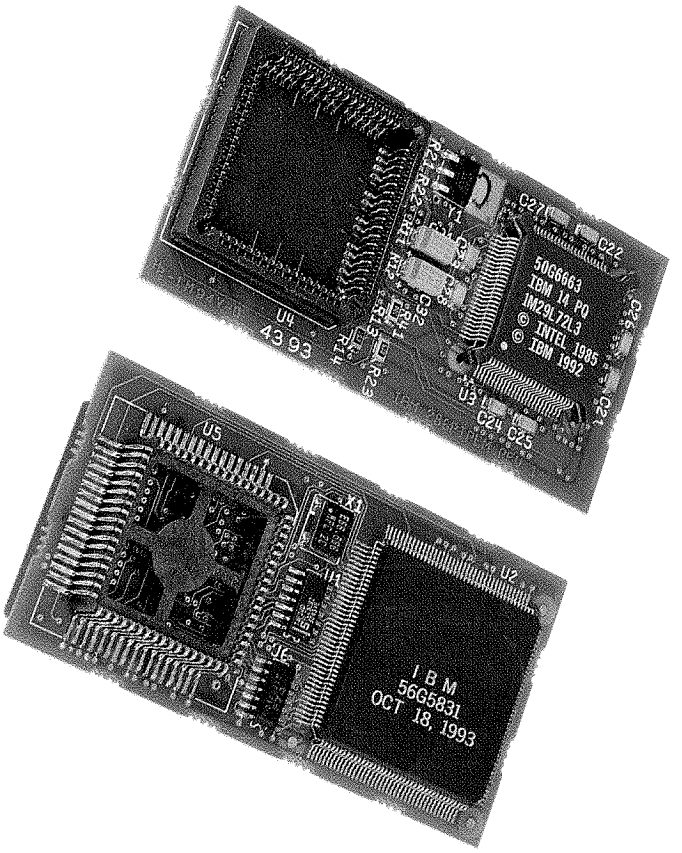
Personal Computer
Upgrade Products

IBM Microelectronics
Total Technology Solutions

386SLC™/486SLC2™

Cached Processor Upgrade Card

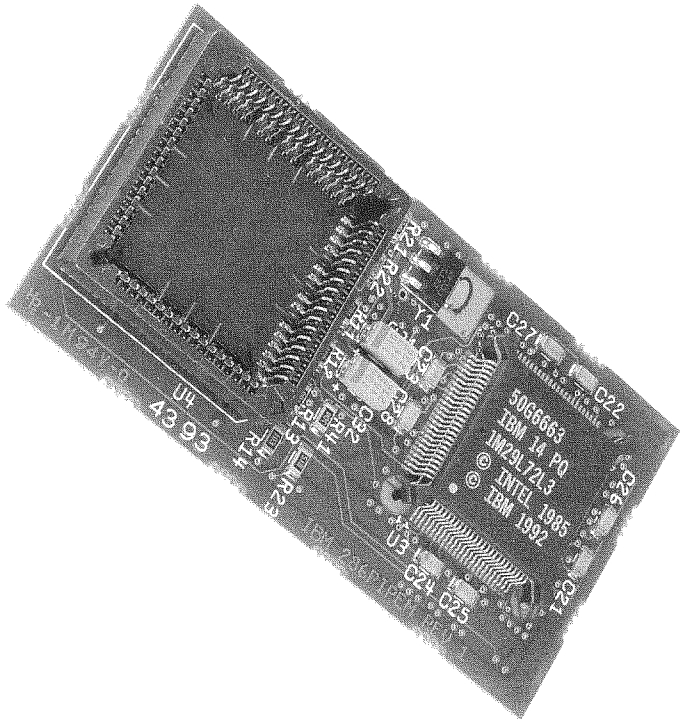
Installation Guide



Featuring the 386SLC and 486SLC2 Processors

386SLC™/486SLC2™ Cached Processor Upgrade Card

Installation Guide



IBM Microelectronics
Personal Computer Upgrade Products

This photo and the color photo on the cover are of one IBM 486SLC2 Cached Processor Upgrade Card. Other designs of the Cached Processor Upgrade Card exist depending on the upgrade type and the model of your PS/2, and may not look like these photos.

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For installation assistance or problem resolution please call **1-800-PS2-2227.**

This product is entitled to a full twelve (12) month warranty, in the United States only, from IBM. If your system is currently covered by an IBM U.S. on-site maintenance agreement, you may call **1-800-IBM-SERV** for required service. If your system is not currently covered for on-site service, please call **1-800-765-5944** to receive a replacement when service is required.

IBM reserves the right to make changes in the devices or the specifications described herein without notice.

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Introduction to IBM Microelectronics 386SLC™/486SLC2™ Cached Processor Upgrade Cards

The 386SLC or 486SLC2 Cached Processor Upgrade Card replaces the 80286 microprocessor in your IBM PS/2. Using IBM Microelectronics technology and the 386SLC or the 486SLC2 microprocessors respectively, these cards provide performance and power surpassing most current 386 microprocessor based personal computer systems.

Several important features of the 386SLC and 486SLC2 Cached Processor Upgrade Cards are:

- Performance enhancement of 8-10X over the 80286 PS/2.
- 25 MHz processor. The 486SLC2 is also available in 33 MHz and can run internally doubled to 50 MHz or 66 MHz respectively.
- Integrated 32-bit-wide 8KB cache and cache controller for "no-wait" processing for the 386SLC Cached Processor Upgrade Card.
- Integrated 32-bit-wide 16KB cache and cache controller for "no-wait" processing for the 486SLC2 Cached Processor Upgrade Card.
- Easy installation – simply plug the 386SLC or 486SLC2 Cached Processor Upgrade Card into the 80286 socket of your IBM PS/2® – Models 25-286, 30-286, 50, 50Z or 60; then load and run the software.

  Note: 386SLC Cached Processor Upgrade Card is available for the IBM PS/2 Models 50, 50Z and 60 only.
- Math co-processor socket supplied on both the 386SLC and 486SLC2 Cached Processor Upgrade Cards.
- Allows you to maintain your investment in your IBM PS/2.
- No need to reinstall or replace most of your software applications, adapter cards or any peripherals.
- Add new applications requiring a more powerful processor.

A cache-enable program, supplied on the 3.5" diskette included with your upgrade card package, allows you to enable or disable the memory cache, and double the clock speed on the 486SLC2 Cached Processor Upgrade Card.

Inventory Checklist

Your IBM Microelectronics 386SLC or 486SLC2 Cached Processor Upgrade Card package contains the following:

- IBM Microelectronics 386SLC Cached Processor Upgrade Card or the IBM Microelectronics 486SLC2 Cached Processor Upgrade Card.
- Extraction tool for removing the 80286 processor.
- Installation Guide for the 386SLC/486SLC2 Cached Processor Upgrade Card.
- A spacer socket (PGA versions only) required on some versions of the PS/2 Model 50.
- 3.5" IBM Utility Diskette (enables memory cache and doubles the clock speed of the 486SLC2).

If any items are missing or damaged, notify your place of purchase.

Packaging Materials

Your 386SLC or 486SLC2 Cached Processor Upgrade Card has been carefully packed in an anti-static envelope to protect it from static electricity and shock prior to being shipped to you. Check for damage while unpacking the cached processor upgrade card. If you notice any damage, notify your place of purchase.

Save all shipping and packaging materials in the event you need to ship these components.

Note: If your cached processor upgrade card kit arrives in cold weather, allow it to reach room temperature before installation in your PS/2.

Important Static Electricity Precautions

Many of the components in your personal computer are sensitive to electrostatic discharge. The following precautions can help you reduce the possibility of damaging the components in your personal computer.

- Touch a grounded surface before handling any components both inside and outside your system unit. If the system unit is connected to a grounded outlet, this can be done by touching the outside chassis of the system unit.
- Do not remove your 386SLC or the 486SLC2 Cached Processor Upgrade Card from the anti-static bag until you are ready to install it in your PS/2.
- Hold the card by the edges. Avoid touching the components on the card.
- Do not slide the card or any ICs over any surface.
- Avoid plastic, vinyl and styrofoam in your work area.

Tool Requirements

- Medium-size flat-blade screwdriver
- Processor extraction tool (supplied with upgrade card)
- Optional:
  - medium screwstarter
  - 3/16 inch nutdriver
  - 1/4 inch nutdriver

Math Co-processor

If your original system had a math co-processor (80287 or equivalent) installed, it must be removed from the system board at the time the accelerator card is installed. If you wish to install a math co-processor to operate with your new processor upgrade card, you must purchase an **Intel 80387SX (or fully compatible equivalent) and its clock speed must match the clock speed of the processor card you are installing, (20 MHz, 25 MHz or 33 MHz).** (Details on installation can be found in the Installation section.)

Utility Diskette

Be sure to read the **README.TXT** file on the utility diskette. It describes any alterations or additions to the installation procedure occurring after this manual was committed to print. The utility diskette also contains an **INSTALL** program that automates the installation procedure.

All unique IBM memory cache functions, (and the clock doubling feature of the 486SLC2), are disabled upon reset and enabled by the software provided with your upgrade option package.

Software Compatibility

With your 386SLC or 486SLC2 Cached Processor Upgrade Card installed you should be able to run your previously installed applications without any changes. In addition, you can now add new applications such as DOS 5.0™ or later, Microsoft Windows™, OS/2™ 2.0 or OS/2 2.1 and many other 386 based applications.

80286 Sockets

The 80286 microprocessor in the IBM PS/2 Models 50 and 60 is plugged into a Pin Grid Array socket (PGA) on the system board. The IBM PS/2 Models 25-286, 30-286 and 50Z use a Plastic Leaded Chip Carrier (PLCC) featuring an arrangement of metal leads surrounding the perimeter of the processor chip. It is best to use a PLCC Extractor for removal of this 80286 microprocessor (PLCC version).

IBM PS/2 Model 25-286

Installing the 486SLC2 Cached Processor Upgrade Card

All the components of the PS/2 Model 25-286 are contained within a single integrated housing. The disk and diskette drives, the system board, and the power and peripheral connections are all contained in the base of the unit with the display and its controls on top.

1. Set the power switch on the system to OFF.
2. Set all external power switches OFF, (i.e. display, printer, etc.).
3. Unplug the system unit's power cord from the power outlet.
4. Disconnect all power cords and cables from rear of machine.
5. Move keyboard and all external options away from the work area.
6. Place the unit on a stable and clear work surface with the display tube **face down**.
7. Remove the two steel slotted screws just below the base of the display unit.
8. Grasp the base of the unit in the area of the tilt assembly and gently lift the base up and tilt it away from the display.

   CAUTION: Remove the bundle of wires from the clip on the inside bottom of the display to allow the base to be tilted out fully.
9. Unscrew and remove any installed adapters from the bus adapter connector to expose the 80286 processor and the 80287 math co-processor (if installed) or its socket.
10. Before removing the 80286 note the location of pin 1 on the processor, (identified by a notch, beveled edge, dot or half-circle).

    Note: The position of pin 1 on the 80286 processor chip will determine **exactly** how the 486SLC2 Cached Processor Upgrade Card will be installed. The location of pin 1 shown in figure 1 is correct for the motherboards we have worked with in developing the card. It is possible that alternative motherboard designs or engineering levels exist and the location of pin 1 on your motherboard is definitive.
11. Insert the metal prongs of the IC chip removal tool in the space between the processor and its socket. Insert the prongs in the slots located diagonally opposite each other and 90 degrees either side of pin 1 (see figure 1). Gently squeeze the plastic handles until the tip near the metal prongs seats on the processor socket. Without

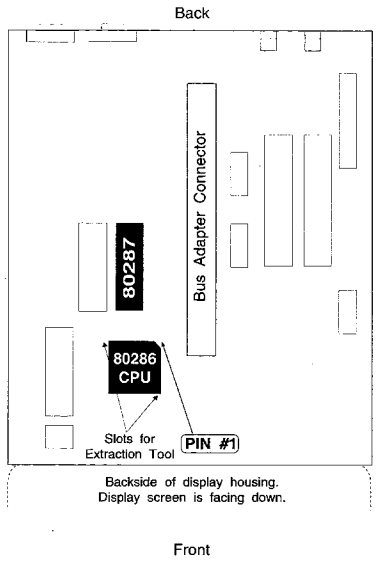

Figure 1. IBM PS/2 Model 25-286 System Board

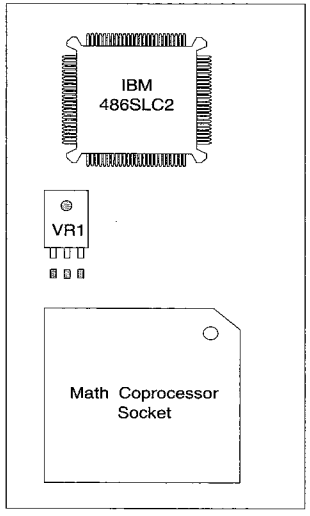

*Figure 2. Top View of the 486SLC2 Cached Processor Upgrade Card for the IBM PS/2 Model 25-286 (see **BOTTOM** of upgrade card for location of Pin #1).*

rocking or lifting up on the tool, gently increase the force on the handles until the prongs lift the processor out of the socket. (Save the 80286 microprocessor in the event you need to temporarily return to the old configuration. Protect the microprocessor by storing it in the antistatic bag the upgrade card came in.)

12. If you have an 80287 math co-processor installed, it **must** be removed. This device is incompatible with the processor on your new upgrade card. Locate the 80287 co-processor as shown in figure 1 and insert a small flat blade screwdriver under the end of the chip. Gently pry upwards; repeat for both ends. Once the pins have been sufficiently exposed, remove the co-processor with your fingers. (Save the 80287 co-processor in the event you need to temporarily return to the old configuration. The math co-processor should also be stored in the antistatic bag.)
13. Next, remove the upgrade card from the protective bag in which it was shipped, being careful to discharge any static electricity in your body before handling the card. Hold the card by the edges at all times. If you wish to install a new math co-processor in your upgrade card, do so at this time. Identify pin 1 of the math co-processor chip (designated by a beveled edge, dot, notch or half moon). Match this corner to the beveled edge on the co-processor socket on the 486SLC2 Cached Processor Upgrade Card. (See figure 2) Carefully insert the co-processor in the socket provided on the top side of the upgrade card. Be sure to align pin 1 on the co-processor with pin 1 in the socket. See figure 2 for the location of pin 1 on the co-processor socket. Firmly press the co-processor module into place. (The pins of the module are easily damaged and must be aligned with the contacts in the socket before pressing the module into place.)
14. Align pin 1 of the connector on the BOTTOM surface of the 486SLC2 Cached Processor Upgrade Card with pin 1 of the processor socket on the mother board. Press the card gently into place, applying an even pressure. (If the 486SLC2 Cached Processor Upgrade Card is not positioned correctly, damage to both your IBM PS/2 and the upgrade card may result.)
15. Return the micro-channel adapter cards to their original positions as noted previously. Be certain to retighten the screws to secure the adapters in place.
16. Replace the cover and reattach all cables and power cords.
17. If you are changing the system configuration by either adding or eliminating a math co-processor, do the following, otherwise skip to step 18.

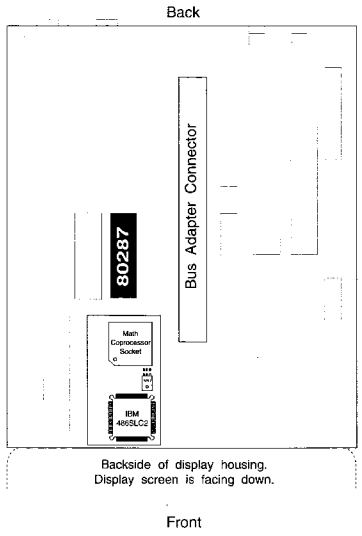

Figure 3. IBM PS/2 Model 25-286 System Board with 486SLC2 Cached Processor Upgrade Card installed.

a). Boot the system from your backup copy of the IBM Reference diskette, containing the configuration files for any micro-channel adapters installed in your PS/2.

b). While the system is booting, a 162 error will appear on the screen indicating a change has been detected in your PS/2 configuration.

c). After the IBM logo appears, press the Enter key.

d). A description of the 162 error code will appear, followed by a prompt asking if you want to run automatic configuration. Answer "Y" (yes), to the reconfiguration question.

e). After the system has been reconfigured, remove the back-up reference diskette and reboot the computer.

18. If you bypassed the reconfiguration steps above, turn on power to your PS/2 and check that it boots successfully. If it does not, check that the upgrade card is correctly inserted in the 80286 socket. Check for bent or damaged pins.

19. Once the machine boots correctly, install the device driver for Enabling/Disabling the Memory Cache and doubling the clock speed. See the section "Software Installation" later in this installation guide.

IBM PS/2 Model 30-286

Installing the 486SLC2 Cached Processor Upgrade Card

The PS/2 Model 30-286 consists of a desktop system unit that houses the disk and diskette drives, the system board, and the power and peripheral connections. The keyboard and the display and its controls are separate units.

Installation of the processor upgrade card begins with opening the system unit and removing the original processor.

1. Set the power switch on the system to OFF.
2. Set all external power switches OFF, (i.e. display, printer, etc.).
3. Unplug the system unit's power cord from the power outlet.
4. Disconnect all power cords and cables from rear of machine.
5. Move keyboard and all external options away from the work area.
6. Place the system unit on a stable and clear work surface.
7. Remove the cover of the unit by loosening the screws on either side of the unit near the front then sliding the cover a short distance toward the back and lifting it off the unit.
8. Unscrew and remove any micro-channel adapter cards, being careful to note their position.
9. Before removing the 80286 note the location of pin 1, (identified by a notch, beveled edge, dot or half-circle).

   Note: The position of pin 1 on the 80286 processor chip will determine **exactly** how the 486SLC2 Cached Processor Upgrade Card will be installed. The location of pin 1 shown in figure 4 is correct for the motherboards we have worked with in developing the card. It is possible that alternative motherboard designs or engineering levels exist and the location of pin 1 on your motherboard is definitive.

10. Insert the metal prongs of the IC chip removal tool in the space between the processor and its socket. Insert the prongs in the slots located diagonally opposite each other and 90 degrees either side of pin 1 (see figure 4). Gently squeeze the plastic handles until the tip near the metal prongs seats on the processor socket. Without rocking or lifting up on the tool, gently increase the force on the handles until the prongs lift the processor out of the socket. (Save the 80286 microprocessor in the event you need to temporarily

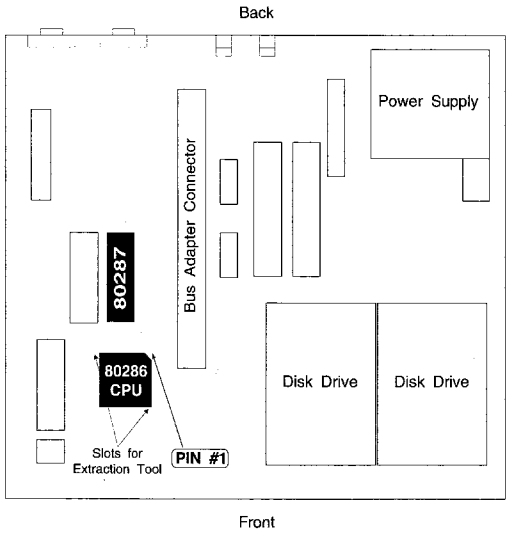

Figure 4. IBM PS/2 Model 30-286 System Board

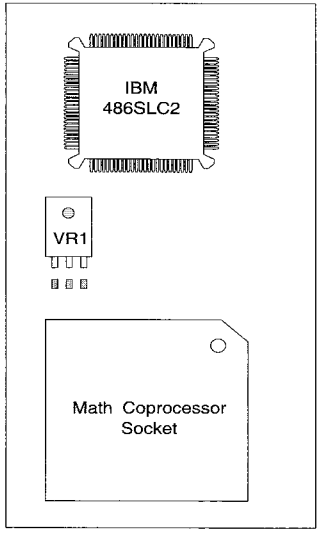

*Figure 5. Top View of 486SLC2 Cached Processor Upgrade Card for the IBM PS/2 Model 30-286, (see **BOTTOM** of upgrade card for location of Pin#1).*

return to the old configuration. Protect the microprocessor by storing it in the antistatic bag the upgrade card came in.)

11. If you have an 80287 math co-processor installed, it MUST be removed. This device is incompatible with the processor on your new upgrade card. Locate the 80287 co-processor as shown in figure 4 and insert a small flat blade screwdriver under the end of the chip. Gently pry upwards; repeat for both ends. Once the pins have been sufficiently exposed, remove the co-processor with your fingers. (Save the 80287 co-processor in the event you need to temporarily return to the old configuration. The math co-processor should also be stored in the antistatic bag.)
12. Next, remove the upgrade card from the protective bag in which it was shipped, being careful to discharge any static electricity in your body before handling the card. Hold the card by the edges at all times. Identify pin 1 of the math co-processor chip (designated by a beveled edge, dot, notch or half moon). Match this corner to the beveled edge on the co-processor socket on the 486SLC2 Cached Processor Upgrade Card. (See figure 5.) Carefully insert the co-processor in the socket provided on the top side of the upgrade card. Be sure to align pin 1 on the co-processor with pin 1 in the socket. See figure 5 for the location of pin 1 on the co-processor socket. Firmly press the co-processor module into place. (The pins of the module are easily damaged and must be aligned with the contacts in the socket before pressing the module into place.)
14. Align pin 1 of the connector on the BOTTOM surface of the 486SLC2 Cached Processor Upgrade Card with pin 1 on the socket. Press the card gently into place, applying an even pressure. (If the 486SLC2 Cached Processor Upgrade Card is not positioned correctly, damage to both your IBM PS/2 and the upgrade card may result.)
15. Return the micro-channel adapter cards to their original positions as noted previously. Be certain to retighten the screws to secure the adapters in place.
16. Replace the cover and reattach all cables and power cords.
17. If you are changing the system configuration by either adding or eliminating a math co-processor, do the following, otherwise skip to step 18.

    a). Boot the system from your backup copy of the IBM Reference diskette, containing the configuration files for any micro-channel adapters installed in your PS/2.

b). While the system is booting, a 162 error will appear on the screen indicating a change has been detected in your PS/2 configuration.

c). After the IBM logo appears, press the Enter key.

d). A description of the 162 error code will appear, followed by a prompt asking if you want to run automatic configuration. Answer "Y" (yes), to the reconfiguration question.

e). After the system has been reconfigured, remove the back-up reference diskette and reboot the computer.

18. If you bypassed the reconfiguration steps above, turn on power to your PS/2 and check that it boots successfully. If it does not, check that the upgrade card is correctly inserted in the 80286 socket. Check for bent or damaged pins.

19. Once the machine boots correctly, install the device driver for Enabling/Disabling the Memory Cache and doubling the clock speed. See the section "Software Installation" later in this installation guide.

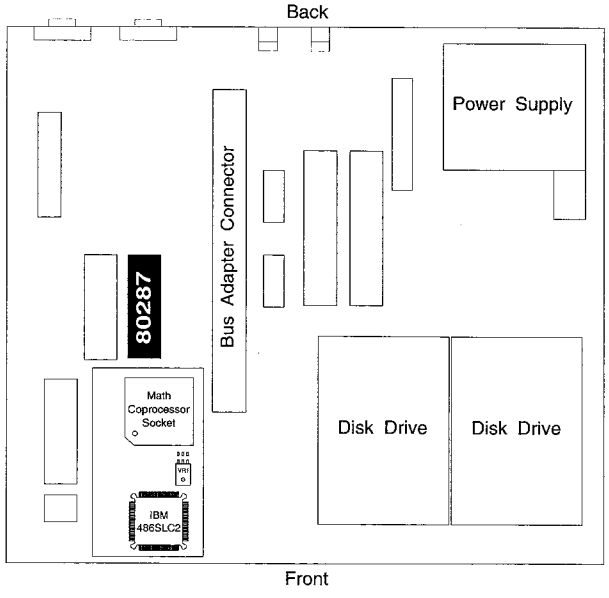

Figure 6. *IBM PS/2 Model 30-286 System Board with 486SLC2 Cached Processor Upgrade Card installed.*

IBM PS/2 Model 50

Installing the 386SLC or the 486SLC2 Cached Processor Upgrade Card

1. Set the power switch on the system unit to OFF.
2. Set all external power switches off, (i.e. display, printer, etc.).
3. Unplug the system unit's power cord from the power outlet.
4. Disconnect all power cords and cables from rear of machine.
5. Move keyboard and all external options away from the work area.
6. Position the unit to allow access to the rear.
7. Using a flat-blade screwdriver or the finger grips, remove the cover mounting screws.
8. Unlock the system cover and carefully slide the system unit's cover away from the rear and to the front. When the cover will go no further, tilt it up, remove it from the base and set it aside.
9. Unscrew and remove any micro-channel adapter cards, being careful to note their position.
10. Before removing the 80286 note the location of pin 1, (identified by either a notch, beveled edge, dot or a half-circle).

    Note: The position of pin 1 on the 80286 processor chip will determine **exactly** how the 386SLC or 486SLC2 Cached Processor Upgrade Card will be installed. The location of pin 1 shown in figure 7 is correct for the motherboards we have worked with in developing the card. It is possible that alternative motherboard designs or engineering levels exist and the location of pin 1 on your motherboard is definitive.

11. Using the IC chip removal tool, gently but firmly insert the edge of the tool under a corner of the microprocessor between the chip and the socket and pry upward to loosen it from the socket. Repeat this action for all four corners until you are able to remove the microprocessor by hand. Carefully remove the chip. (Save the 80286 microprocessor in the event you need to temporarily return to the old configuration. Protect the microprocessor by storing it in the antistatic bag the upgrade card came in.)
12. If you have an 80287 co-processor installed, this must also be removed. Locate the 80287 co-processor as shown in figure 1 and insert a small flat-blade screwdriver under the end of the chip.

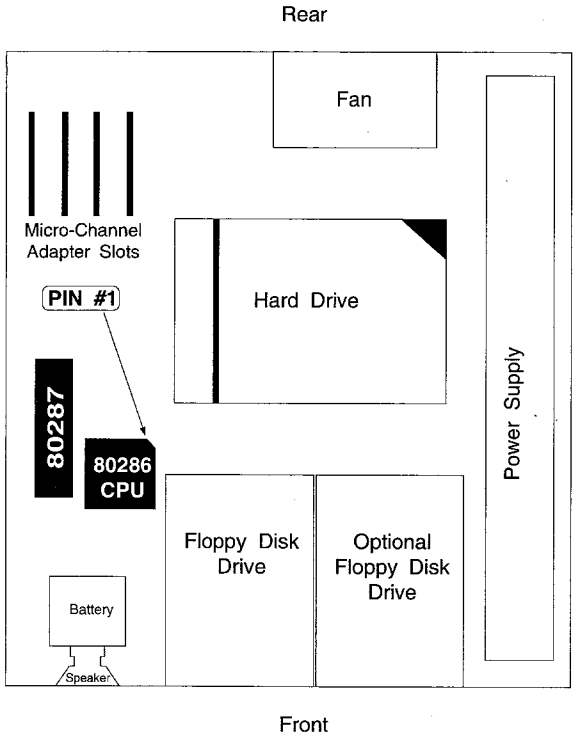

Figure 7. IBM PS/2 Model 50 System Board

Gently pry upwards, repeat for both ends. Once the pins have been sufficiently exposed remove with your fingers. (Save the 80287 co-processor in the event you need to temporarily return to the old configuration. The math co-processor should also be stored in the antistatic bag.)

13. If you are adding the math co-processor, identify pin 1 of the math co-processor chip, (designated by either a beveled edge, dot, notch or half-circle). Match this corner to the bevelled edge for the math co-processor on the 386SLC Cached Processor Upgrade Card, (see figure 8), or the 486SLC2 Cached Processor Upgrade Card, (see figure 9). Carefully place the co-processor into the socket located on the upgrade card being sure to align the pins and the connector. Firmly press the module into place. (The pins of the module are

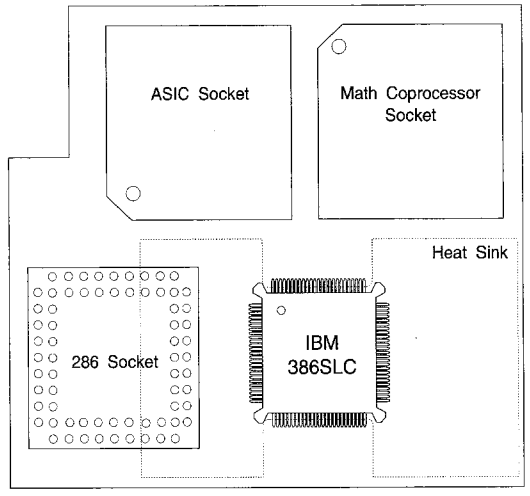

*Figure 8. Top View of the 386SLC Cached Processor Upgrade Card for the IBM PS/2 Model 50/60, (see **BOTTOM** of upgrade card for location of Pin #1).*

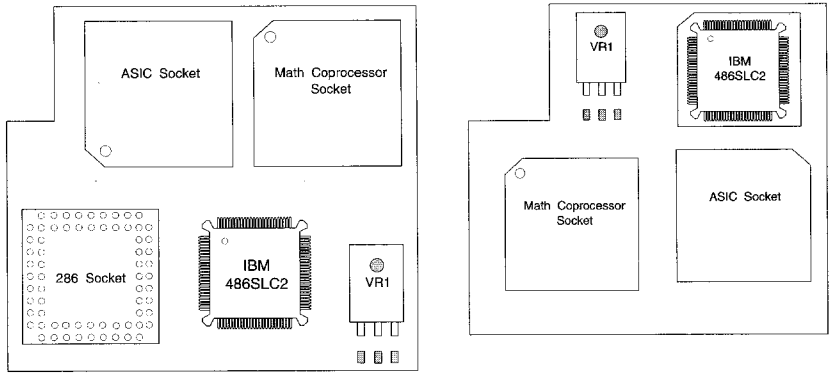

*Figure 9. Top View of the 486SLC2 Cached Processor Upgrade Card for the IBM PS/2 Model 50/60, (see **BOTTOM** of upgrade card for location of Pin #1).*

easily damaged and must be aligned with the connector before pressing the module into place.)

14. Align the beveled edge of the 80286 outline on the bottom surface of the 386SLC or 486SLC2 Cached Processor Upgrade Card with pin 1 on the 80286 socket. Press gently into place, applying an even pressure. **(If the 386SLC or 486SLC2 Cached Processor Upgrade Card is not positioned correctly, damage to both your IBM PS/2 and the upgrade card may result.)**

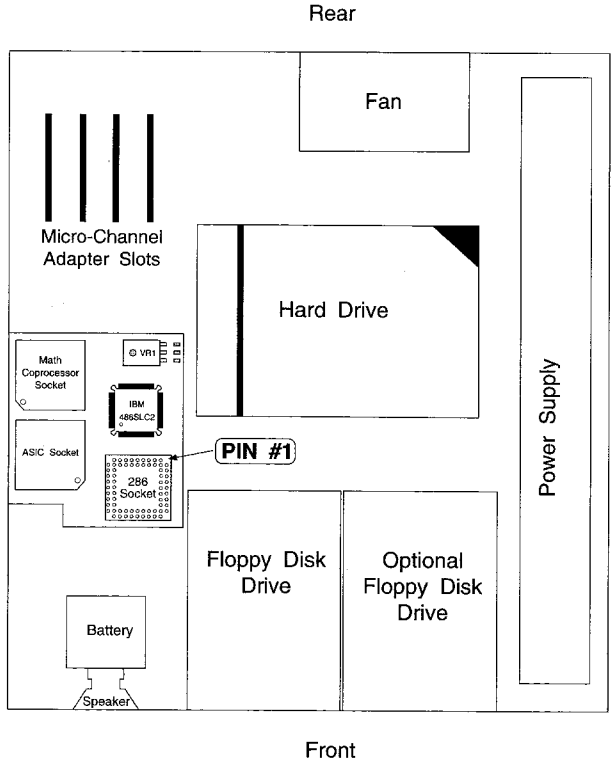

Figure 10. IBM PS/2 Model 50 with 486SLC2 Cached Processor Upgrade Card installed.

Note: Some versions of the Model 50 used a slimline version of the PGA socket on the system board. The optional spacer should be installed between the socket and the accelerator card to provide adequate clearance over the capacitor.

15. Return micro-channel adapter cards to their original positions as noted previously. Be certain to retighten the screws to secure the adapters in place.
16. Replace the cover and reattach all cables and power cords.
17. If you are changing the system configuration by either adding a math co-processor or eliminating a math co-processor do the following steps, (otherwise skip to step 18).
    a). Boot the system from your backup copy of the IBM Reference diskette, containing the configuration files for any micro-channel adapters installed in your PS/2 Model 50.
    b). While the system is booting, a 162 error will appear on the screen indicating a change in your PS/2 configuration.
    c). After the IBM logo appears, press the **enter** key.
    d). A description of the 162 error code will appear, followed by a prompt asking if you want "auto configuration." Answer "Y" (yes), to the reconfigure question.
    e). After the system has been reconfigured, remove the back-up reference diskette and reboot the computer.
18. Turn on power to your PS/2, check that it boots successfully. If it does not, check that the 386SLC or 486SLC2 Cached Processor Upgrade Card is correctly inserted into the 80286 socket. Check for bent or damaged pins.
19. Once the machine boots correctly, install the device driver for Enabling/Disabling the Memory Cache, and in the case of the 486SLC2 version, doubling the clock speed.

IBM PS/2 Model 50Z

Installing the 386SLC or the 486SLC2 Cached Processor Upgrade Card

1. Set the power switch on the system unit to OFF.
2. Set all external power switches off, (i.e. display, printer, etc.).
3. Unplug the system unit's power cord from the power outlet.
4. Disconnect all power cords and cables from rear of machine.
5. Move keyboard and all external options away from the work area.
6. Position the unit to allow access to the rear.
7. Using a flat-blade screwdriver or the finger grips, remove the cover mounting screws.
8. Unlock the system cover and carefully slide the system unit's cover away from the rear and to the front. When the cover will go no further, tilt it up, remove it from the base and set it aside.
9. Unscrew and remove any micro channel adapter cards, being careful to note their position.
10. Before removing the 80286 note the location of pin 1, (identified by either a notch, beveled edge, dot or a half-circle).

    Note: The position of pin 1 on the 80286 processor chip will determine **exactly** how the 386SLC or 486SLC2 Cached Processor Upgrade Card will be installed. The location of pin 1 shown in figure 11 is correct for the motherboards we have worked with in developing the card. It is possible that alternative motherboard designs or engineering levels exist and the location of pin 1 on your motherboard is definitive.
11. Insert the metal prongs of the IC chip removal tool into the space between the processor and its socket. Insert the prongs in diagonally opposite corners. Gently squeeze the plastic handles until the tip near the metal prongs seats on the processor. Without rocking or lifting up on the tool, gently increase the force on the handle until the prongs lift the processor out of the socket. Carefully remove the chip. (Save the 80286 microprocessor in the event you need to temporarily return to the old configuration. Protect the microprocessor by storing it in the antistatic bag the upgrade card came in.)

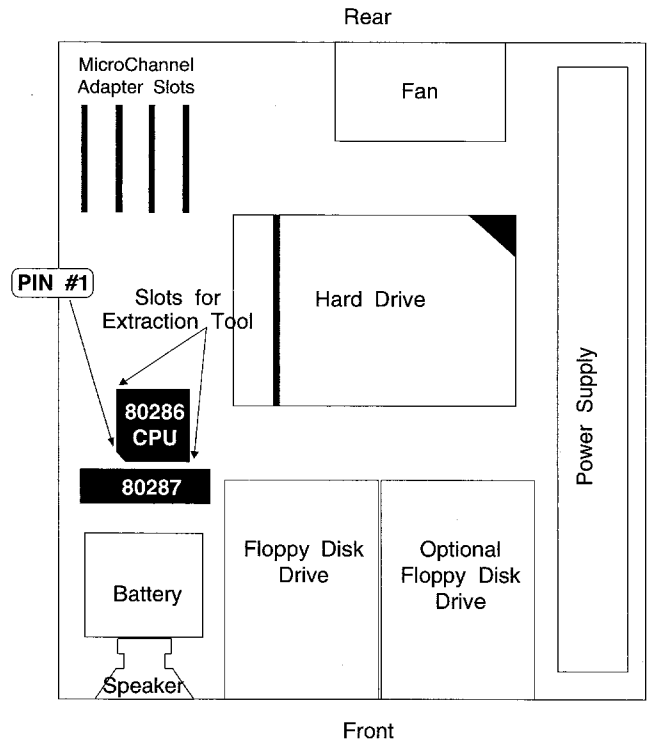

Figure 11. IBM PS/2 Model 50Z System Board

12. If you have an 80287 co-processor installed, this must also be removed. Locate the 80287 co-processor as shown in figure 5 and insert a small flat-blade screwdriver under the end of the chip. Gently pry upwards, repeat for both ends. Once the pins have been sufficiently exposed remove with your fingers. (Save the 80287 co-processor in the event you need to temporarily return to the old configuration. The math co-processor should also be stored in the antistatic bag.)

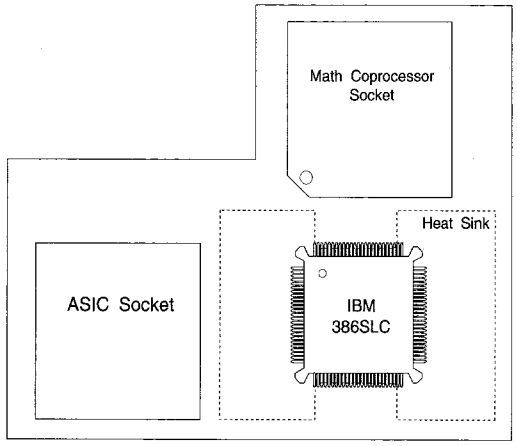

*Figure 12. Top View of the 386SLC Cached Processor Upgrade Card for the IBM PS/2 Model 50Z, (see **BOTTOM** of upgrade card for location of Pin #1).*

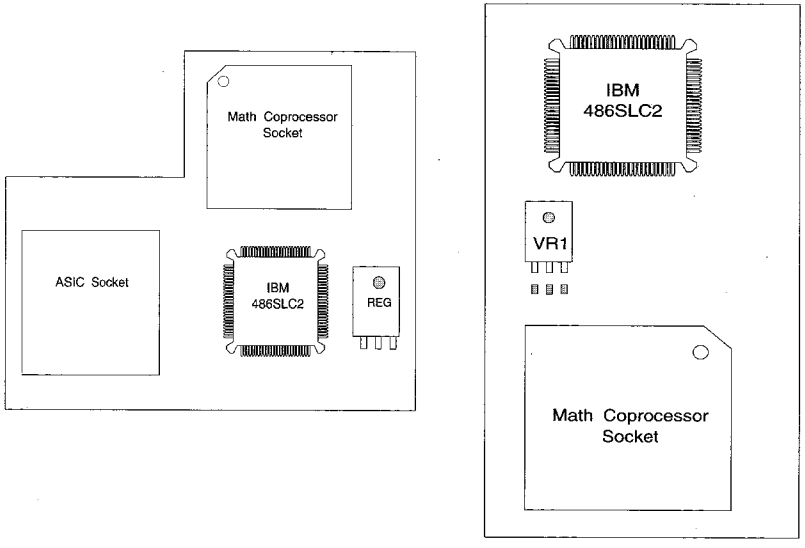

*Figure 13. Top View of the two versions of the 486SLC2 Cached Processor Upgrade Card for the IBM PS/2 Model 50Z, (see **BOTTOM** of upgrade card for location of Pin #1).*

13. If you are adding the math co-processor, identify pin 1 of the math co-processor chip, (designated by either a beveled edge, dot, notch or half-moon). Match this corner to the bevelled edge for the co-processor on the 386SLC Cached Processor Upgrade Card, (see figure 12), or the 486SLC2 Cached Processor Upgrade Card, (see figure 13. Carefully place the co-processor into the socket located on the upgrade card being sure to align the pins and the connector. Firmly press the module into place. (The pins of the module are easily damaged and must be aligned with the connector before pressing the module into place.)
14. Align the beveled edge of the 80286 outline on the bottom surface of the 386SLC or 486SLC2 Cached Processor Upgrade Card with pin 1 on the 80286 socket. Press gently into place, applying an even pressure. **(If the 386SLC or 486SLC2 Cached Processor Upgrade Card is not positioned correctly damage to both your IBM PS/2 and the upgrade card may result.)**
15. Return micro-channel adapter cards to their original positions as noted previously. Be certain to retighten the screws to secure the adapters in place.
16. Replace the cover and reattach all cables and power cords.
17. If you are changing the system configuration by either adding a math co-processor or eliminating a math co-processor do the following steps, (otherwise skip to step 18).
    a). Boot the system from your backup copy of the IBM Reference diskette, containing the configuration files for any micro-channel adapters installed in your PS/2 Model 50Z.
    b). While the system is booting, a 162 error will appear on the screen indicating a change in your PS/2 configuration.
    c). After the IBM logo appears, press the **enter** key.
    d). A description of the 162 error code will appear, followed by a prompt asking if you want "auto configuration." Answer "Y" (yes), to the reconfigure question.
    e). After the system has been reconfigured, remove the back-up reference diskette and reboot the computer.
18. Turn on power to your PS/2, check that it boots successfully. If it does not, check that the 386SLC or 486SLC2 Cached Processor Upgrade Card is correctly inserted into the 80286 socket. Check for bent or damaged pins.

19. Once the machine boots correctly, install the device driver for Enabling/Disabling the Memory Cache, and in the case of the 486SLC2 version, doubling the clock speed.

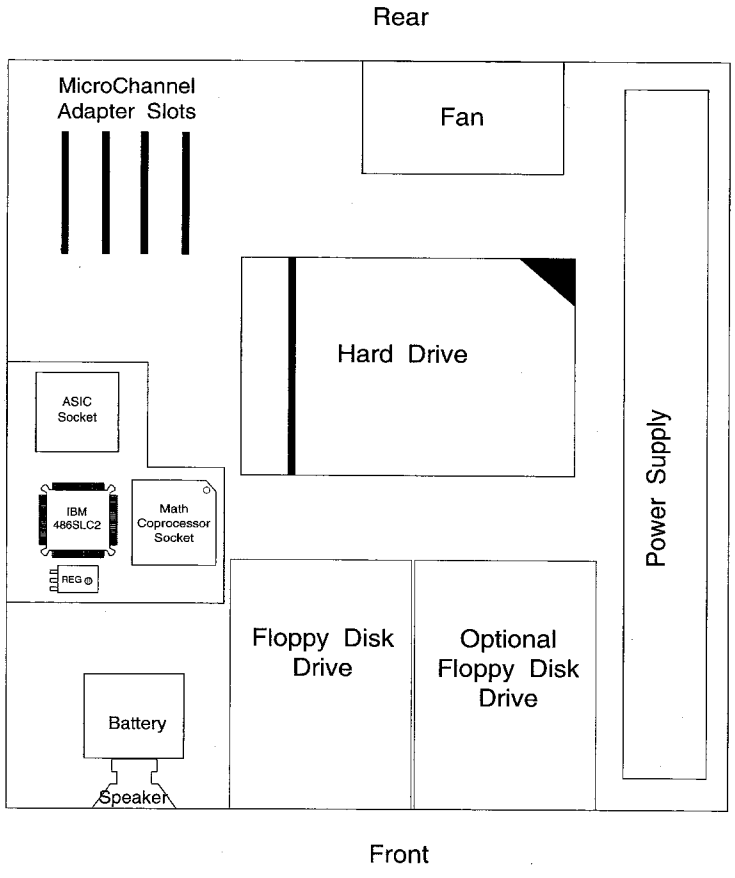

Figure 14. IBM PS/2 Model 50Z with 486SLC2 Cached Processor Upgrade Card installed.

IBM PS/2 Model 60

Installing the 386SLC or the 486SLC2 Cached Processor Upgrade Card

1. Set the power switch on the system unit to OFF.
2. Set all external power switches off, (i.e. display, printer, etc.).
3. Unplug the system unit's power cord from the power outlet.
4. Disconnect all power cords and cables from rear of machine.
5. Move keyboard and all external options away from the work area.
6. Place the PS/2 Model 60 on its side and unlock the side panel.
7. Loosen the two (2) cover retainer screws, then tilt the side panel and remove from the base. Set the side panel aside.
8. Unscrew and remove any micro channel adapter cards, being careful to note their position.
9. Before removing the 80286 note the location of pin 1, (identified by either a notch, beveled edge, dot or a half-circle).

   Note: The position of pin 1 on the 80286 processor chip will determine **exactly** how the 386SLC or 486SLC2 Cached Processor Upgrade Card will be installed. The location of pin 1 shown in figure 15 is correct for the motherboards we have worked with in developing the card. It is possible that alternative motherboard designs or engineering levels exist and the location of pin 1 on your motherboard is definitive.
10. Using the IC chip removal tool, gently but firmly insert the edge of the tool under a corner of the microprocessor between the chip and the socket and pry upward to loosen it from the socket. Repeat this action for all four corners until you are able to remove the microprocessor by hand. Carefully remove the chip. (Save the 80286 microprocessor in the event you need to temporarily return to the old configuration. Protect the microprocessor by storing it in the antistatic bag the upgrade card came in.)
11. If you have an 80287 co-processor installed, this must also be removed. Locate the 80287 co-processor as shown in figure 11 and insert a small flat-blade screwdriver under the end of the chip. Gently pry upwards, repeat for both ends. Once the pins have been sufficiently exposed remove with your fingers. (Save the 80287 co-processor in the event you need to temporarily return to the old configuration. The math co-processor should also be stored in the antistatic bag.)

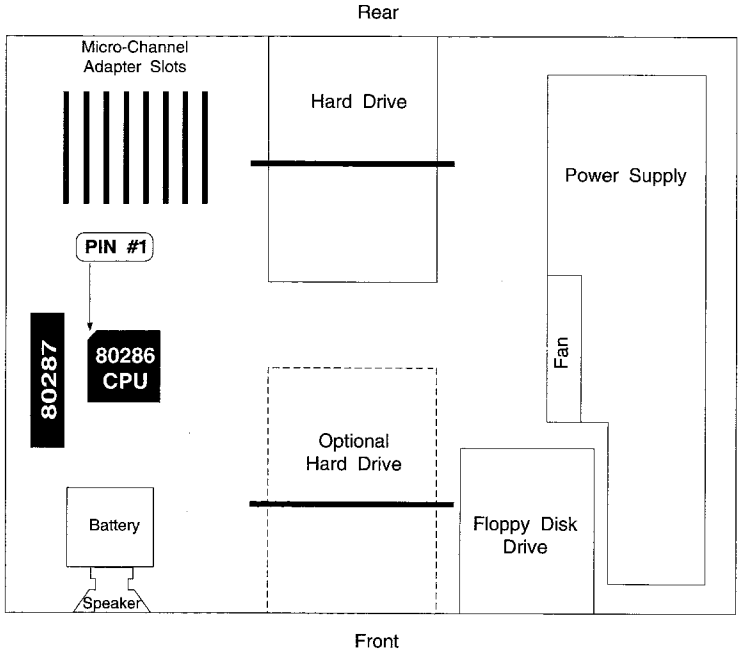

Figure 15. IBM PS/2 Model 60 System Board, (see bottom of card for location of Pin #1).

12. If you are adding the math co-processor, identify pin 1 of the math co-processor chip, (designated by either a beveled edge, dot, notch or half-moon). Match this corner to the bevelled edge for the co-processor on the 386SLC Cached Processor Upgrade Card, (see figure 16), or the 486SLC2 Cached Processor Upgrade Card, (see figure 17). Carefully place the co-processor into the socket located on the upgrade card being sure to align the pins and the connector. Firmly press the module into place. (The pins of the module are easily damaged and must be aligned with the connector before pressing the module into place.)

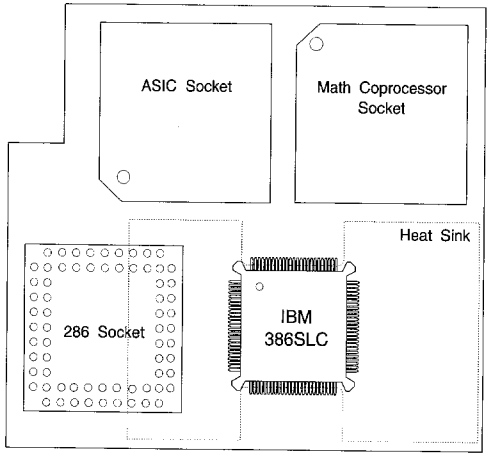

*Figure 16. Top View of the 386SLC Cached Processor Upgrade Card for the IBM PS/2 Model 50/60, (see **BOTTOM** of upgrade card for location of Pin #1).*

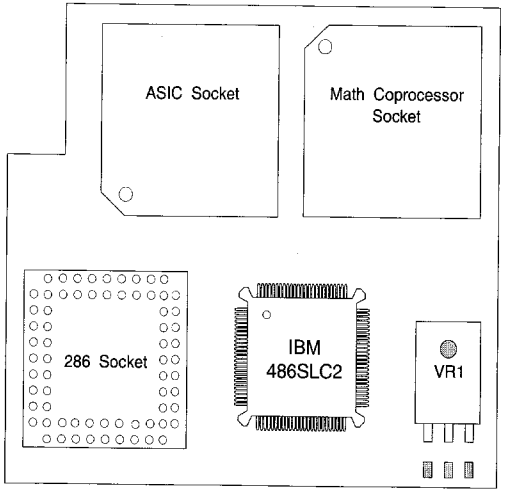

*Figure 17. Top View of the 486SLC2 Cached Processor Upgrade Card for the IBM PS/2 Model 50/60, (see **BOTTOM** of upgrade card for location of Pin #1).*

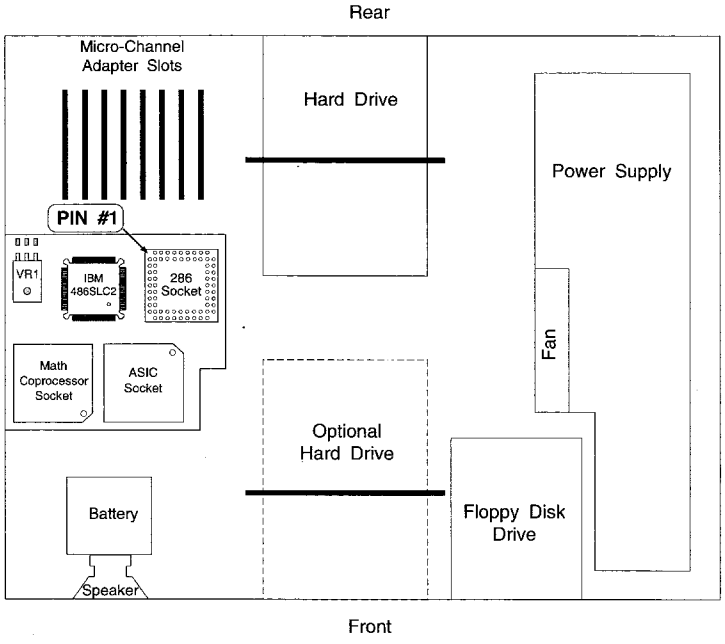

Figure 18. IBM PS/2 Model 60 System Board with 486SLC2 Cached Processor Upgrade Card installed.

13. Align the beveled edge of the 80286 outline on the bottom surface of the 386SLC or 486SLC2 Cached Processor Upgrade Card with pin 1 on the 80286 socket. Press gently into place, applying an even pressure. **(If the 386SLC or 486SLC2 Cached Processor Upgrade Card is not positioned correctly damage to both your IBM PS/2 and the upgrade card may result.)**
14. Return micro-channel adapter cards to their original positions as noted previously. Be certain to retighten the screws to secure the adapter cards in place.
15. Replace the cover and reattach all cables and power cords.

16. If you are changing the system configuration by either adding a math co-processor or eliminating the math co-processor do the following steps, (otherwise skip to step 17).
    a). Boot the system from your backup copy of the IBM Reference diskette, containing the configuration files for any micro-channel adapters installed in your PS/2 Model 60.
    b). While the system is booting, a 162 error will appear on the screen indicating a change in your PS/2 configuration.
    c). After the IBM logo appears, press the **enter** key.
    d). A description of the 162 error code will appear, followed by a prompt asking if you want "auto configuration." Answer "Y" (yes), to the reconfigure question.
    e). After the system has been reconfigured, remove the back-up reference diskette and reboot the computer.
17. Turn on power to your PS/2, check that it boots successfully. If it does not, check that the 386SLC or 486SLC2 Cached Processor Upgrade Card is correctly inserted into the 80286 socket.
18. Once the machine boots correctly, install the device driver for Enabling/Disabling the Memory Cache, and in the case of the 486SLC2 version, doubling the clock speed.

Software Installation

DOS Software

The DOS support software for the SLC accelerator cards consists of a device driver (**SLCCARD.SYS**) and an executable program (**SLCCARD.EXE**) to be run from the DOS prompt (C:\>). Together they enable the SLC processor to function in its enhanced mode.

The driver enables the SLC processor cache, defines the cacheable memory and its R/O or R/W status for both the 386SLC and 486SLC2 processors. It also enables 2x clocking on the 486SLC2 processor.

The driver must be installed at system boot-up time in order for the upgrade card to perform properly. If the driver is not installed, caching and double clocking will not be enabled and system performance will be severely degraded.

The CONFIG.SYS file must be modified to include the DOS driver SLCCARD.SYS.

The file AUTOEXEC.BAT must be modified to include the path to the executable program (SLCCARD.EXE) in the PATH= statement.

The executable program may be used to display or alter the processor settings previously established when the device driver was installed. Only the settings and values included as arguments to the program will be changed; other settings and values will remain as originally set.

The executable program will perform its functions only if the device driver has previously been installed. If the device driver is not present when the command is entered, an error message will be displayed and no function will be performed.

Installation of the device driver and the executable module may be accomplished manually or by means of the convenient install program included on the distribution diskette.

The Install Program

The INSTALL program resides on the software distribution diskette. To run the install program, insert the distribution diskette in the "A:" drive, type **A: <Enter>** then **install <Enter>.** A sequence of panels with messages and installation options will lead you through the installation process. The basic functions that you can perform by means of the INSTALL program are:

- Transfer the device driver and the executable program from the distribution diskette to the operational diskette or hard file.
- Specify arguments and argument values for the SLCCARD device driver.
- Modify the CONFIG.SYS file to include the device driver with the specified arguments and argument values.
- Modify the AUTOEXEC.BAT file to include the path to the executable file SLCCARD.EXE.

When specifying arguments and argument values for the SLCCARD device driver, you will use the same syntax as described for the manual installation below. It is recommended that the default settings be accepted for normal use. You should, therefore, normally select

- the Install option to transfer the files,
- the Modify CONFIG.SYS option to add the DEVICE= command and
- the Modify AUTOEXEC.BAT option to add Path to the executable file.

Manual Installation

To manually install the device driver and executable programs, copy SLCCARD.SYS, SLCCARD.EXE and RSETPROC.EXE to the root directory (or any other directory of your choice) on the hard drive, or copy onto a bootable floppy disk if you are booting from a floppy.

Using any text editor add the following line as the first DEVICE= line of the CONFIG.SYS file.

DEVICE=C:\(dir)\SLCCARD.SYS [optional arguments]

(**Note**: C: \(dir) indicates the drive and path where the driver program is located; yours may be different.)

Optional Arguments

Optional arguments are valid either on the DEVICE= command line in CONFIG.SYS or when entered from the DOS prompt. Options set from CONFIG.SYS are in effect until changed by issuing the command SLCCARD from the DOS prompt. Alterations made by issuing the command are effective until changed by reissuing the command with new values specified or until the system is rebooted.

Example:

DEVICE=C:\(dir)\SLCCARD.SYS /ECNPX

This will enable the math co-processor cache read capability. This option is only valid if a Cyrix math co-processor is installed. This sample command will also set the following defaults:

- The processor cache is enabled.
- 2x clocking is enabled, if the processor type is the 486SLC2.
- All memory in the address range 00000 through 9FFFF is cached.
- All memory in the address range A0000 through FFFFF is **not** cached.
- All memory in the address range 00000 through FFFFF is Read/Write accessible.
- All installed memory in the address range 100000 through FFFFFF (1 Meg - 16 Meg) is cached.

The program may also be run from the DOS prompt (C:\>) by typing:

C:\(dir)\SLCCARD /ECNPX and pressing **<Enter>**

With the program you can enable or disable the SLC processor cache, modify the cacheable memory, designate 64KB segments of the first 1 Meg of memory as read only, enable or disable the math co-processor cacheing (Cyrix co-processor only) for either the 386SLC or 486SLC2 processors, and enable or disable the 2x clock mode on the 486SLC2 processor.

To run the program from the DOS prompt, make sure that the directory and/or drive is in the DOS path or is the current drive and directory. For example, to get system help or to display the status using the A: drive, type

A: <Enter> then type

SLCCARD ? for help or **SLCCARD /S?** for status.

Several optional arguments are provided to enable the user to display and alter processor clocking and memory management characteristics. The arguments are specified using keywords that begin with /. There must be at least one blank space between arguments and there must be no spaces between characters within an argument (i.e. **/s?** not / s ?). Some of the keywords have variable values associated with them.

The default set-up should be used for all but special or engineering purposes. This can be done in the CONFIG.SYS file (DEVICE=SLCCARD.SYS) or from the DOS prompt (C:\> SLCCARD).

For an on screen list of options available in the program type SLCCARD followed by a space then ? and a list will be displayed.

The following is a list of arguments and their meanings:

[blank]	(no arguments) sets all values to their defaults and displays status.
?	returns a list of the switch options.
/s?	returns processor status.
/ec	enables the cache.
/dc	disables the cache.
/e2xc	enables double clock mode.
/d2xc	disables double clock mode.
/ecnpx	enables co-processor cacheability.
/dcnpx	disables co-processor cacheability.

Note: /ecnpx or /dcnpx switch must not be used if an INTEL co-processor is installed. It is useful for improving performance with a Cyrix co-processor installed.

Cache Region Control Options

Processor cacheing is activated selectively in system memory. Cacheable regions are selectable in 64KB increments. In the address range 00000 through FFFFF (0-1 Meg) each of the 16 64KB regions may be designated as cacheable or non cacheable.

The same regions may be independently designated Read/Write or Read Only. If a **Write** occurs to a Read Only line in the cache, the cache will invalidate the line, the Write will occur on the external bus and a cache reload will occur.

In the address range 100000 - FFFFFF (1 Meg - 16 Meg) cacheability may be specified for contiguous 64KB regions beginning at address 100000 (1 Meg).

The switch **/ec**, listed above, activates processor cacheing. If this switch is specified with no additional arguments, the following defaults are in effect:

- Cacheing is enabled.
- 2x clocking is enabled, if the processor type is 486SLC2.
- All memory in the address range 00000 through 9FFFF is cached.
- All memory in the address range A0000 through FFFFF is **not** cached.
- All addresses in the range 00000 through FFFFF are Read/Write. Writes to these addresses are store-through Writes, if the address is presently cached.
- All installed memory in the address range 100000 through FFFFFF (1 Meg - 16 Meg) is cached.

Several arguments are provided for use with special applications requiring other than the default settings. Refer to the IBM Microelectronics processor data sheets prior to making any modifications to these parameters. The following arguments may be entered either on the DEVICE= line in the CONFIG.SYS file or at the DOS prompt:

Argument: **/uncache={blank | address [,address[,...]] | address range}**

The **uncache=** argument specifies those 64KB segments of memory in the address range 00000 - FFFFF that are not to be cached.

Examples

/uncache= specifies that all addresses in the range are to be cached.

/uncache=A0000 specifies that all addresses in the range are to be cached except A0000 through AFFFF.

/uncache=A0000,C0000 specifies that all addresses in the range are to be cached except A0000 through AFFFF and C0000 through CFFFF.

/uncache=A0000-FFFFF specifies that all addresses in the range 00000 through 9FFFF are to be cached but addresses in the range A0000 through FFFFF are not to be cached. This is the default setting when the argument is **omitted**.

Argument: **/readonly={blank | address [,address[,...]] | address range}**

The **readonly=** argument specifies those 64KB segments of memory in the address range 00000 - FFFFF that are considered read only by the cache control.

Examples

/readonly= specifies that all addresses in the range are to be read/write. This is the default when the argument is **omitted**.

/readonly=A0000 specifies that all addresses in the range are to be read/write except A0000 through AFFFF.

/readonly=A0000,C0000 specifies that all addresses in the range are to be read/write except A0000 through AFFFF and C0000 through CFFFF.

/readonly=A0000-FFFFF specifies that all addresses in the range 00000 through 9FFFF are read /write but addresses in the range A0000 through FFFFF are read only.

Argument: **/maxcache={blank | address}**

The /maxcache= argument specifies the maximum address to be cached in the address range 100000 - FFFFFF (1Meg-16Meg). If an address less than 1Meg is specified, the argument has no effect.

Examples

/maxcache= specifies that no memory above 1Meg is to be cached.

/maxcache=03FFFF specifies that no memory above 1Meg is to be cached. (The address specified is less than 1Meg.)

/maxcache=A6FFFF specifies that addresses in the range 100000 through A6FFFF are to be cached.

/maxcache=FFFFFF specifies that all memory in the system, up to 16Meg will be cached. This is the default when the argument is omitted.

Note: All changes made from the DOS prompt will remain in effect until the command is reissued with new values or until a system re-boot occurs. To make the changes permanent, the appropriate options must be set in the device driver line of the CONFIG.SYS file.

OS2 Software

OS2 V2.0 and later can be installed and run with the IBM Microelectronics 386SLC or 486SLC2 Cached Processor Upgrade card. The file SLCOS220.SYS must be in the OS2 root directory. Add the following statement as the **last** DEVICE= line in CONFIG.SYS.

DEVICE = C:\(dir)\SLCOS220.SYS

Note: C:\(dir) indicates the drive where the driver program is located, yours may be different.

This will enable the processor upgrade card to operate in high performance mode.

The DOS type switch options are not presently supported with this driver.

OS2 V1.3 will not work reliably at the present time with the accelerator card.

Reference Diskette Modifications:

The following **changes must be made** to the REFERENCE diskette so that the VGA diagnostics test will not fail.

Copy the program file **SLCCARD.SYS** to the root directory of the REFERENCE diskette.

The CONFIG.SYS file on the REFERENCE diskette must also be modified to include **DEVICE=SLCCARD.SYS** as the **first DEVICE= line**.

Be sure to check the README file for last minute changes, additions and deletions. In particular, read the section "Known Software Issues" for information regarding the use of several popular application programs.

Troubleshooting

This troubleshooting section is designed to assist you in correcting problems with your system. **For additional assistance or problem resolution please call 1-800-PS2-2227.**

Machine Does Not Boot

1. Check that all power and cables are plugged into the proper locations. The system unit power indicator and display indicators should show light indicating power.
2. Turn off the computer and unplug the unit from the power outlet. Remove the cover from the system unit and check that all adapter boards are firmly seated in their sockets. Replace the cover and turn the power on again.
3. Turn off the computer and unplug the unit from the power outlet. Check the orientation of the 386SLC or 486SLC2 Cached Processor Upgrade Card and insure that it is firmly seated in the 80286 socket.
4. Remove the 386SLC or 486SLC2 Cached Processor Upgrade Card, replace with the 80286 and 80287 (if previously installed) and turn the power on. If system boots, the 386SLC or 486SLC2 Cached Processor Upgrade Card may be defective. Contact your dealer.

System Boots from Floppy Disk, does not boot from Hard Disk

Check the connections to the hard disk and controller card. Connection may have been dislodged.

System does not read floppy drive

Check the connections to the floppy disk controller card. Connection may have been dislodged.

Replacing the 386SLC or the 486SLC2 Cached Processor Upgrade Card

To remove your 386SLC or 486SLC2 Cached Processor Upgrade Card from your IBM PS/2 Models 50, 50Z or 60 and restore the system with your original 80286 microprocessor, simply follow these steps:

1. If the **CONFIG.SYS** has been modified to enable the cache (for either the 386SLC or 486SLC2 cache enable program), remove the line or make it a REM statement.
2. Set the power switch on the system unit to OFF.
3. Set all external power switches off, (i.e. display, printer, etc.).
4. Unplug the system unit's power cord from the power outlet.
5. Disconnect all power cords from the rear of your machine.
6. Move your keyboard and all external options away from the work area.
7. Place the unit on a stable and clear workspace.
8. **Model 25-286:**

   Place the unit with the display tube **face down.** Remove the 2 steel slotted screws just below the base of the display unit. Grasp the base of the unit in the area of the tilt assembly and gently lift the base up and tilt it away from the display.

   Models 30-286:

   Remove the cover of the system unit by loosening the screws on either side of the unit near the front, then sliding the cover a short distance toward the back and lifting it off the unit.

Models 50/50Z:

Unlock the system cover and carefully slide the system unit's cover away from the rear and to the front. When the cover will go no further, tilt it up, remove it from the base and set it aside.

Model 60:

Lay the tower system unit on its side and remove the side panel

9. Unscrew and remove any micro-channel adapter boards, being careful to note their position.
10. Hold the 386SLC or 486SLC2 Cached Processor Card gently on the edges and pull upwards, while rocking side to side, being careful not to bend any pins. Be sure to note the position of pin 1, (pin 1 of the 80286 must be inserted into pin 1 of the socket).

    Place the 386SLC or 486SLC2 Cached Processor Upgrade Card in the original packaging material and contact your dealer or IBM for repair or replacement.
11. If you are restoring the 80287, align pin 1 on the 80287 with pin 1 of the socket and press into place, being careful not to bend the pins.
12. Replace the 80286 microprocessor, be careful to align pin 1 of the chip with pin 1 of the socket.
13. Return adapter boards to their original positions as noted previously, being certain to tighten the screws.
14. Replace the cover and reattach all cables and power cords.
15. Turn on power to your PS/2, check that it boots successfully. (If you are changing the system's configuration, reconfigure the system using the backup copy of your IBM Reference diskette containing the configuration files for any microchannel adapters installed in the system).
16. If your PS/2 does not boot, check that the 286 is firmly inserted into the 80286 socket.

Trademarks

For Devices Labelled FCC Class A

Federal Communications Commission Statement

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

IBM is not responsible for any radio or television interference caused by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with 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.

For Devices Labelled FCC Class B

Federal Communications Commission Radio Frequency Interference Statement

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment 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 equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult an IBM authorized dealer or service representative for help.

IBM is not responsible for any radio or television interference caused by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with 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.

Canadian Department of Communications Compliance Statement

This equipment does not exceed Class B limits per radio noise emissions for digital apparatus, set out in the Radio Interference Regulation of the Canadian Department of Communications.

Avis de conformité aux normes du ministère des Communications du Canada.

Cet équipement ne dépasse pas les limites de Classe B d'émission de bruits radioélectiques pour les appareils numériques, telles que prescrites par le Règlement sur le brouillage radioélectrique établi par le ministère des Communications du Canada.