

**Kingston Technology  
Lightning 486  
Installation Guide**

**Model: 486/BL66**



# **Kingston Technology's**

## **Lightning 486**

**IBM Blue Lightning  
66Mhz Processor Upgrade  
For PS/2 Models 70 & 80**

### **Installation Guide**

**Kingston Technology Corporation  
17600 Newhope  
Fountain Valley, CA 92708  
(714) 435-2600**

## 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.

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***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.

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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

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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.

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## FCC Certification

This device has been tested and found to comply with limits for Class B digital device, pursuant to Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received; including interference that may cause undesired operation.

This device generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this device does cause harmful interference to radio or television reception, which can be determined by turning the device off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Re-orient or relocate the receiving antennas.
- Increase the separation between the device and the receiver.

- Connect the device into an outlet on a circuit different from that to which the receiver is connected.

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## Introduction

Congratulations on the purchase of your Kingston *Lightning 486* processor upgrade for IBM® PS/2 Model 70 and 80 computers. Using the IBM Blue Lightning microprocessor, the Lightning 486 runs at a clock-doubled rate of 66Mhz with an internal cache of 16KB, 32-bit internal processing, and the sophisticated instruction set of the 80486 processor. With the Lightning 486, your IBM PS/2 Model 70 or 80 will go from a 16Mhz, 20Mhz, or 25Mhz 386DX to a 486DLC powerhouse running at 66Mhz for increased power and performance for today's most demanding software applications.

The Lightning 486 processor upgrade is a small daughtercard upgrade which installs directly into the existing 386DX socket. There are no special drivers or software to install. The Lightning 486 supports your existing 387DX math coprocessor. For PS/2 Model 70 Type II or Type III system boards, Kingston provides a PGA socket extender to seat the processor board slightly the system board so as not to interfere with other components on the system board.

## Special Features

Your Kingston Lightning 486 includes these important features:

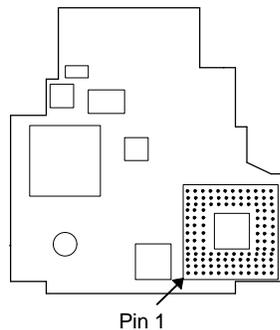
- IBM-designed Blue Lightning 66Mhz microprocessor.
- Uses sophisticated memory mapping of 80486 instruction set.
- 16KB internal cache onboard.
- Supports 80387DX math coprocessor.
- No software required for installation or operation.
- No device drivers to load or use valuable memory.

## Package Contents

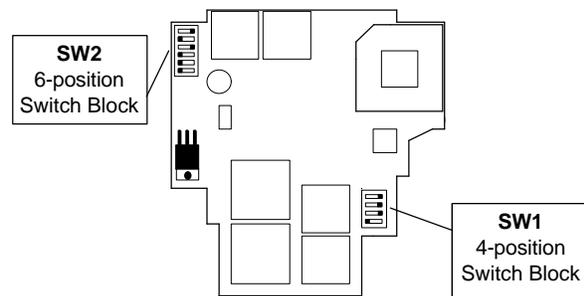
The Lightning 486 package should contain the following items:

- Kingston 486/BL66 processor board
- Chip Extractor Tool
- 132-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. Only open the anti-static bag containing the Processor Upgrade when you are at the point of installing it into the computer. Remove the protective foam pad from the 80386DX plug connector pins very carefully, and take care not to damage the pins when installing the upgrade. Retain all the protective packaging for future use.



**Fig. 1-1 486/BL66 Bottom View**



**Fig. 1-2 486/BL66 Top View**

## Where To Begin

- To install the Processor Upgrade in a Model 70 see "Installing into the PS/2 Model 70" on page 3.
- To install the Processor Upgrade in a Model 80 see "Installing into the PS/2 Model 80" on page 11.

## Installing into the PS/2 Model 70

The Lightning 486 processor upgrade is designed for use in IBM PS/2 Model 70 and Model 80 machines. Installation procedures differ according to your computer type, and for this reason these instructions are divided into specific installation sections for each computer. If you are installing the Processor Upgrade in a Model 80, go to “Installing into the PS/2 Model 80” on page 12.

*This section contains specific instructions for the PS/2 Model 70.*

### Step 1. Identifying your System-Board Type

The Lightning 486 is designed for use in three versions of the Model 70 system board. These system boards are defined in these instructions as Type I, Type II and Type III. It is important that you identify your system board type. The following descriptions show how to identify the different system board types.

- The Type I system board covers the entire base of the computer, and the battery assembly plugs directly into the system board.
- The Type II system board does not cover the entire base of the computer, and the battery assembly has a cable that connects it to the system board.
- The Type III system board is only installed in the PS/2 Model 70 “A” series machines (For example: 70-A21, 70-A16). It covers the entire base of the computer, mounting a daughter board under the diskette drive, and the battery assembly plugs directly into the system board.

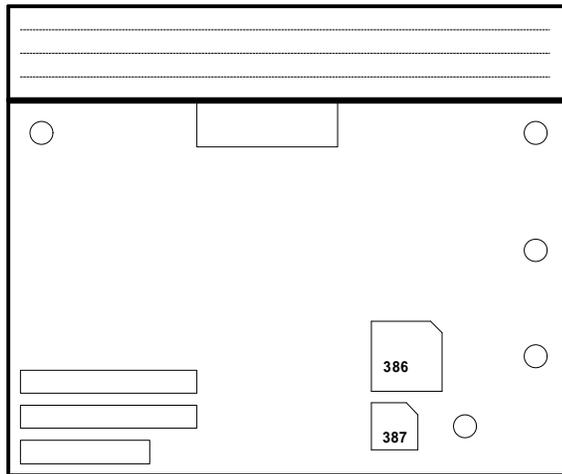
The Kingston Lightning 486 is installed with a different orientation in each of these system boards depending on Pin 1 of the CPU socket. Refer to the following illustrations to determine your particular system board type. Notice the beveled corner denoting Pin 1. This is important when installing the processor upgrade. Pin 1 on the CPU socket must match Pin 1 on the processor connector.

As you will be removing the drive-support structure from your computer, you will be disconnecting the battery from the system board. This will deprive the CMOS memory of backup power, and when restarting your computer you will need to use the Reference Diskette to restore the system configuration into CMOS.

**Note:** *Running Automatic Configuration from your Reference Diskette will reset the system and all its adapters to predefined defaults.*

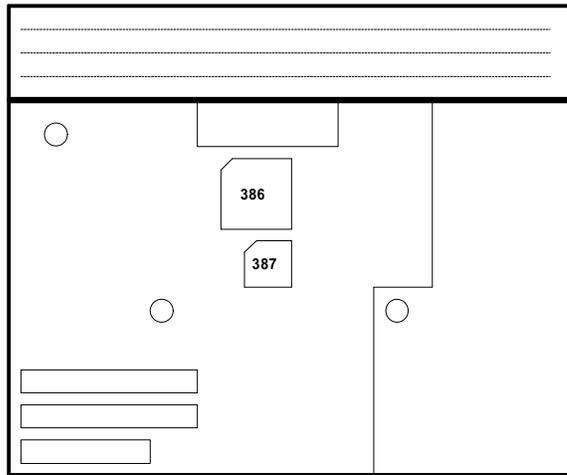
If there are adapters in your system that require manually configured parameters to operate correctly, view and record these parameters using the View Configuration utility from your Reference Diskette. After this installation, you may manually set parameters for these adapters by running the Change Configuration utility from your Reference Diskette.

The following illustration shows the Model 70 Type I system board :



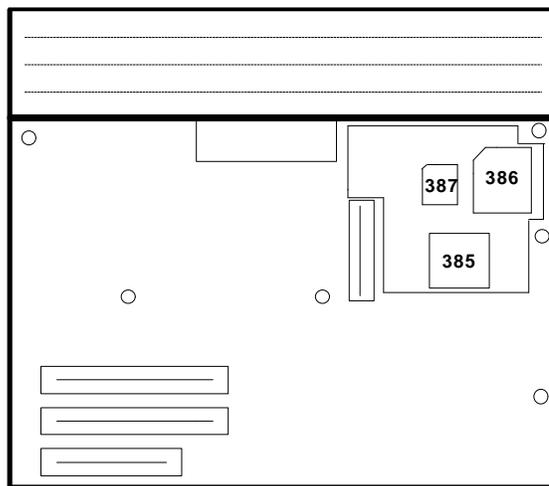
**Fig. 2-1 Model 70 Type I system board**

The following illustration shows the Model 70 Type II system board :



**Fig. 2-2 Model 70 Type II system board**

The following shows the Model 70 Type III system board :



**Fig. 2-3 Model 70 Type III system board**

**NOTE:** Do not proceed if the position or orientation of the components on your system board differs from the illustrations. Contact the place of purchase or Kingston for assistance.

## Step 2. Removing the Adapters and Cables

1. Turn off the computer and disconnect all power cords and cables.
2. Remove the cover from your computer.
3. Take note of the positions of any adapters that have been installed in the expansion slots of the computer, and then remove them.
4. Remove the diskette drive, the hard disk drive, and the drive-support structure from your computer. (Detailed instructions on this procedure can be found in the Model 70 Quick Reference documentation.)

## Step 3. Removing the 80386DX Processor

Before beginning the installation procedure, compare your Lightning 486 with the illustrations on page 2. If your processor upgrade differs significantly from these illustrations, contact your supplier before proceeding further.

1. Look carefully at your computer's system board to locate the 80386DX processor. Before you attempt to remove it, take note of its orientation and the position of the notched or beveled corner on the chip denoting Pin 1. The position of this corner (Pin 1) determines how the Lightning 486 will be installed. Pin 1 of the CPU socket must match Pin 1 on the underside of the processor upgrade connector. Refer to the illustrations on pages 4 and 5 to check the location of the 80386DX processor chip on your particular PS/2 Model 70 system board.
2. Having noted its position, remove the 80386DX from its socket using the Chip Extractor Tool provided. Gently insert the edge of the tool under one side of the 80386DX, levering it up slightly. Repeat this action for each side of the 80386DX, working around the sides several times until the pins on the underside of the 80386DX are sufficiently exposed so it may be carefully lifted out with your fingers. Be careful not to bend or break the pins.

## Step 4. Installing the 132-Pin PGA Socket Extender

The 132-Pin PGA Socket Extender, supplied in the processor upgrade package, is required on all Model 70 **Type II and Type III** system boards, in order to raise the Lightning 486processor upgrade board above components on the system board.

**Note:** **Do not** use the extender if you are installing the Processor Upgrade on a Model 70 Type I system board.

If you have a Type II or Type III series system board, install the 132-Pin PGA Socket Extender as follows:

1. Locate the beveled edge or rounded corner on 132-Pin PGA Socket Extender. Match this beveled edge to that on the 80386DX socket on your system board.
2. Now position the pins on the 132-Pin PGA Socket Extender over the holes on the system board 80386DX socket.
3. Once you are sure the alignment is correct, gently press 132-Pin PGA Socket Extender down until it is firmly inserted in the system board 80386DX socket.

## Step 5. Setting the Switches

The processor upgrade switches are set to the factory default settings for all motherboards. Retain these settings unless you have Extended Memory mapped I/O device controllers installed in your system or a Type III motherboard and have additional Bus Master adapters installed. In these cases the switch settings may need adjustment depending on the particular configuration of your system. For information on each switch's function, refer to "Appendix A Switch Settings" in the back of this manual.

The default Switch Settings are set as follows. Refer to page 2 for Switch Block locations.

SW1 (4-position SW Block)				SW2 (6-position Switch Block)					
SW1	SW2	SW3	SW4	SW1	SW2	SW3	SW4	SW5	SW6
ON	OFF	OFF	OFF	ON	ON	ON	OFF	ON	OFF

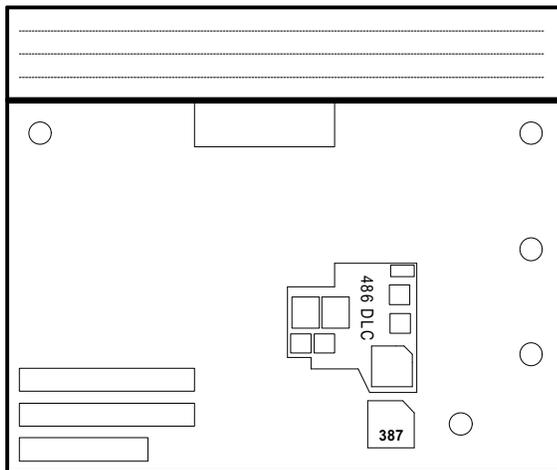
## Step 6. Orienting the Processor Upgrade

When installing the Lightning 486, the orientation (Pin 1) of the PGA plug on processor upgrade must match the original orientation (Pin 1) of the 80386DX processor chip. Pin 1 is denoted by a beveled or cut edge.

1. Look at the Lightning 486 carefully. There is a PGA plug on the underside of the processor upgrade. This has a stenciled outline with a beveled corner indicated by a stenciled white arrow. Refer to the illustrations on page 2 in order to locate the PGA plug and Pin 1.
2. With the Lightning 486 positioned so that the beveled corner on the PGA plug matches the position of the beveled corner on the original 80386DX chip, you are ready to insert the processor upgrade in the empty 80386DX socket. Refer to the illustrations on pages 8 and 9 to check the positioning of the Lightning 486 adapter.

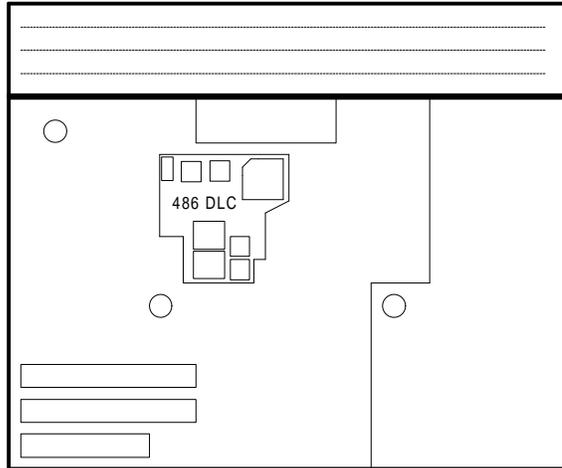
**Warning:** If the processor upgrade is not installed correctly, it may result in damage to the computer, the processor upgrade, or both. Please take particular care when inserting the processor upgrade into the 80386DX processor socket.

The following shows the Model 70 Type I system board with the processor upgrade installed:



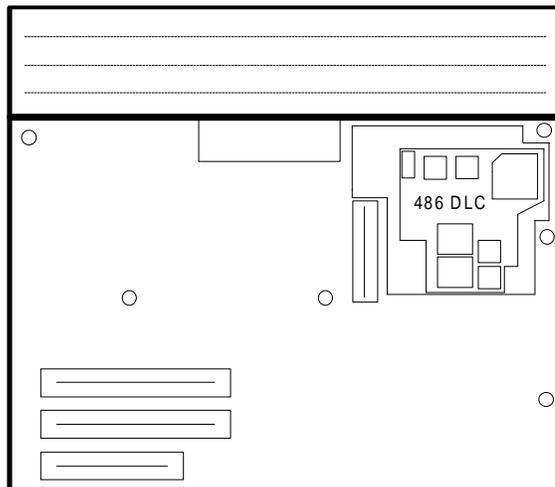
**Fig. 2-4 Model 70 Type I with Upgrade Installed**

The following shows the Model 70 Type II system board with the processor upgrade installed :



**Fig. 2-5 Model 70 Type II with Upgrade Installed**

The following shows the Model 70 Type III system board with the processor upgrade installed :



**Fig. 2-6 Model 70 Type III with Upgrade Installed**

## Step 7. Inserting the Processor Upgrade

1. To insert the processor upgrade correctly, you need to have the pins on the Lightning 486 adapter exactly lined up with the corresponding holes on the system board 80386DX socket.
2. When you are sure the alignment is correct, gently push the Lightning 486 into the socket, applying an even pressure.

**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.

## Step 8. Completing the Installation

1. Replace any adapters removed earlier.
2. Replace the cover of your computer, and reconnect the power and signal cables.
3. Check that your computer starts correctly. If it does not, turn off your computer, remove the processor upgrade, and repeat the installation procedure again. Remember to match Pin 1 on the processor upgrade with Pin 1 on the CPU socket.

When your computer starts correctly, the installation is complete.

## Installing into the PS/2 Model 80

The Lightning 486 processor upgrade is designed for use in IBM PS/2 Model 70 and Model 80 machines. Installation procedures differ according to your computer type, and for this reason these instructions are divided into specific installation sections for each computer. If you are installing the Processor Upgrade in a Model 70, go to “Installing into the PS/2 Model 70” on page 3.

*This section contains specific instructions for the PS/2 Model 80.*

As you will need to open your computer, and will have to remove adapters and other components to install the Lightning 486, have your IBM Model 80 *Quick Reference* documentation available as you work.

### Step 1. Identifying your System-Board Type

The Processor Upgrade is designed for use in three versions of the Model 80 system board. These system boards are defined in these instructions as Type I, Type II and Type III. It is important that you identify your system board type. The following shows how to identify the different system board types.

- The Type I system board is installed in most 16 MHz and some 20 MHz machines.
- The Type II system board is installed in most 20 MHz machines and some 16 MHz machines.
- The Type III system board is installed in all 25 MHz PS/2 Model 80 machines (“A” series).

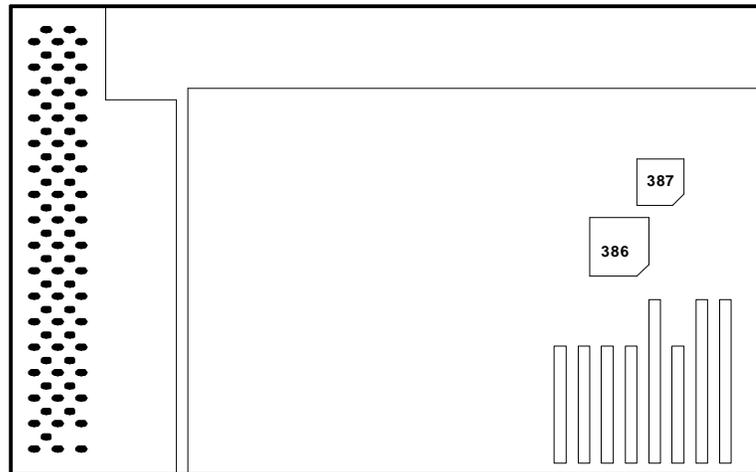
The Lightning 486 adapter is installed with a different orientation in each of these system boards. Be sure that you refer to the following illustrations and observe the instructions for your particular system board type.

As you will be removing the drive-support structure from your computer, you will be disconnecting the battery from the system board. This will deprive the CMOS memory of backup power, and when restarting your computer you will need to use the Reference Diskette to restore the system configuration into CMOS.

**Note:** *Running Automatic Configuration from your Reference Diskette will reset the system and all its adapters to predefined defaults.*

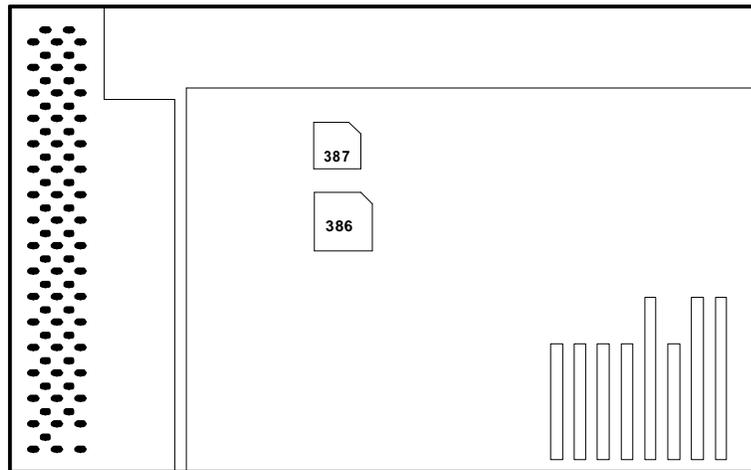
If there are adapters in your system that require manually configured parameters to operate correctly, view and record these parameters using the View Configuration utility from your Reference Diskette. After this installation, you may manually set parameters for these adapters by running the Change Configuration utility from your Reference Diskette.

The following shows the Model 80 Type I system board:



**Fig. 3-1 Model 80 Type I system board**

The following shows the Model 80 Type II system board :



**Fig. 3-2 Model 80 Type II system board**

The following shows the Model 80 Type III system board :



**Fig. 3-3 Model 80 Type III system board**

**NOTE:** Do not proceed if the position or orientation of the components on your system board differs from the illustrations. Contact your supplier or Kingston for assistance.

## Step 2. Removing the Adapters and Cables

1. Turn off the computer and disconnect all power cords and cables.
2. Remove the cover from your computer.
3. Take note of the positions of any adapters that have been installed in the expansion slots of the computer, and then remove them.
4. For Type II and Type III machines, remove the hard disk drive, and the drive-support structure from your computer. (Detailed instructions on this procedure can be found in the Model 80 *Quick Reference*.)

## Step 3. Removing the 80386 Processor

Before beginning the installation procedure, compare your Lightning 486 with the illustrations on page 2. If your Processor Upgrade differs significantly from these illustrations, contact your supplier or Kingston before proceeding further.

1. Look carefully at your computer's system board to locate the 80386DX processor. *Before* you attempt to remove it, take note of its orientation and the position of the notched or beveled corner on the chip denoting Pin 1. The position of this corner determines how the Lightning 486 will be installed. Refer to the illustrations on pages 12 and 13 to check the location of the 80386DX processor chip on your particular PS/2 Model 80 system board.
2. Having noted its position, remove the 80386DX from its socket using the Chip Extractor Tool provided. Gently insert the edge of the tool under one side of the 80386DX, levering it up slightly. Repeat this action for each side of the 80386DX, working around the sides several times until the pins on the underside of the 80386DX are sufficiently exposed so it may be carefully lifted out with your fingers.

## Step 4. Installing the 132-Pin PGA Socket Extender

The 132-Pin PGA Socket Extender supplied in the Processor Upgrade package is only required on Model 80 Type II system boards, in order to raise the Lightning 486 board above components on the system board.

- **Do not** use the extender if you are installing the Processor Upgrade on a Model 80 Type I or Type III system board.

If you have a Type II series system board, install the 132-Pin PGA Socket Extender as follows:

1. Locate the beveled edge or rounded corner on the 132-Pin PGA Socket Extender. Match this beveled edge to that on the 80386DX socket on your system board.
2. Now position the pins on the 132-Pin PGA Socket Extender over the holes on the system board 80386DX socket.
3. Once you are sure the alignment is correct, gently press the 132-Pin PGA Socket Extender down until it is firmly inserted in the system board 80386DX socket.

## Step 5. Setting the Switches

The processor upgrade switches are set to the factory default settings for all motherboards. Retain these settings unless you have Extended Memory mapped I/O device controllers installed in your system or a Type III motherboard and have additional Bus Master adapters installed. In these cases the switch settings may need adjustment depending on the particular configuration of your system. For information on each switch's function, refer to "Appendix A Switch Settings" in the back of this manual.

The default Switch Settings are set as follows. Refer to page 2 for Switch Block locations.

<b>SW1</b> (4-position SW Block)	<b>SW2</b> (6-position Switch Block)
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SW1	SW2	SW3	SW4	SW1	SW2	SW3	SW4	SW5	SW6
ON	OFF	OFF	OFF	ON	ON	ON	OFF	ON	OFF

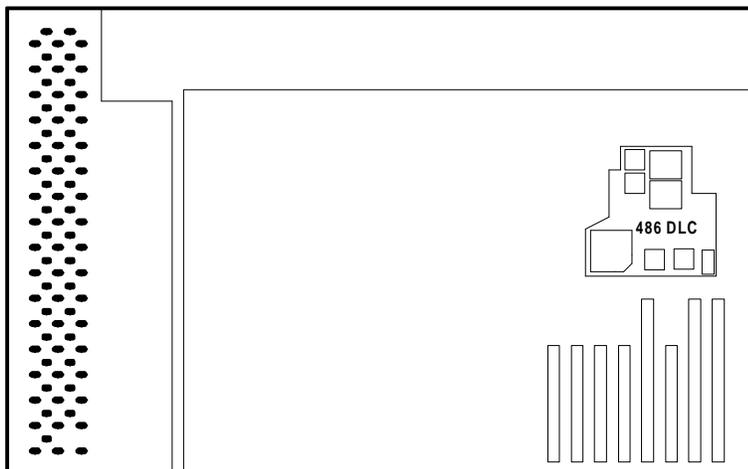
## Step 6. Orienting the Processor Upgrade

When installing the Lightning 486, the orientation (Pin 1) of the PGA plug on the Processor Upgrade must match the original orientation (Pin 1) of the 80386DX processor chip. Pin 1 is denoted by a beveled or cut edge.

1. Look at the Lightning 486 carefully. There is a PGA plug on the underside of the Processor Upgrade. This has a stenciled outline with a beveled corner indicated by a stenciled white arrow. Refer to the illustrations on page 2 in order to locate the PGA plug and Pin 1.
2. With the Lightning 486 positioned so that the beveled corner on the PGA plug matches the position of the beveled corner on the original 80386DX chip, you are ready to insert the Processor Upgrade in the empty 80386DX socket. Refer to the illustrations on pages 17 and 19 to check the positioning of the Lightning 486.

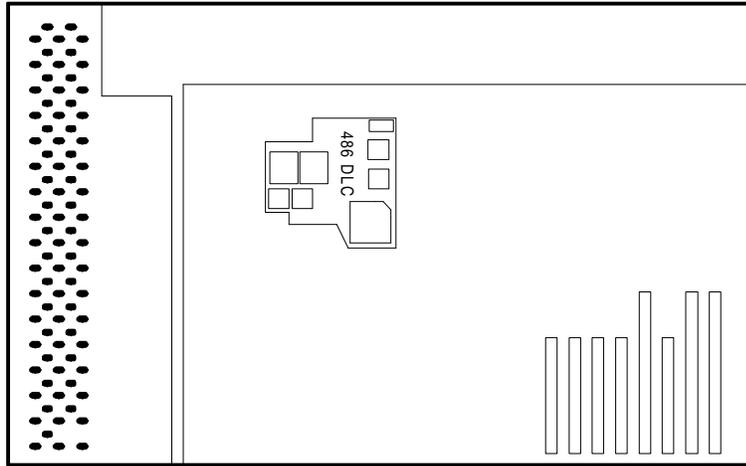
**Warning:** If the Lightning 486 is not installed correctly, it may result in damage to the computer, the Processor Upgrade, or both. Please take particular care when inserting the Lightning 486 into the 80386DX processor socket.

The following shows the Model 80 Type I system board with the Lightning 486 installed.



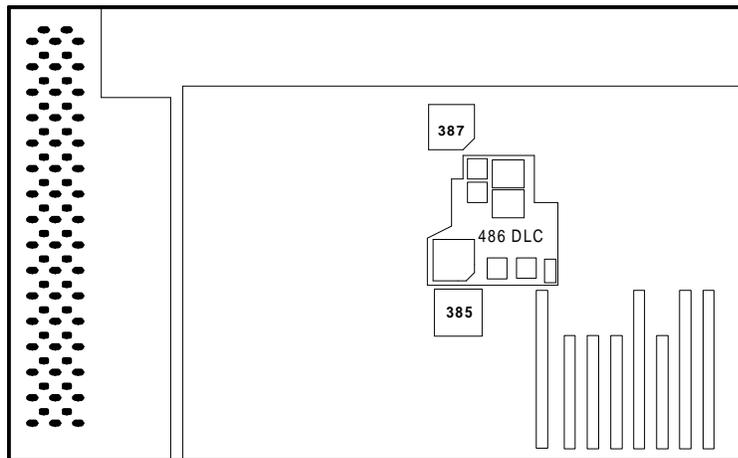
**Fig. 3-4 Model 80 Type I with Upgrade Installed**

The following shows the Model 80 Type II system board with the Lightning 486 installed.



**Fig. 3-5 Model 80 Type II with Upgrade Installed**

The following shows the Model 80 Type III series system board with the Lightning 486 installed.



**Fig. 3-6 Model 80 Type III with Upgrade Installed**

## Step 7. Inserting the Processor Upgrade

1. To insert the Processor Upgrade correctly, you need to have the pins on the Lightning 486 exactly lined up with the corresponding holes on the system board 80386DX socket.
2. When you are sure the alignment is correct, gently push the Lightning 486 into the socket, applying an even pressure.

**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 Lightning 486 and begin the insertion again.

## Step 8. Completing the Installation

1. Replace the hard disk drive, the drive-support structure and any adapters removed earlier.
2. Replace the cover of your computer, and reconnect the power and signal cables.
3. Check that your computer starts correctly. If it does not, turn off your computer, remove the Lightning 486, and repeat the installation procedure again. Remember to match Pin 1 on the processor upgrade with Pin 1 on the CPU socket. When your computer starts correctly, the installation is complete.

# Appendices

## Appendix A Technical Information

Listed below are details on the processor's switch settings and memory cache functions.

### Switch Settings

Switch Number	Switch Position	Switch Function
<b>SW1.1</b> (see note 1)	<b>ON</b> <b>OFF</b>	Default - cache ON at startup Cache OFF at startup
<b>SW1.2</b> (see note 4)	<b>OFF</b> <b>ON</b>	Default - Do not flush cache on Interrupt 9 Flush cache cache on Interrupt 9
<b>SW1.3</b> (see note 4)	<b>OFF</b> <b>ON</b>	Default - Do not flush cache on Interrupt 10 Flush cache cache on Interrupt 10 (Hex A)
<b>SW1.4</b> (see note 4)	<b>OFF</b> <b>ON</b>	Default - Do not flush cache on Interrupt 11 Flush cache on Interrupt 11 (Hex B)
<b>SW2.1</b> (see note 4)	<b>ON</b> <b>OFF</b>	Default - Flush cache on Interrupt 14 Do not flush cache on Interrupt 14 (Hex E)
<b>SW2.2</b> (see note 3)	<b>ON</b> <b>OFF</b>	Default - Enable fast RAM count Disable fast RAM count
<b>SW2.3</b> (see note 2)	<b>ON</b> <b>OFF</b>	Default - Cache all extended memory Disable caching from 14 to 16 MB
<b>SW2.4</b> (see note 5)	<b>OFF</b> <b>ON</b>	Default - Enable write pipeline Disable write pipeline
<b>SW2.5</b> (see note 6)	<b>ON</b> <b>OFF</b>	Default -Do not flush cache on writes to the C000-DFFF region. Flush cache on writes to the C000-DFFF region.
<b>SW2.6</b> (see note 4)	<b>OFF</b> <b>ON</b>	Default - Do not flush cache on Interrupt 15 Flush cache on Interrupt 15 (Hex F)

**Notes:**

1. This switch setting is only read at power on, not on a warm boot (Ctl+Alt+Del). See "Memory Caching" in this chapter for cache control options.
2. The default (ON) allows for memory mapped devices above 32 MB of extended memory and allows for normal RAM in the 14 to 16 MB region. Set to OFF if a memory mapped device (i.e. XGA video adapter) is located in the 14 to 16 MB region.
3. This switch setting caches the ROMs on the adapter cards of the system for a faster RAM count and is only active before the system boots. If the system stops after the memory count completes, try turning this switch OFF. The RAM count will now be at a slow speed, however system performance after boot will not be adversely affected.
4. The Interrupt Cache Flush Enable switches (SW1.2-4, SW2.1,6) cause the cache to be flushed whenever the chosen interrupt occurs. These switches can be set to OFF for all Type I and Type II systems for optimal performance. For operation of Type III systems with Bus Master Adapters, Interrupt Cache Flushing should be set to ON for those Interrupts (IRQs) used by the Bus Master Adapters present in the system.
5. This switch enables a write pipeline to absorb CPU writes into a buffer to reduce CPU wait states. If you are connected to a network and experience problems, turn Bank 2 Switch 4 to ON.
6. **For XGA and XGA-2 adapters**, set Bank 2 Switch 5 to OFF. In order to maintain video integrity, the L1 cache needs to be flushed when the Processor Upgrade detects writes to the C000-DFFF region. By default, the Processor Upgrade does not perform this cache flushing. To enable cache flushing, set Switch 5 to OFF.

The default settings work with the standard hard drive controllers. If problems are encountered, enable all interrupts. If the problems then disappear but performance is degraded, selectively disable those interrupts not requiring cache flushing for proper operation. As a rule, for optimum performance only flush cache on IRQs used by bus master adapters and controllers which use Direct Memory Access (DMA).

## Memory Caching

All system memory (up to 32 MB) is automatically cached and the cache may be turned on or off from startup. Caching should always be enabled from startup unless you have a particular software application which will not load with caching enabled. To control your cache speed under OS/2 or DOS (but not a DOS session in OS/2), insert the Utility Diskette in drive A and at the prompt, type:

**A:\** (to log to the root directory of drive A:)

then **slow** (to disable the Lightning 486 cache.)

or **fast** (to enable the Lightning 486 cache.)

A warm boot of the machine (Ctrl+Alt+Del) will not change the current status of the cache. The Cache ON control switch (SW1.1) only takes effect at power up.

## Software Compatibility

The Lightning 486 processor upgrade, which replaces the 80386DX processor on your system board, allows the Blue Lightning processor to emulate the presence of the original 80386DX processor, so no special software is required to interface to the computer. As soon as the Lightning 486 is installed, full 80486 compatibility is achieved. For this reason, it is not necessary to ship any device drivers with the product.

The Lightning 486 processor upgrade is fully compatible with operating systems and applications that require 80486 processors, such as IBM OS/2 2.1 and DOS 6.0 with Microsoft Windows 3.1.

## Appendix B Running 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 Lightning 486, 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 Lightning 486 processor upgrade into an IBM PS/2 Model 70-161 20Mhz computer with no math coprocessor present. The Diagnostic Programs below indicate the relative speed in Megahertz (Mhz) of the CPU (Central Processing Unit) and the FPU (Floating Point Unit, a.k.a. math coprocessor). Remember, the Lightning 486 does support an 80387DX math-co, if one is installed on the system board, but in some of the Benchmark tests it actually calculated FPU performance (See note below).

Benchmark Tests	PS/2 70-161 386DX 20Mhz	Lightning 486 Installed CPU	Lightning 486 Installed FPU
<b>Landmark Speed 2.0</b>	23.64 Mhz	153.16 Mhz	13.93*
<b>Norton SI 5.0</b>	14.20 Mhz	99.10 Mhz	Built In*
<b>Checkit 3.0</b>	12.35 Mhz	97.70 Mhz	none
<b>PC Bench 8.0</b>	5.08 Mhz	17.20 Mhz	none

**\*Note:** The FPU tests the speed of the math coprocessor. The Lightning 486 microprocessor does not have a built-in math coprocessor. Because the Blue Lightning processor uses the 486 instruction set with accelerated internal processing, the Landmark Speed Test and Norton SI Test calculate FPU efficiency even though no math-coprocessor is present. For testing purposes, disregard the FPU rating and, instead, refer to the CPU clock speed to verify the enhanced performance of the Lightning 486. If you have an 80387DX mathco installed, your FPU results will be much higher.

## Appendix C Troubleshooting

This section describes problems you may encounter after installing the Lightning 486 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. Call the place of purchase. However, before you call, write down the following information:
  - Your computer model
  - The switch settings of your Lightning 486 Processor Upgrade.
  - 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 applications and operating system.

**Note:** It will be necessary to use your computer's Reference Diskette to reconfigure the computer in order to clear most errors described in this section. Automatic Configuration will reset the computer and all its adapters to pre-defined defaults. If there are adapters in your computer that require manually set parameters to function correctly, press N when prompted to "Automatically Configure the system? (Y/N)" and use the Set Configuration utility instead. Then go into Change Configuration. From this menu you can manually configure the system. To save any changes press the [F10] key followed by [Enter]. Exit all the way out to reboot your system.

## Adapter or System Fails Diagnostic Tests

The diagnostic tests should always be run with the Lightning 486 **cache disabled**. Before running the diagnostic tests, boot DOS or OS/2 and disable the cache using the Utility Diskette as detailed in the section titled “Memory Caching” on page 24 of this manual. Without turning off the power to the system, remove the Utility Diskette and place the Diagnostic Reference Diskette for your system in drive A:. You may now soft reboot (Ctrl+Alt+Del) and boot into the reference utility with cache disabled.

In some cases, with the Processor Upgrade installed in your computer, the diagnostic test for some Micro Channel adapters might still indicate that the adapter is failing when the adapter actually operates correctly. If you experience this problem, remove the Processor Upgrade and replace the 80386DX processor. Run the adapter diagnostic tests. If the adapter passes the tests, the adapter is fully functional. If the adapter fails the tests, refer to the information that came with the adapter for the appropriate action to take.

## Computer Does Not Start

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

1. Check that the power and signal cords 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 Lightning 486 is to remove the processor upgrade and carefully reinstall it. Check that all other adapters are firmly seated in their sockets. Replace the cover and try the power again.
3. Check the switch settings on your Lightning 486 against those recommended in the appropriate installation chapter of this manual.
4. Remove the Lightning 486 from your computer and replace it with the original 80386 processor. Try the power again. If the computer now starts, the Processor Upgrade may be incompatible with your computer. Contact your supplier.



## **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.

## **Adapter or Computer Cannot Be Configured**

If you are unable to configure the system, or any of the adapters in the system, after installing the Lightning 486, try disabling the cache on the Processor Upgrade. Power off the computer and set switch SW1.1 on the Processor Upgrade to the OFF position, then restart and attempt the configuration again. If this is successful, power off the computer and return switch SW1.1 on the Processor Upgrade to the ON position.

## **165 Error on Startup**

This error means an adapter in the system has been moved from one expansion slot and placed in a different slot. The error can be eliminated either by moving the adapter to its original slot or by using the Reference Diskette to reconfigure the adapter in its current slot.

## **Cannot Load Application Program**

Your application program may be speed sensitive. Refer to the application program manual for information on speed (memory caching) requirements. Refer to "Memory Caching" in the "Technical Information" chapter of this manual for information on enabling or disabling memory caching.

## **Computer Hangs While Installing OS/2 From Diskettes**

It is recommended that you run the OS/2 install program while the Processor Upgrade cache is disabled. Before running the OS/2 install program, boot DOS or OS/2 and disable the cache using the Utility Diskette as detailed in the section titled "Memory Caching" on page 24 of this manual. Without turning off the power to the system, remove the Utility Diskette and place OS/2 Installation Diskette for your system in drive A:. You may now soft reboot (Ctrl+Alt+Del) and boot into the OS/2 install program with cache disabled.

## XGA Video Adapters

If your IBM XGA or XGA II video adapter is unable to run in XGA display mode, there are two things to check:

1. The XGA adapter may be loading 1MB of VRAM into the 14MB to 16MB system memory address range. If you disable the 1MB VRAM Aperture or run in VGA mode, the display is fine. To correct this, either set Switch 3 on SW2 to OFF to avoid caching this memory region, or update the ADF file for your XGA adapter. Older Adapter Description Files (ADF) load the 1MB VRAM into the memory range between 15MB and 16MB. Because many systems now use 16MB of RAM, the newer ADF files load the video memory between 63MB and 64MB. Check with your IBM distributor for the latest ADF file versions.
2. The XGA adapter is using an Interrupt Level (IRQ) which must have the cache flushed. Verify which IRQ the XGA adapter is using and enable the cache flush mode for that IRQ setting.

## Revision History

<b>Revision Level</b>	<b>Comment</b>
A1	General Release
A2	Changed page reference errors on pp.14 & 16.
A3	Added switch setting changes per IBM to correct network and XGA adapter problems.
A4	Changed default setting of SW1.4 to OFF - do not flush cache on IRQ 11.