers use ZIF (zero-insertion-force) sockets with a lever or retaining screw to make removing the CPU chip quick and easy. Kingston provides a PGA socket extender to use with certain types of ZIF socket installations. TurboChip also uses a cooling fan to control the TurboChip's operating temperature for year's of reliable performance.
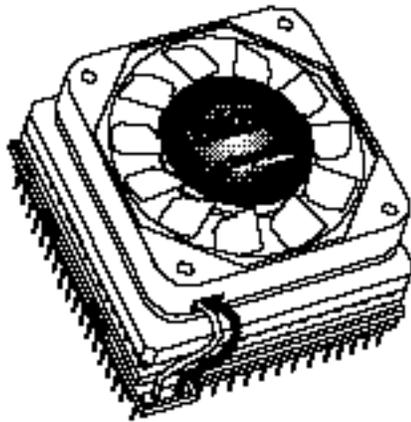
TurboChip

486 Clock-Tripled Processor Upgrade

Special Features

Your Kingston TurboChip includes these important features:

- Powerful 486DX4 microprocessor running at 100MHz or 75MHz.
- 8KB internal cache.
- Integrated math coprocessor functions.
- "Plug and Play" installation. No software drivers to install.

Kingston features the Landmark System Speed Test® Version 2.00 for testing the performance of your new TurboChip upgrade. The Speed Test program is located on a 3.5" Utility Diskette included in your TurboChip package. Kingston suggests running the speed test before and after installation to compare the performance increase. Refer to Appendix A on page 14 for instructions on running Landmark System Speed.

Package Contents

The TurboChip package should contain the following items:

- TurboChip processor upgrade
- Chip Extractor Tool
- 168-Pin PGA Socket Extender
- Utility Diskette
- This Installation Guide

If any of the items are missing or damaged, please contact your Kingston dealer for a replacement. Remove the Processor Upgrade from its special anti-static foam pad only when you are at the point of installing it into your computer. Remember to ground yourself first to avoid static electricity discharge. Do this by applying both hands to a neutral metal surface like the rear of the computer or the power supply metal housing. Remove the protective foam pad from the TurboChip connector pins very carefully, and take care not to damage the pins when installing the upgrade. Retain all the protective packaging for future use.

Before You Begin

The TurboChip installation should take less than 15 minutes to complete. Before you begin, however, there are two things to be aware of. First, notice the location of Pin 1 on the TurboChip upgrade. This corner of the upgrade must match Pin 1 on the processor socket (See figures below).   Secondly, determine your type of CPU configuration. The 486 processor may be *socketed* (easily removed), or ***surface-mounted*** (soldered directly to the system board). If the CPU is surface-mounted, it cannot be removed. In this case, install TurboChip into the adjacent OverDrive socket. For socketed configurations, the TurboChip is installed directly into the CPU socket. Take a few moments to read the sections below before beginning the installation process.

Pin 1 Orientation

The location of Pin 1 on the TurboChip must be oriented to match Pin 1 on the processor socket. Pin 1 on the TurboChip is denoted by a white corner edge on the CPU chip. When installing TurboChip, it must be oriented so that Pin 1 is aligned with Pin 1 on the CPU socket. The socket should also have a beveled edge or silk-screened arrow denoting Pin 1. Before installing TurboChip, refer to the original 486 processor to verify the location of Pin 1. Figures 1-1 and 1-2 show the location of Pin 1 on the TurboChip. Figure 1-3 shows Pin 1 on the original 486 processor, please make a note of it before removing.
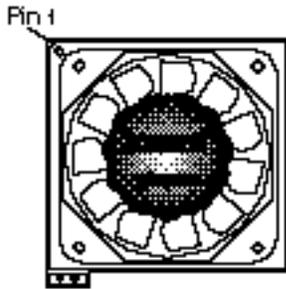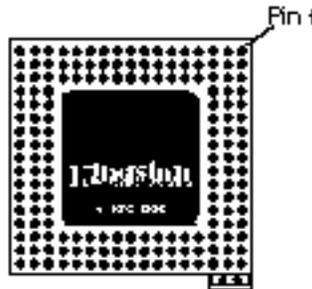
Fig. 1-1 Top View   Fig. 1-2 Bottom View   Fig. 1-3 Original 486 CPU

Types of CPU Configurations

Your 486DX or 486SX computer will most likely resemble one of the following types of processor (CPU) configurations. If the CPU is surface-mounted (Option 3), it cannot be removed. In this case, install TurboChip into the adjacent OverDrive socket. For all other installations, install TurboChip directly into the CPU socket.

Now you are ready to begin the TurboChip installation. Remember, the TurboChip replaces the existing CPU so there is no need to change any system jumpers. If the CPU cannot be removed, then use the OverDrive socket, but your system will require setting jumpers when using this socket.

Installing TurboChip

The TurboChip processor upgrade is designed to work in a wide variety of 486 computers. The installation procedure will differ slightly according to the location of your 486 processor socket. Also, the orientation when installing TurboChip will depend on the location of Pin 1 on the processor socket. If needed, Kingston includes a PGA Socket Extender for some types of ZIF sockets where the upgrade may prevent the retaining bar from closing (detailed in Step 4). Follow the steps below to install TurboChip into your computer.

Step 1. Opening the Computer

1. Set the power switch on the system unit to OFF.

2. Set all external power switches OFF (i.e. display, printer, etc.).

3. Disconnect all power cords and cables from the rear of the computer.

4. Remove the cover from your computer as described in your owner's manual. Make sure you have room to work. If necessary, place the computer on a desktop surface that is easily accessible with plenty of area to work.

Step 2. Locating the CPU

1. Locate the 486 CPU processor on your system board or CPU expansion card. The CPU chip is generally labeled by the manufacturer, such as "INTEL." The CPU chip will also have descriptive markings, such as "80486DX-33" denoting the CPU type (486DX) and the CPU speed (33MHz).

2. Make sure the 486 CPU is accessible. If the CPU socket is located under an expansion card, move any full-length adapter cards to other expansion slots. If no slots are available, place a half-length card in the slot nearest the CPU socket so that the CPU socket is unobstructed. If the CPU socket is located under the floppy drive (e.g., IBM ValuePoints), loosen the retaining screws and remove the drive bay for easier installation.

Step 3. Removing the CPU Chip

1. Before removing the CPU chip from its socket, note the position and orientation of Pin 1 (identified by either a notch, beveled edge, dot, or half-circle). The position of this corner (Pin 1) determines how the TurboChip will be installed. **Pin 1 on the CPU socket must match Pin 1 on TurboChip.** Refer to Figure 1-1 on page 3 for the location of Pin 1 on the TurboChip upgrade.

2. If the CPU is socketed in a standard or ZIF socket, remove it following the steps below. If the CPU is surface-mounted (soldered to the board), look for a ZIF type OverDrive socket. **Do not attempt to remove a surface-mounted CPU.**

    ❏ **For Standard Sockets:** use the Chip Extractor Tool provided to remove the 486 CPU chip from its socket. Gently insert the edge of the tool **between** the CPU chip and the socket. **(Do not pry up the socket)**. Start on one side of the 486 chip, levering it up slightly. Refer to Figure 2-3. Repeat this action for each of the four sides of the 486 chip, working around the sides several times until the pins on the underside of the chip are sufficiently exposed so it may be carefully lifted out with your fingers. Be careful not to bend or break the pins. Afterwards, if pins are slightly bent, lay the Chip Extractor Tool lengthwise between the rows of pins to straighten the pins back to their original state. Use the TurboChip's packaging material to store the 486 chip in a safe place.

    ❏ **For ZIF Sockets:** unlatch the side lever, overhead bar, or retaining screw to unlock the socket and remove the CPU with your fingers. See below.
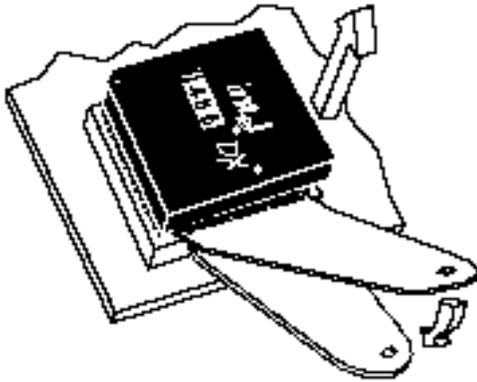
Standard Socket Removal   **ZIF Socket Removal**
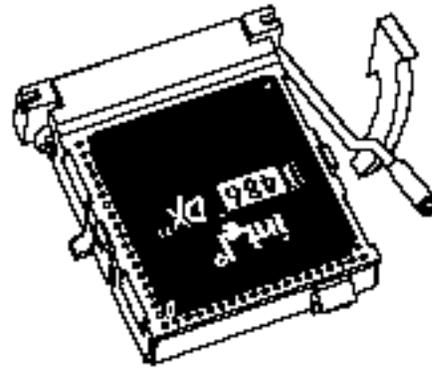
Figure 2-3 Removing the CPU Chip

Step 4. Is the PGA Socket Extender Needed?

The 168-Pin PGA Socket Extender, supplied with your TurboChip upgrade package, is used in certain types of ZIF socket installations only. ZIF sockets are commonly used for either processor sockets or OverDrive sockets. The TurboChip can be installed into either socket, but only use the OverDrive socket if the CPU is surface-mounted and cannot be removed. Using the OverDrive socket will require setting system jumpers adding another step to the installation process. Refer to your owner's manual for any special settings that must be performed when using the OverDrive socket.

There are three types of ZIF sockets depending on the mechanism used to open and close the socket. ZIF sockets use either: 1) a side bar lever, 2) retaining screw, or 3) overhead bar to remove the CPU from the socket. The first two types of ZIF sockets, side bar and retaining screw, do not require the socket extender. The third type, overhead bar, is a three sided lever that opens and closes directly over the CPU chip. With the added height of the TurboChip installed, the overhead bar cannot close properly. For this reason, the PGA Socket Extender can be placed into the socket allowing the bar to close. The TurboChip upgrade can then be installed into the Socket Extender.

Is the PGA Socket Extender Needed?

No	No	Yes

ZIF Socket with Sidebar

ZIF Socket with Retaining Screw

ZIF Socket with Overhead Bar
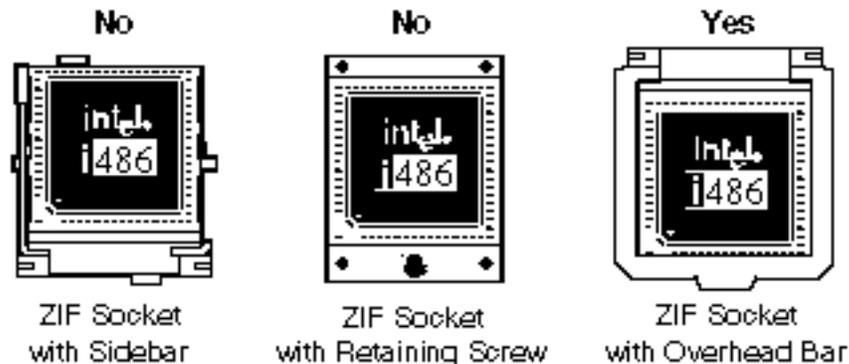
Installing the PGA Socket Extender (If Needed)

The overhead bar-type ZIF socket does require installing the PGA Socket Extender while the socket is open, then lowering the bar to a closed position, and finally, installing the TurboChip upgrade into the socket as detailed in this manual. To install the PGA Socket Extender, read the steps below.

If you have a ZIF socket with Overhead Bar, install the PGA Socket Extender as follows:

1. Locate the beveled edge or rounded corner on the socket extender. Match this beveled edge (Pin 1) to that on the CPU socket on your system board.

2. Now position the pins on the PGA Socket Extender over the holes on the 486 CPU socket.

3. Once you are sure the alignment is correct, gently press the PGA Socket Extender down until it is seated properly into the ZIF socket.

4. Lower the Overhead Bar down towards the socket to lock the extender in place. Now proceed with Step 5 to continue with the installation.

Fig. 2-4 ZIF socket with Overhead Bar   Inserting Socket Extender
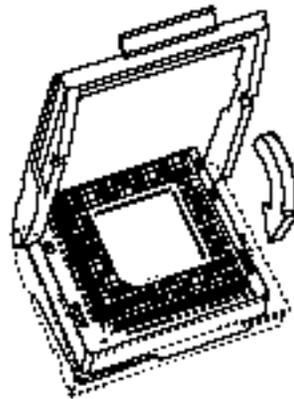
Step 5. Orienting the TurboChip

When installing the TurboChip, the orientation of Pin 1 (marked with a white dot on the upper-left corner of the unit) must match the original Pin 1 orientation of the 486 processor chip (See Figure 1-1 on page 3). Pin 1 is usually denoted by a beveled or cut edge. The orientation of the processor socket will vary depending on the make and model of your particular computer. Follow the steps below to determine the correct orientation of TurboChip in your computer.

1. Look at the TurboChip carefully. There is a beveled corner marked with a white dot on one corner of the TurboChip CPU. Refer to the illustrations on page 3 for help in locating Pin 1 on the TurboChip.

2. With the TurboChip positioned so that the beveled corner on the upgrade matches the beveled corner on the processor socket, you are ready to insert TurboChip into the empty CPU socket.

Warning: If the processor upgrade is not installed correctly (Pin 1 to Pin 1), it may result in damage to the computer, the processor upgrade, or both. Please orient Pin 1 on the TurboChip upgrade to match Pin 1 on your CPU socket. Refer to Figure 2-5 below.
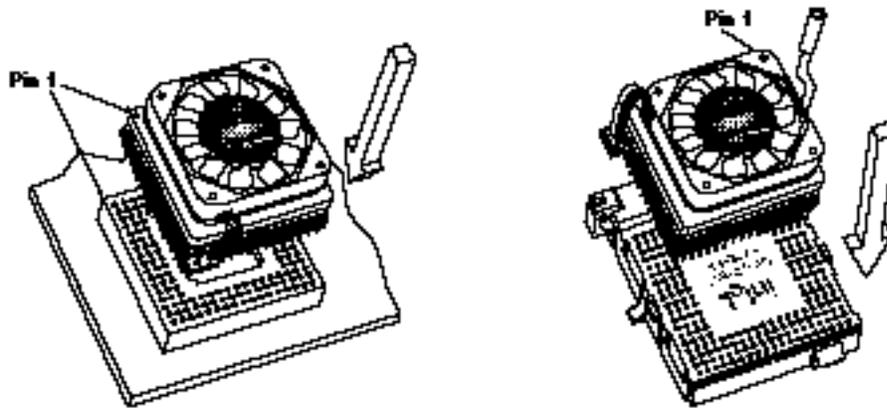
Standard Socket Orientation   **ZIF Socket Orientation**

Figure 2-5 Orienting the TurboChip

Step 6. Inserting the TurboChip

To insert the processor upgrade correctly, you need to have the pins on the TurboChip adapter exactly lined up with the corresponding holes on the CPU socket.

❑ **For Standard Sockets and Overhead ZIF with Socket Extender Installed**

When you are sure the alignment is correct, grasp the sides of the TurboChip with your thumb and forefinger and gently push the adapter into the socket applying an even pressure. Finally, to make sure a good connection is made, use both thumbs to push down firmly on opposite corners of the fan unit, again using even pressure. **Do not push down from the center of the fan.** Refer to Figure 2-6.

Note: You will meet some resistance so firmness is required. If it proves difficult to insert the processor upgrade, stop and check the alignment. If the alignment is incorrect, remove the processor upgrade and begin the insertion again.

❑ **For Sidebar or Retaining Screw ZIF Sockets**

While the socket is unlocked or in the open position, align the pins on the TurboChip into the holes on the ZIF socket. **Place the TurboChip into the socket without using any force.** Apply gentle pressure, only if needed, to make sure the processor is completely inserted. Lower the sidebar lever or rotate the retaining screw to close the socket back to a locked position. Refer to Figure 2-7.
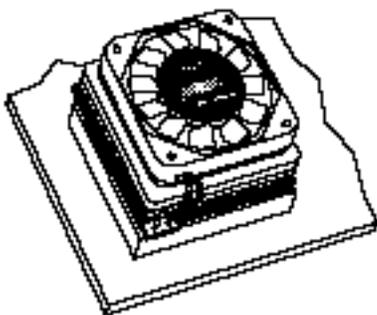
Fig. 2-6 TurboChip Installed   *Fig. 2-7 Securing the ZIF Socket*
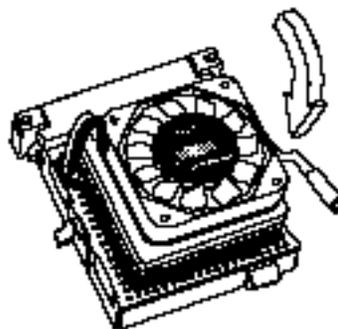
Step 7. Increasing the Clock Speed (TC486/75 Only)

Normally, computers will automatically detect a faster CPU running in the processor socket and no adjustment is required. Some computer system boards have jumper settings that allow the user to adjust the clock speed of the system. If you have a slower machine (16MHz or 20MHz), you may be able to set the CPU rate to 25MHz when using the TC486/75. Check your system documentation for jumper settings to see if you can select the speed of the CPU.

Note: Do not exceed 25Mhz when using the TurboChip TC486/75. To increase your system speed to 33Mhz, you must use the TC486/100.

Step 8. Completing the Installation

1. Replace any adapters removed earlier.

2. Replace the cover of your computer, and reconnect any cables that were removed.

3. Check that your computer starts correctly. It should begin a memory count and run its POST (Power-On-Self-Test). If it does not boot, turn to *"Appendix B Troubleshooting"* in the back of this manual for help.

Congratulations! The installation is now complete. Because TurboChip requires no device drivers, there is no software installation to perform. If you experience any problems, refer to *"Appendix B Troubleshooting"*. If your problem is beyond the scope of this manual or you have questions regarding this product, call Kingston Technical Support at (714) 435-2639 to speak to a trained technician.

Appendices

Appendix A   Running the Landmark Speed Test

Included on the Kingston Utility diskette is the Landmark System Speed Test Version 2.0. To verify the clock speed and ensure proper operation of your new TurboChip, run SPEED200.EXE from a DOS prompt.

Note: Due to the multitasking nature of both Windows and OS/2, running Landmark Speed Test in these environments yields inconsistent results. In order to obtain accurate results, you must start SPEED200 directly from DOS. Do not open a DOS window from within OS/2 or Windows.

To run SPEED200.EXE from DOS, follow the steps below:

Step 1.   Insert the Kingston Utility diskette into Drive A.

Step 2.   At the DOS prompt, enter the following commands:

C> **A:** [Enter]
A> **SPEED200** [Enter]

Speed Test can also be run with the following switches, as desired:

/b   bypass initial menu screen.

/nv   do not run video test.

/q   run in quiet mode (no sound). Note: Pressing [F10] while the test is running turns sound off.

/xx   perform test for *xx* seconds, then exit.

To use one or more switches, type the following command in bold:

A> **SPEED200 /b /nv /q** [Enter]

Benchmark Test Results

The following test results were found when installing the TurboChip 100MHz processor into an IBM ValuePoint 33MHz, Model 6384-N50, and a TurboChip 75MHz processor into a Compaq Prolinea 4/25s. The Diagnostic Programs below indicate the relative speed in Megahertz (MHz) of the processor, or a value indicating the overall performance index.

TurboChip 100MHz

Diagnostic Program used	IBM ValuePoint 6384-N50 33MHz	TurboChip TC486/100 100MHz
Landmark Speed 2.0 MHz in relation to IBM AT	112 MHz	332 MHz
Norton SI 5.0 CPU Index Performance Index	72 52.4	125 87.9

TurboChip 75MHz

Diagnostic Program used	Compaq Prolinea 4/25s 25MHz	TurboChip TC486/75 75MHz
Landmark Speed 2.0 MHz in relation to IBM AT	84 MHz	252 MHz
Norton SI 5.0 CPU Index Performance Index	54 38	95 66

Appendix B   Troubleshooting

This section describes problems you may encounter when installing the TurboChip processor upgrade. If you experience any problems, do the following:

1. Read this section carefully, and see if your problem is described. Try the suggested actions.

2. If necessary, call the place of purchase. However, before you call, write down the following information:

   - Your computer make and model.

   - The exact wording of any error messages associated with your problem.

   - The contents of your CONFIG.SYS and AUTOEXEC.BAT files.

   - The version numbers of your software applications and operating system.

Computer Does Not Start

If there is no display on the screen when you turn the power on:

1. Check that the power cord and all necessary cables are correctly plugged in and power is ON. There should be a light on your system unit and on your monitor indicating that they have power.

2. Turn off your computer and disconnect the power cable. Remove the cover from the system unit and check the seating and orientation of the processor upgrade. The best method for checking the seating of the TurboChip is to remove the processor upgrade and carefully reinstall it. But first, see if the connector pins are showing between the upgrade and the socket. If so, the TurboChip may not be seated properly to the processor socket. Use both thumbs on opposite corners of the fan unit, applying even pressure to seat the processor upgrade completely into the processor socket. **Do not push down on the center of the fan unit.**

3. Check that all other adapters are firmly seated in their sockets. Replace the cover and try the power again.

4. If it still does not boot, remove the TurboChip from your computer and replace it with the original 486 processor. Try the power again. If the computer now starts, the Processor Upgrade may be incompatible with your computer. Contact Kingston Technical Support at (714) 435-2639 for help in diagnosing any problems.

Cannot Access Diskette or Hard Disk Drive

You may have dislodged the connection between the diskette or the hard disk drive and its controller card when you installed the Processor Upgrade.   Check this connection now.

Where to Reach Kingston

If you have any problems, questions, or comments associated with installing or using your TurboChip processor upgrade, please call Kingston Technology Technical Support to speak to a technician. For the latest file updates and information, access the Kingston Bulletin Board Service or CompuServe using your modem. Kingston has internet addresses for e-mail communications as well. To receive immediate product information sent to you by fax, call Kingston's RAMfax™ service.

Technical Support:	6:00 am to 6:00 pm Pacific Time Monday through Friday (800) 435-0640 or (714) 435-2639
BBS:	Kingston's Bulletin Board Service (714) 435-2636, up to 14.4Kbps, 8-N-1
CompuServe:	71333,3714 or type: **GO KINGSTON**
Internet:	For Product Information: **sales@kingston.com** For Technical Support: **tech_support@kingston.com**
RAMfax:	Automatic Faxback System (U.S. and Canada) (800) 435-0056 or (714) 435-2677

Limited Warranty

KINGSTON TECHNOLOGY CORPORATION ("Kingston") warrants that this product is free from defects in material and workmanship. Subject to the conditions and limitations set forth below, Kingston will, at its option, either repair or replace any part of this product which proves defective by reason of improper workmanship or materials. Repair parts or replacement products will be furnished by Kingston on an exchange basis, and will be either new or refurbished to be functionally equivalent to new.

This warranty applies only to the original end user purchaser, and does not cover any damage to this product which results from accident, abuse, misuse, natural or personal disaster, or any unauthorized disassembly, repair or modification.

Duration Of Warranty

*Lifetime Warranty***:** The following Kingston products are covered by this warranty for life: solid state memory (e.g., Single Inline Memory Modules, or "SIMMs"), network interface cards and adapters, solid state PCMCIA interface adapters, and x86-based microprocessor upgrade products.

*Five Year Warranty***:** The following Kingston products are covered by this warranty for a period of five years from the date of original retail purchase: storage enclosures, power supply units and subassemblies, Winchester hard disk drives with a capacity of one gigabyte or more, and all other Kingston products (other than those products covered by a two-year or one-year warranty, as provided below).

Two Year Warranty: The following Kingston products are covered by this warranty for a period of two years from the date of original retail purchase: Winchester hard disk drives in a 2.5 inch, 3.5 inch or 5.25 inch form factor and with a capacity of less than one gigabyte.

*One Year Warranty***:** The following Kingston products are covered by this warranty for a period of one year from the date of original retail purchase: Winchester hard disk drives in a 1.8 inch form factor, optical storage products, and magnetic tape storage products.

Warranty Claim Requirements

To obtain warranty service, return the defective product, freight prepaid and insured, to your local authorized Kingston dealer or distributor, or to the Kingston factory service center located at 17600 Newhope Street, Fountain Valley, California 92708, U.S.A. You must include the product serial number (if applicable) and a detailed description of the problem you are experiencing. For products covered by the five-year, two-year or one-year warranty, you must also include proof of the date of original retail purchase as evidence that the product is within the applicable warranty period. If you return the product directly to the Kingston factory, you must first obtain a Return Material Authorization ("RMA") number by calling Kingston Customer Service at (714) 438-1810, and include the RMA number prominently displayed on the outside of your package. Products must be properly packaged to prevent damage in transit.

Free Technical Support

Kingston provides free technical support. If you experience any difficulty during the installation or subsequent use of a Kingston product, please contact Kingston's Technical Support Department at (714) 435-2639 prior to servicing your system. This warranty covers only repair or replacement of defective Kingston products, as provided above. Kingston is not liable for, and does not cover under warranty, any costs associated with servicing and/or installation of Kingston products.

Disclaimers

The foregoing is the complete warranty for Kingston products and supersedes all other warranties and representations, whether oral or written. Except as expressly set forth above, no other warranties are made with respect to Kingston products and Kingston expressly disclaims all warranties not stated herein, including, to the extent permitted by applicable law, any implied warranty of merchantability or fitness for a particular purpose.

In no event will Kingston be liable to the purchaser, or to any user of the Kingston product, for any damages, expenses, lost revenues, lost savings, lost profits, or any other incidental or consequential damages arising from the purchase, use or inability to use the Kingston product, even if Kingston has been advised of the possibility of such damages.

Revision History

Revision Level	Comment
X0	Preliminary Release
X1	Added BEFORE YOU BEGIN section, and SL Jumper settings to Troubleshooting.
X2	Added more drawings.
X3	Moved Warranty to back. Removed SL Jumper. Proof-reading changes.