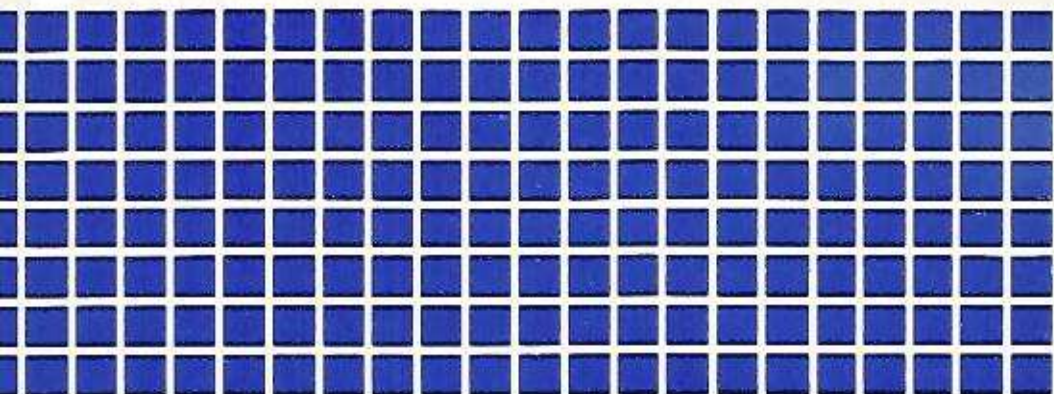


# **User's Guide and Reference Manual**



**P E R F O R M E R - 2 8 6**

- 80286 Performance Accelerator and Memory Board -

(For IBM PC and compatible computers)

**MA Systems**  
2015 O'Toole Avenue  
San Jose, California 95131

Part# 900057

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First Edition  
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## A WORD BEFORE YOU BEGIN

Congratulations! You now have the finest 80286-based performance booster available. The PERFORMER-286 lets you put the power of an IBM PC AT into your ordinary IBM PC or PC compatible computer system simply by installing a printed circuit board. Before you get started, make certain you have the following items in your PERFORMER-286 carton:

- PERFORMER-286 board
- IC removal tool
- Plastic card edge guide
- Ribbon cable
- Warranty and owner registration form
- User's Guide





## Chapter 1. INTRODUCING THE PERFORMER-286

The PERFORMER-286 gives your ordinary IBM PC or PC compatible the power and performance of an IBM PC AT computer at a fraction of the cost. The PERFORMER-286 is an IBM style expansion board which provides an 80286 microprocessor together with either 512K bytes or 640K bytes of 16-bit memory. The 80286 operates at the same 6Mhz clock speed as the PC AT computer, but actually runs standard PC software faster than the AT because it has no wheel-spinning "wait states." The PERFORMER-286 runs software five to seven times faster than a PC. And performance can be further increased by adding an optional 80287 math coprocessor to the PERFORMER board.

The PERFORMER-286 emulates the operation of the 8088 processor, and so offers 100% compatibility with your entire library of IBM PC software. In the unlikely event you have a program that for some reason is not compatible with the PERFORMER-286, you can return your PC to "normal" operation by flipping a rear-panel switch.

### 1.1 PERFORMER-286 Configurations and Features

The PERFORMER-286 (Figure 1-1) comes ready to use. It contains the 80286 microprocessor and 512K bytes of random-access memory (RAM). This RAM is different than the RAM that you already have in your PC--it is organized into 16-bit "words" rather than 8-bit bytes. This allows the 80286 processor to write to and read from memory twice as fast.



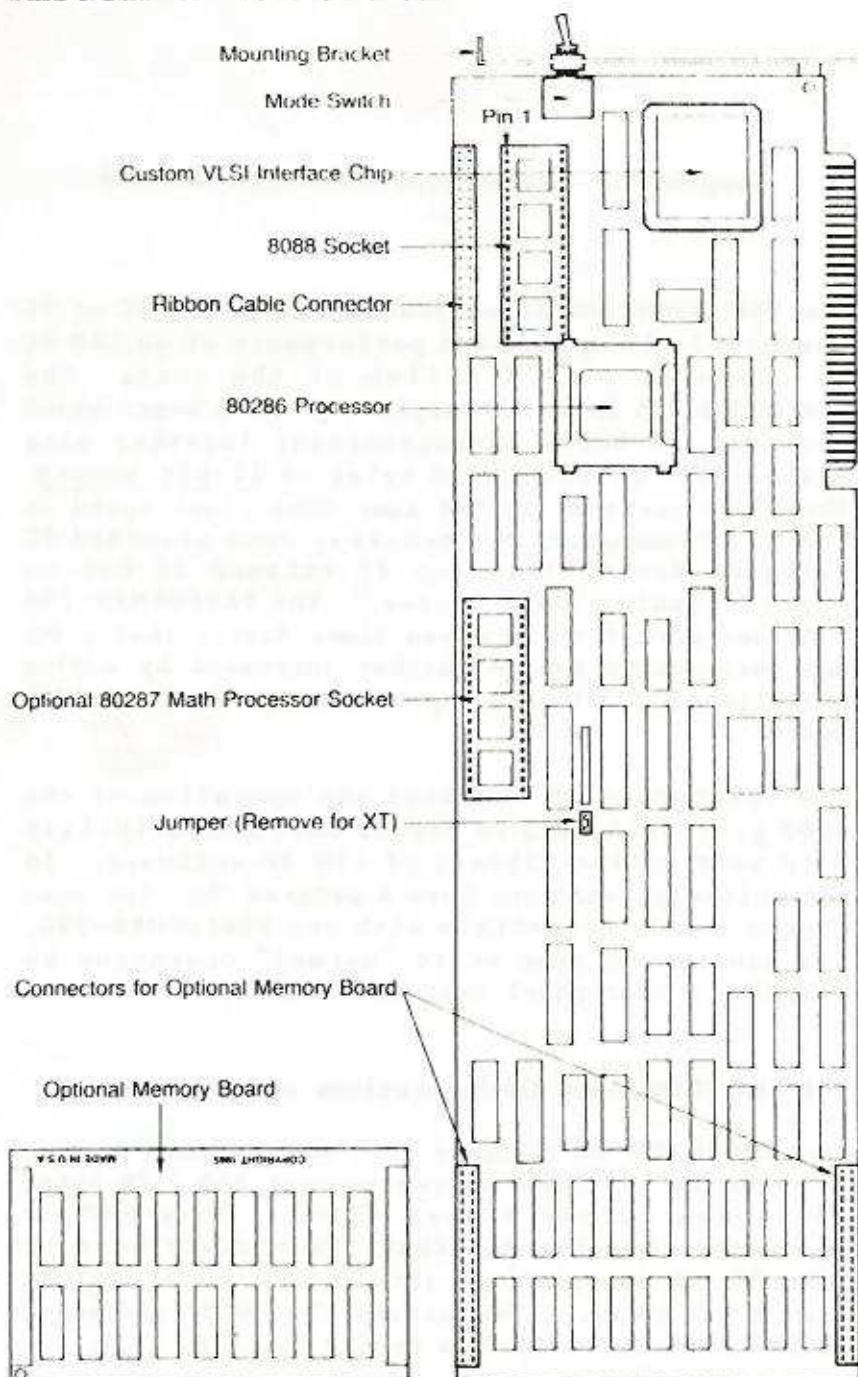


Figure 1-1: The PERFORMER-286

If you want a full 640K bytes of memory, you can add an optional 128K byte memory module. This optional memory module is a small circuit board that plugs into sockets provided on the main PERFORMER-286 board. Memory can be further increased by installing memory expansion boards which support the Lotus/Intel specification for expanded memory up to eight megabytes.

If you have software that can take advantage of it, you might want to add the optional 80287 math coprocessor to your PERFORMER-286. This optional processor IC simply plugs into a socket on the board.

### 1.2 System Requirements

The PERFORMER-286 is designed to be used in any IBM PC, PC XT, or 100% compatible computer. It installs in a standard IBM expansion slot and has a ribbon cable that plugs into the 8088 socket.

Your PC must have 256K bytes of RAM installed, either entirely on the system board, or with part of the RAM on the system board and the remainder on a memory expansion board. If you have a PC XT or compatible, you need only 64K bytes of RAM installed. Additional RAM (more than 256K for the PC or 64K bytes for the XT) will no longer be used. In addition to providing an 80286 processor, the PERFORMER also has up to 640K bytes of RAM. This means that your existing memory expansion boards, if any, are no longer needed. The memory on the PERFORMER board is used both in 80286 mode and in 8088 mode.

These are the only requirements. No other hardware or software is required. You can use all of your

existing software library with no modifications, and you can continue to use DOS in the normal manner. The only difference you will see is one of speed.

### 1.3 Related Manuals

This manual assumes that you are familiar with your PC computer. If you're not comfortable with the idea of opening your computer, removing and inserting boards, setting switches, and installing cables, you should seek the help of your dealer.

During the installation process, you may need to refer to the following IBM manuals:

- Guide to Operations
- Technical Reference
- Installation and Setup

## Chapter 2. Installation

Installing the PERFORMER-286 is easy. Here is an overview of the steps you will perform:

1. Remove the PC's cover.
2. Prepare the PC for PERFORMER installation.
3. Prepare the PERFORMER for installation.
4. Install the PERFORMER-286 board and connect its ribbon cable to the empty 8088 socket on the PC's system board.
5. Reinstall covers and test.

You will need the following tools to install the PERFORMER-286:

- Flat-blade screwdriver
- IC removal tool (supplied)

### 2.1 Removing the PC's Cover

The first step is to remove the cover from your computer to gain access to the expansion slots. To remove the cover, follow these steps:

1. Turn off the power to your computer and to all connected peripherals.
2. Disconnect all cables and cords from the back of the computer.



3. Place the computer on a clean work space, with the back of the computer facing you. Remove all unnecessary components, tools, papers, and clutter from this work space.
4. Use the flat-blade screwdriver to remove the cover mounting screws from the back of the computer, as shown in Figure 2-1. Put these screws in a small cup so they can be found during reassembly.

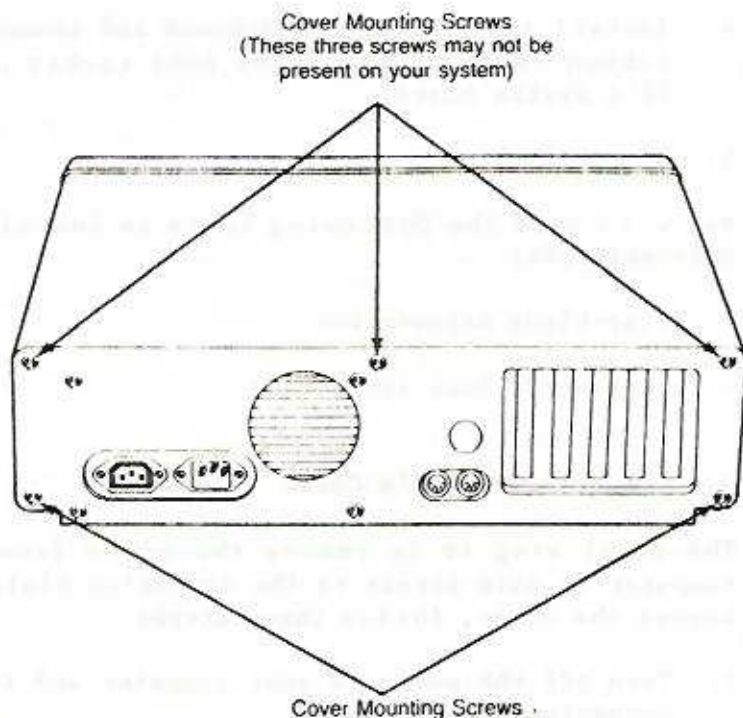


Figure 2-1: Removing the PC Cover Mounting Screws

5. Carefully remove the computer's cover by sliding it away from the rear and toward the front as shown in Figure 2-2. When it will go no further, tilt it up, remove it from the base, and set the cover in a safe place where it won't get scratched or dented.

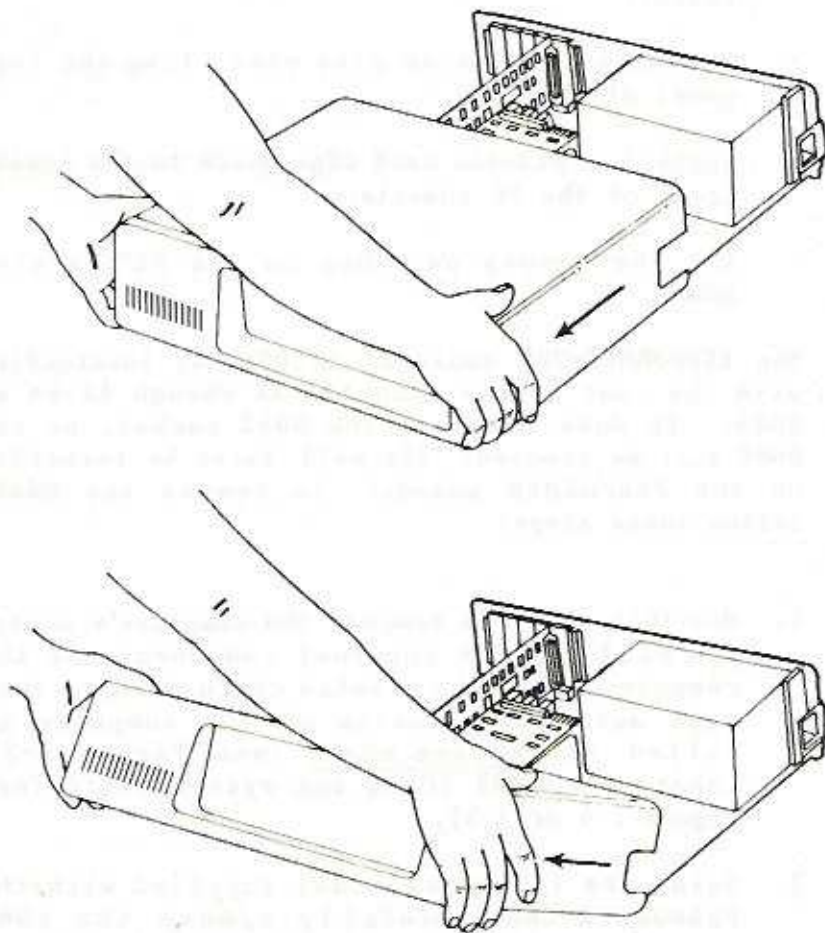


Figure 2-2: PC Cover Removal

## 2.2 Preparing the PC for PERFORMER Installation

This section explains how to prepare the PC for installation of the PERFORMER-286. To prepare the PC, you'll be doing the following steps:

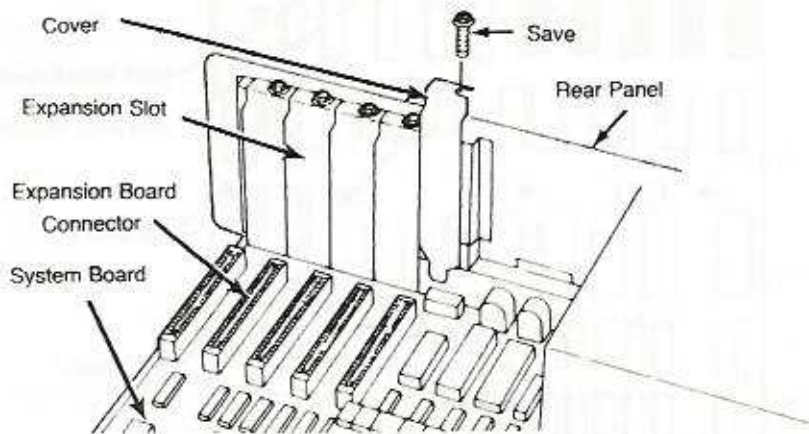
- Remove the 8088 processor from the system board.
- Remove an expansion slot cover from the rear panel of the PC.
- Install a plastic card edge guide to the inside front of the PC chassis.
- Set the memory switches on the PC's system board.

The PERFORMER-286 emulates an 8088 by interacting with the rest of the computer as though it is an 8088. It does this via the 8088 socket, so the 8088 must be removed. (It will later be installed on the PERFORMER board.) To remove the 8088, follow these steps:

1. Now that you have removed the computer's cover, you will see the internal components of the computer. The big printed circuit board that lays across the bottom of the computer is called the system board (see Figure 2-3). Locate the 8088 IC on the system board (see Figure 2-4 or 2-5).
2. Using the IC removal tool supplied with the PERFORMER-286, carefully remove the 8088 processor. To remove the IC, rock the IC back and forth with the extractor tool until it comes out of the socket. Be careful when



handling this large IC so as to avoid bending or breaking the pins. Carefully set the 8088 to one side--you'll be using it again in a moment.



**Figure 2-3: Inside the PC**

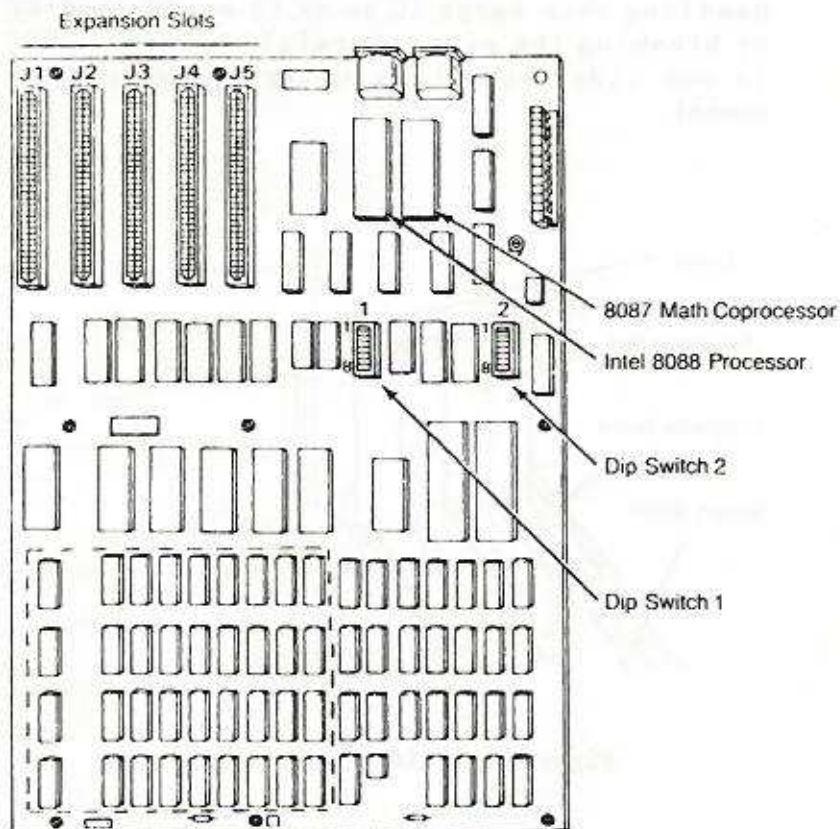
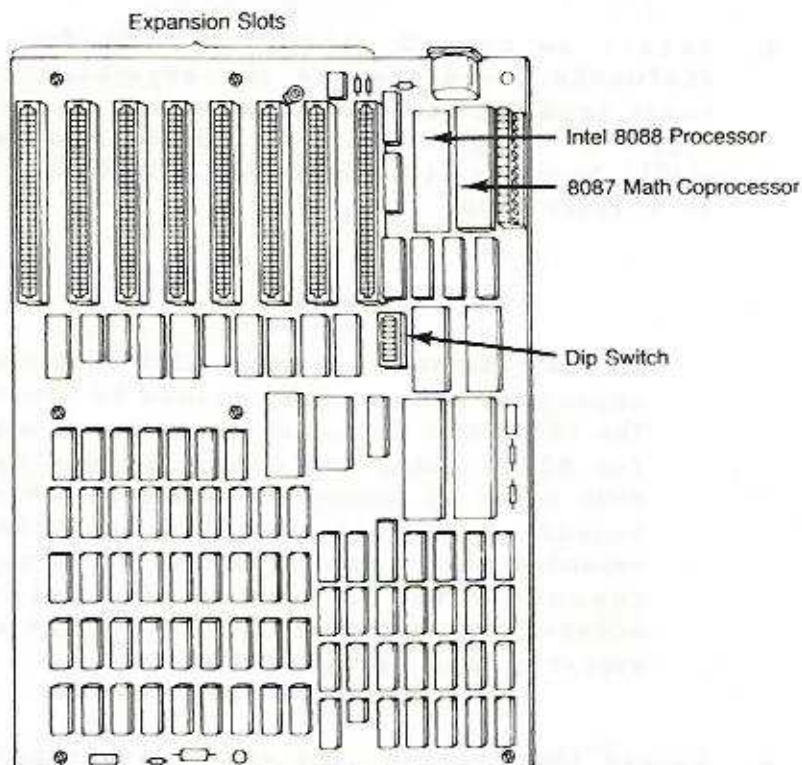


Figure 2-4: IBM PC System Board



**Figure 2-5: IBM PC XT System Board**

**Note:**

If your computer has an 8087 math coprocessor, you may leave it installed and use it in 8088 mode. However, if your PERFORMER-286 has the optional 80287 math coprocessor, the 8087 must be removed and its socket left empty.

3. Select an unused expansion slot for the PERFORMER board. Remove the expansion slot cover from the rear of the selected slot (see Figure 2-3). Save the cover's mounting screw--you'll be using it to mount the PERFORMER board in a later step.

**Note:**

If your computer has other 256K byte memory expansion boards, they should be removed. The PERFORMER uses only its on-board memory for 80286 mode, and also provides up to 640K bytes of memory in 8088 mode. Memory boards compatible with the Lotus-Intel expanded memory specification should not be removed--this memory will still be accessible when using software that also supports this specification.

4. Locate the plastic card edge guide supplied with the PERFORMER and install it on the back of the front of the chassis, so that the front edge of the PERFORMER card will slide into the guide when the board is installed in the selected expansion slot. The guide snaps into place.
5. Locate the two DIP switches on the PC's system board (see Figure 2-4). DIP switch 1 is the one closest to the expansion slots. DIP switch 2 is the one closest to the power supply box. (If you have an IBM PC XT, there is only one DIP switch, as shown in Figure 2-5.)

## 6. IBM PC only:

Set the switches of DIP switch 2 as shown in Figure 2-6. Set the switches for the amount of memory installed on the PERFORMER board--either 512K bytes or 640K bytes.

## IBM PC XT only:

Set the switches for 64K bytes of RAM, as shown in Figure 2-7. (The XT automatically determines the total memory available when it is turned on.)

### Important:

Do not change the settings of switches not shown in the figures.



(a) 512K Performer



(b) 640K Performer

**Figure 2-6: IBM PC Switch Settings**



**Figure 2-7: IBM PC XT Switch Settings**

The PC is now ready for installation of the PERFORMER-286 board.



### 2.3 Preparing the PERFORMER for Installation

To prepare the PERFORMER-286 for installation, follow these steps:

1. Lay the PERFORMER board on a flat surface with the mounting plate on the right.
2. Locate the 8088 socket (see Figure 1-1).
3. Install the 8088 IC (removed from the system board in a previous step) into the 8088 socket on the PERFORMER board. Be certain to locate pin 1 of the IC to pin 1 of the socket. (Note that the 8088 installs in the opposite direction of the other ICs on the board! Its pin 1 points to your right, while pin 1 of all other ICs point to your left.)

Use care when installing the 8088. Place it gently on top of the socket with all pins aligned with their mating receptacles. Gently but firmly press the 8088 into the socket, checking the pins as it seats to be sure none have bent.

4. Locate the jumper on the PERFORMER board (see Figure 1-1). If you are installing the PERFORMER in an ordinary IBM PC or compatible, leave this jumper installed. If you are installing the PERFORMER on an XT, remove this jumper.
5. Locate the ribbon cable supplied with the PERFORMER. Note that one end is a long, narrow plug, while the other end looks very similar to the 8088 IC you removed from the system board.

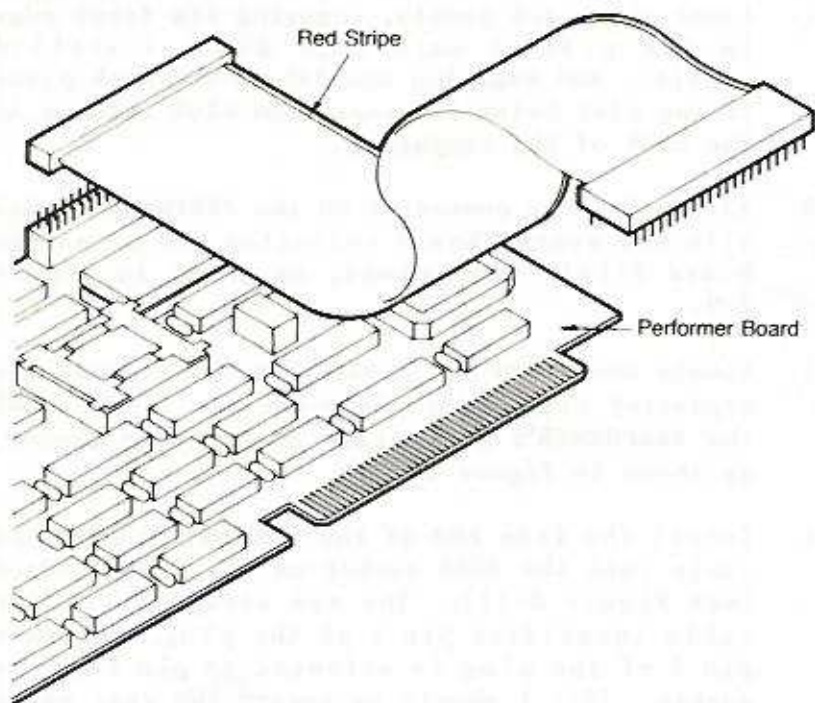
## 2.4 Installing the PERFORMER-286

Now you can install the PERFORMER-286 into the PC. Follow these steps:

1. Position the PERFORMER board over the selected expansion slot, with the end plate toward the back and the components pointing toward the power supply side of the computer.
2. Lower the board gently, engaging its front edge in the plastic card edge guide installed earlier, and engaging the tab on the back plate in the slot below the expansion slot opening in the back of the computer.
3. Align the edge connector on the PERFORMER board with the system board connector and press the board firmly into place, as shown in Figure 2-9.
4. Locate the screw you saved when you removed the expansion slot cover plate and use it to mount the PERFORMER's back plate in the same manner, as shown in Figure 2-10.
5. Insert the free end of the PERFORMER's ribbon cable into the 8088 socket on the system board (see Figure 2-11). The red stripe on ribbon cable identifies pin 1 of the plug. Be sure pin 1 of the plug is oriented to pin 1 of the socket. (Pin 1 should be toward the rear panel of the computer.) Be certain that all pins are aligned, then press the plug gently but firmly into place. Check the pins once again to be certain that none have bent.

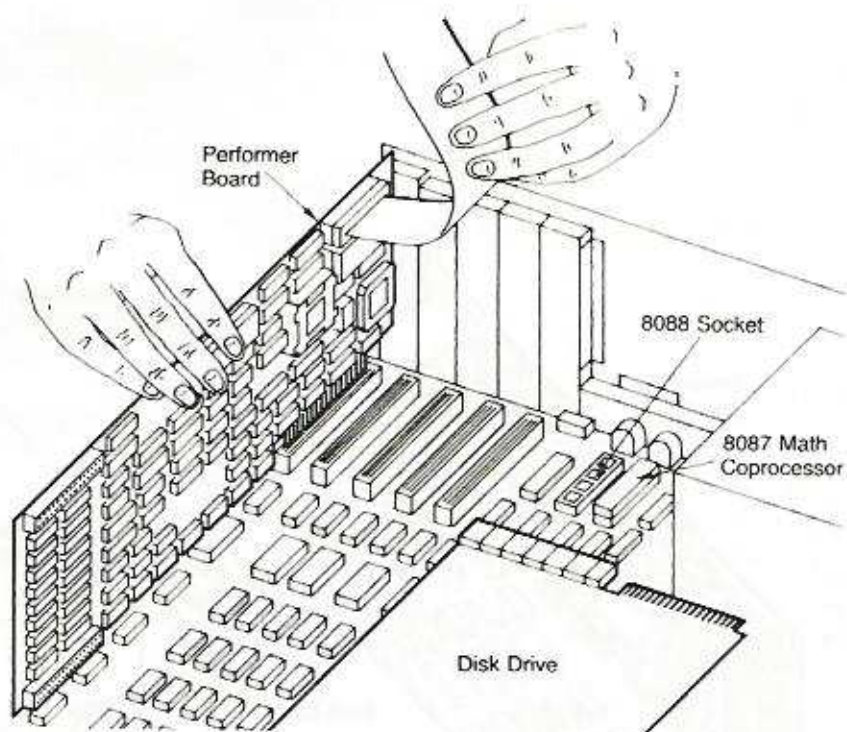


6. Connect the long, narrow connector of this ribbon cable to the row of pins at the top of the PERFORMER board (see Figure 2-8). Be sure that the plug is oriented so that the red stripe on the cable is at pin 1 of the connector (the red stripe should be toward the metal bracket on the board).

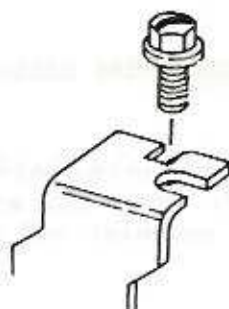


**Figure 2-8: Attaching Ribbon Cable to PERFORMER**

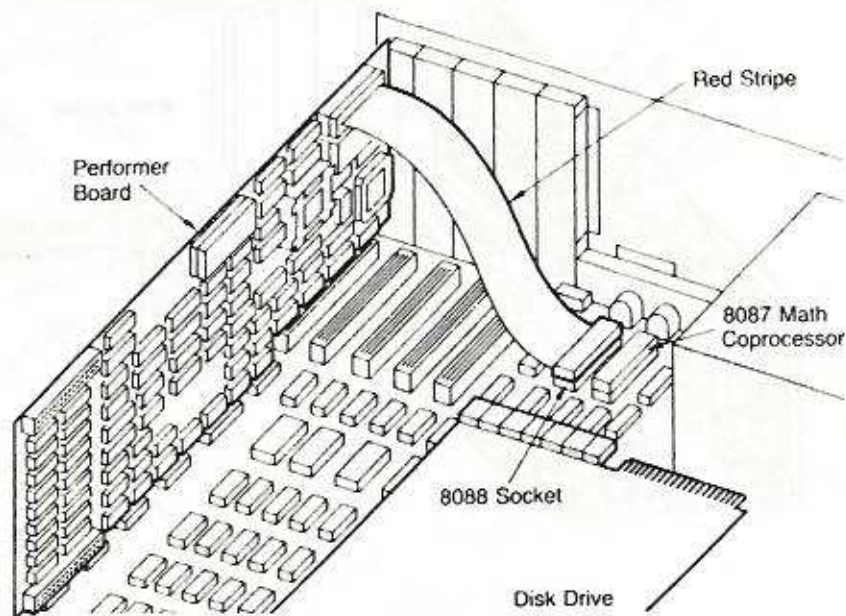
Your PERFORMER-286 board is now ready to install in the computer.



**Figure 2-9: Installing the PERFORMER-286**



**Figure 2-10: Mounting the PERFORMER Board**



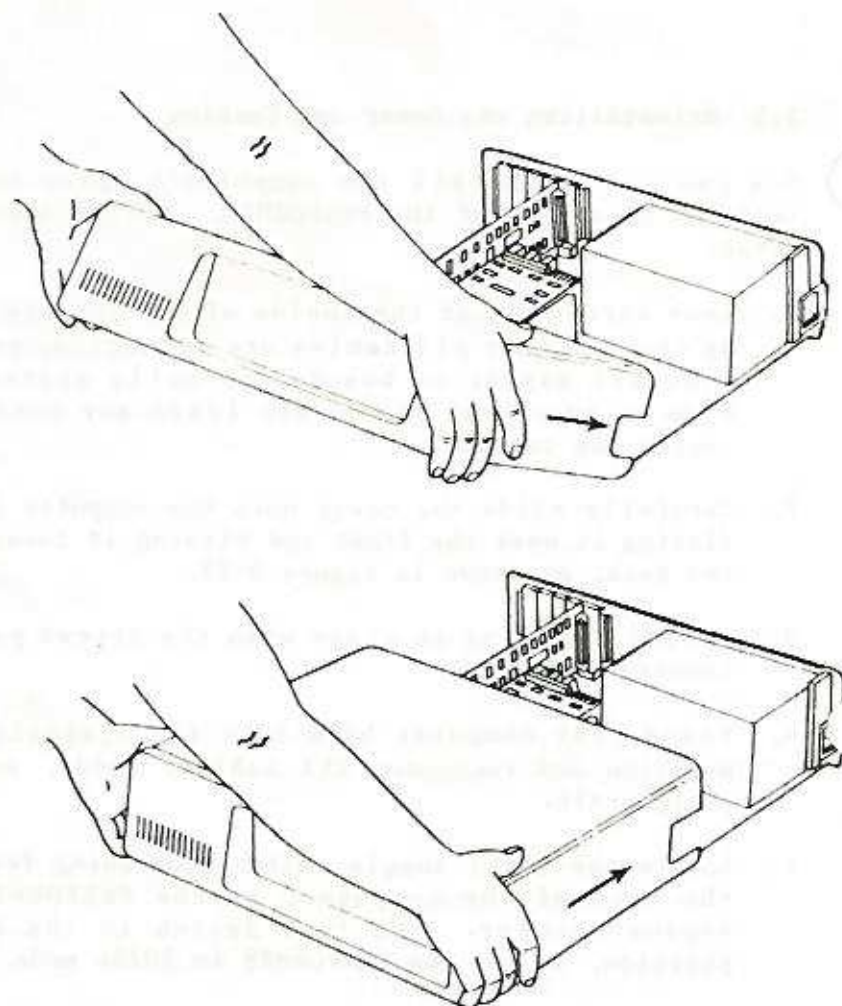
**Figure 2-11: PERFORMER-286 Ribbon Cable Connection**

This completes the installation of the PERFORMER into the computer. Now, you are ready to put the cover back on the computer and check operation.

## 2.5 Reinstalling the Cover and Testing

Now you must reinstall the computer's cover and test the operation of the PERFORMER. Follow these steps:

1. Look carefully at the inside of the computer. Be certain that all cables are connected, and that all expansion boards are fully seated. Also be sure that you do not leave any tools inside the computer.
2. Carefully slide the cover onto the computer by fitting it over the front and sliding it toward the back, as shown in Figure 2-12.
3. Secure the cover in place with the screws you removed earlier.
4. Place your computer back into its operating position and reconnect all cables, cords, and peripherals.
5. Locate the small toggle switch protruding from the back of the computer, at the PERFORMER expansion slot. Set this switch to the UP position, to put the PERFORMER in 80286 mode.
6. Turn on the computer and boot DOS as you normally would (either with a diskette in drive A: or from the hard disk).



**Figure 2-12: IBM PC Cover Replacement**

7. Use the DOS command CHKDSK to verify memory size. The memory size should be either 512K bytes or 640K bytes, depending on how much memory is installed on the PERFORMER.



Your computer is now ready to perform like an AT! You now can run all of your programs just as you normally would, but at five to seven times the normal PC speed.

**Note:**

If you have software (particularly games) that depends on the speed of the 8088 for proper operation, you can switch to 8088 mode by powering down the computer, setting the rear panel toggle switch to the DOWN position, and turning power back on. The 8088 will function with all of the PERFORMER's memory available to it (either 512K bytes or 640K bytes).





## Chapter 3. Options

This chapter explains how to install the optional memory module and the optional 80287 math coprocessor on the PERFORMER-286 board.

To install either of these options, the board must be removed from the computer; therefore, it's easiest to install them before you install the PERFORMER in the first place.

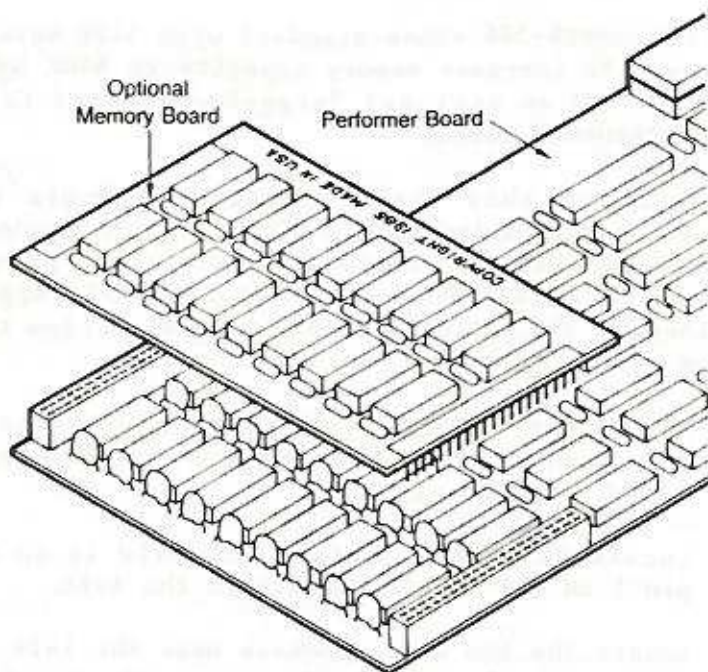
### 3.1 Memory Module Option

The PERFORMER-286 comes standard with 512K bytes of memory. To increase memory capacity to 640K bytes, you can add an optional "piggyback" board to the main PERFORMER board.

Each end of this board contains a 40-pin male connector that mates with a 40-pin female connector on the PERFORMER. These two connectors provide both electrical connection and physical support. To install the optional memory module, follow these steps.

1. Remove the PERFORMER-286 from the computer and lay it on a clean, flat surface with the toggle switch on your right.
2. Locate the memory module and hold it so that pin 1 on all its ICs points to the left.
3. Locate the two empty sockets near the left edge of the board, one at the top, and one at the bottom.

4. Place the memory module on top of these two sockets and carefully align its two plugs with the two sockets on the PERFORMER board. See Figure 3-1.
5. When you are certain that all pins are aligned, press the board into place.
6. Reinstall the PERFORMER-286 into the computer, then boot the computer and run the DOS utility CHKDSK to verify that 640K bytes of memory is installed.



**Figure 3-1: Memory Module Installation**

### 3.2 80287 Math Coprocessor

Installing the 80287 math coprocessor is simply a matter of inserting the IC into the socket provided on the PERFORMER board. Follow these steps:

1. Remove the PERFORMER-286 from the computer and lay it on a flat, clean surface with the toggle switch to your right.
2. If your computer already has an 8087 math coprocessor installed on its system board, remove it. It can no longer be used.
3. Locate the 80287 chip and hold it so that pin 1 corresponds to pin one on the PERFORMER board socket (pin 1 should be to your left).
4. Lay the 80287 on top of the socket and carefully check that all pins align with their mating receptacles on the socket.
5. Gently but firmly press the 80287 chip into the socket. Check once again that all pins have seated in their receptacles and none have bent.
6. Reinstall the PERFORMER-286 into the computer, and check for proper operation.

1. The first step is to check the system configuration.

2. The second step is to check the system configuration.

3. The third step is to check the system configuration.

4. The fourth step is to check the system configuration.

5. The fifth step is to check the system configuration.

6. The sixth step is to check the system configuration.

7. The seventh step is to check the system configuration.

8. The eighth step is to check the system configuration.

## Chapter 4. Technical Notes

The PERFORMER-286 uses a custom CMOS VLSI chip to interface the 80286 to the 8088 system. This custom chip converts 80286 signals to 8088 signals. To the 80286, the custom chip looks like a 16-bit memory or peripheral device operating at the 80286 clock speed. To the 8-bit circuitry, the custom chip looks like an ordinary 8088 processor operating at its own clock rate. The two clocks operate simultaneously. When the 80286 requests a 16-bit data transfer from an 8-bit peripheral, the hardware transparently converts the request into multiple 8-bit transfers.

Since the PERFORMER-286 has no on-board firmware, it does not introduce a compatibility issue. Virtually all software that runs on a standard IBM PC will run on the PERFORMER, and will run much faster. The only compatibility issue is the one introduced by this increased speed. If your software depends upon the 4MHz clock speed of the 8088 (for example, to display messages for a certain period of time) these events may occur so quickly that you will not have time to evaluate them.

### Specifications

PERFORMER-286 with 512K bytes of RAM

2.60 amps @ + 5 VDC

PERFORMER-286 with 640K bytes of RAM

2.80 amps @ + 5 VDC





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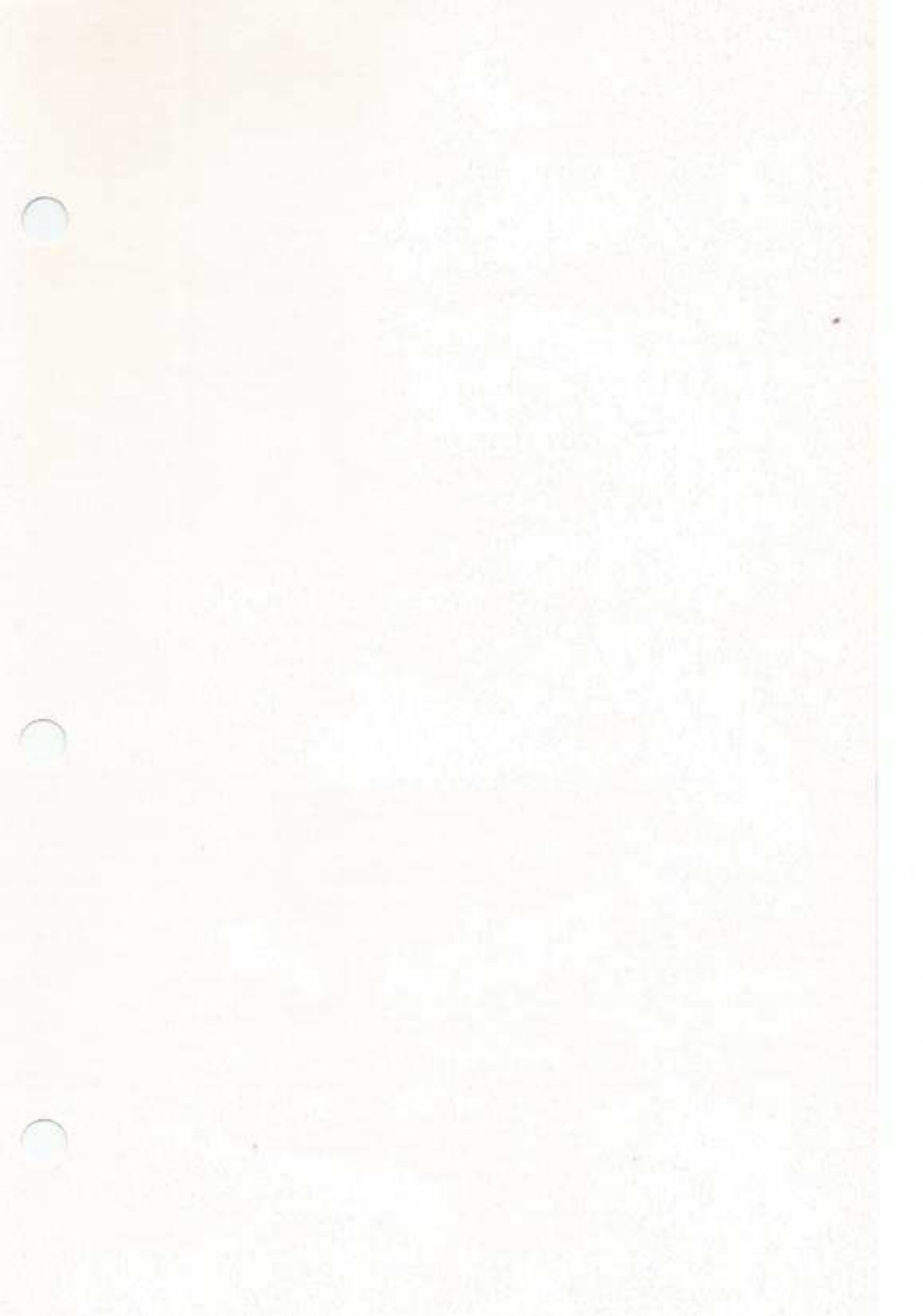
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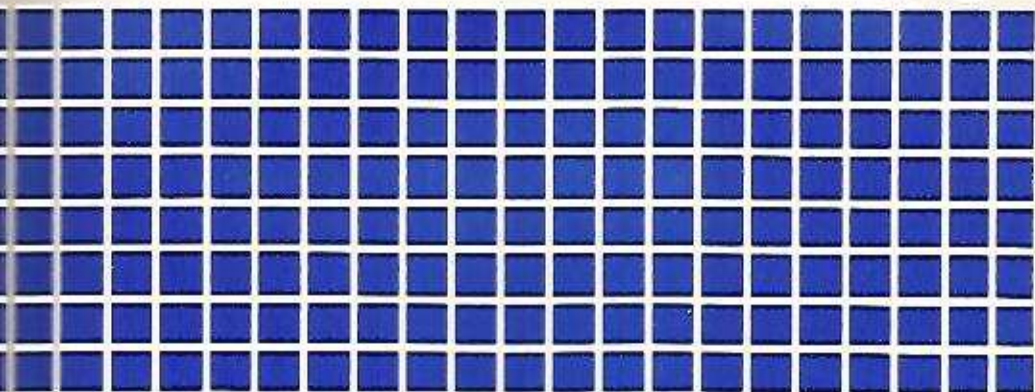
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