**Kingston Technology
KTM-PS64
Memory Expansion
for IBM PS/2 Model 70,
80, and 90 Computers**

KTM-PS64
Memory Expansion Board for IBM PS/2
Model 70, 80, and 90 Computers

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Welcome

Kingston Technology welcomes you to the growing family of IBM PS/2 users who have chosen Kingston Memory Expansion options for their computers. As application programs expand in size and complexity, the need for efficient and reliable memory expansion becomes critical. Our aim is to provide you with high quality memory expansion products that give maximum performance benefits at an affordable cost. We have engineered our memory products to be durable, reliable, and trouble-free; and we are confident that you will receive optimum performance from this Kingston product for many years to come.

The information in this manual will guide you through the process of placing the memory modules on the circuit board, installing the circuit board inside your computer, and configuring the necessary software to recognize the new memory. Please take a few moments to read through this manual now and familiarize yourself with the procedures you will need to follow when you install the Kingston board and software. This can save you a lot of anxiety later on.

We have tried to anticipate many of the problems that may arise during the installation, and most of your questions will be answered by reading this manual. However, if you encounter a situation that you can't resolve, or have any questions regarding the installation or use of the product, please call the Kingston Technical Support Center in Fountain Valley, CA. Our main goal is customer satisfaction.

1. General Description

The Kingston Technology KTM-PS64 Memory Expansion Board is capable of adding up to 64MB of Random Access Memory to IBM PS/2 Model 70, 80, and 90 personal computer systems. From one to four Single In-line Memory Modules (SIMMs) can be plugged into sockets on each KTM-PS64 board, and can be combined in a wide variety of memory configurations.   The KTM-PS64 board can be installed in any 16-bit expansion slot on the PS/2 system board.

The KTM-PS64 Memory Expansion Board (shown in Figure 1) supports both extended (linear) and expanded (paged) memory options, and also supports Lotus/Intel/Microsoft Expanded Memory Specification (LIM EMS) version 4.0 software to enable memory paging.   While EMS 4.0 remains compatible with applications written for EMS 3.2 and Enhanced Expanded Memory Specification (EMMS), you will get even greater performance benefits with applications written specifically for EMS 4.0, such as Microsoft Windows 2.0 and Quarterdeck Office Systems' DESQview.
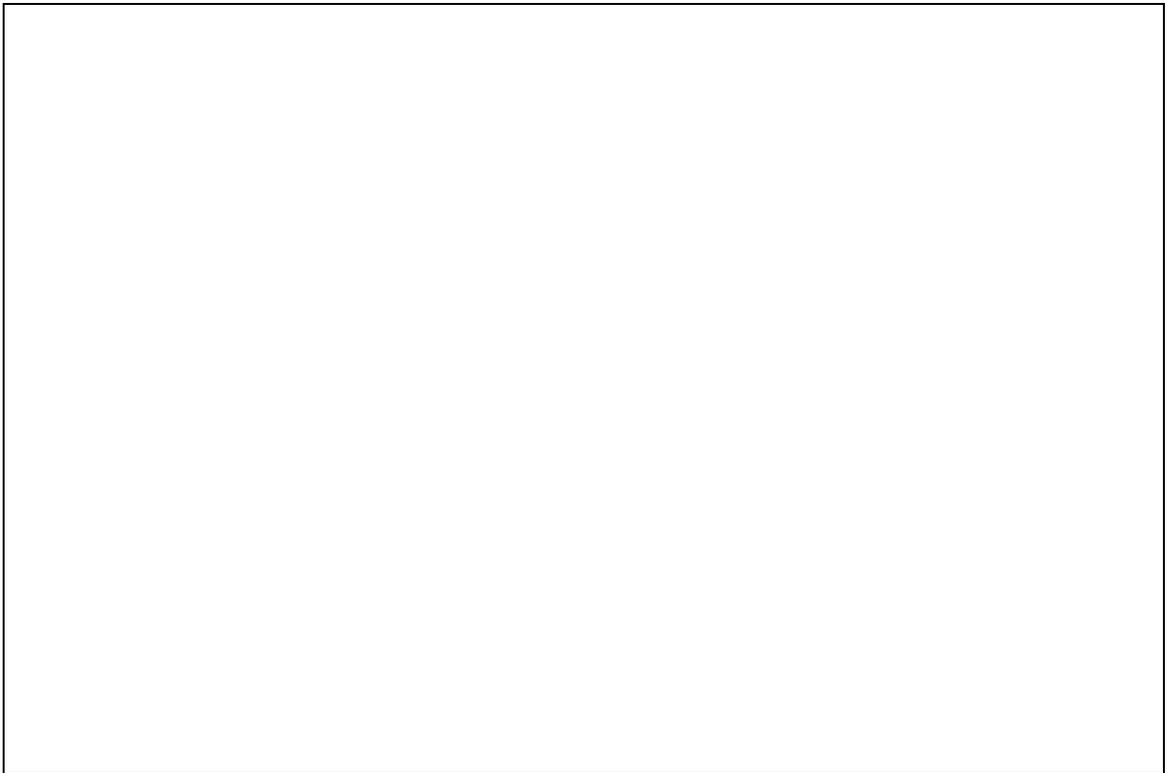
Figure 1: KTM-PS64 Memory Expansion Board

2. Package Contents

In addition to this manual, you should also receive the following items:

- One KTM-PS64 Memory Expansion Board

- One or more Single In-line Memory Modules (SIMMs)

- One Kingston Option Diskette

If any item is missing or damaged, contact the Kingston dealer or distributor from whom you purchased the upgrade.

Precautions

Kingston memory boards are shipped in an anti-static plastic bag, inside a cushioned box, which protects them from shock and static electricity that could cause severe damage to the memory chips.

Before you remove any memory component from its packaging, be sure you discharge any static electricity by touching a securely grounded metal object.

Also, keep magnetized tools, such as magnetic screwdrivers, away from the board and memory modules.

3. Before You Begin

Read through this manual before you begin installing the KTM-PS64 board, so you'll know what to expect as you go along. Although this is a relatively easy installation, you may feel more comfortable asking your local Kingston dealer or computer service center to do it for you. There will undoubtedly be a fee associated with doing this, but your peace of mind may be worth the cost.

Pay special attention to Appendix A, "Extended vs. Expanded Memory." If your computer uses DOS, you will have to decide how much of your added Kingston memory to allocate as extended (linear) memory, and how much to allocate as expanded (paged) memory. If your computer uses OS/2, all added memory should be allocated as extended since OS/2 can address all added memory directly.

Besides the contents of the KTM-PS64 memory upgrade package described earlier, you will also need to prepare a backup copy of your IBM PS/2 Reference Diskette. (Follow the instructions in the IBM PS/2 Quick Reference Manual to make the back up copy if you don't already have one.) And you will also need a flat-tip, non-magnetic screwdriver.

Allow plenty of time for the installation and configuration process. It should take you only an hour or two, but if you rush yourself, errors and set-backs are more likely to occur. We want this process to go smoothly for you, so have patience and use caution.

Installation Overview

Here is a quick look at the steps you will need to take to install the KTM-PS64 board and configure your PS/2 to use it.

❏   Check the contents of the KTM-PS64 package.   **(Section 2)**

❏   Create a configuration diskette.   **(Section 4)**

❏   Install SIMMs on the KTM-PS64 board.   **(Section 5)**

❏   Install the KTM-PS64 board in your PS/2.   **(Section 6)**

❏   Configure and allocate memory using the configuration diskette. **(Section 7)**

  ❏   If your operating system is OS/2, or if all new memory was allocated as **extended**, you're finished. STOP HERE.

  ❏   If all or part of new memory was allocated as **expanded**, install the Kingston EMS driver. (Section 8) Now you're finished. STOP HERE.

4. Creating the Configuration Diskette

Because you will have to reconfigure your computer system's memory configuration during the installation process, you need create a special configuration diskette for that purpose now. You will need:

-   The Kingston Option Diskette

-   The backup copy of your IBM Reference Diskette

NOTE: This portion of the installation requires the use of DOS. If you are running OS/2, opening a DOS window satisfies this requirement. If your hard disk has no operating system, or uses an operating system that cannot simulate DOS, you must create a bootable DOS diskette for this purpose.

The following steps show you how to copy the file from the Kingston Option Diskette onto the backup of the IBM Reference Diskette.

1. Boot the PS/2 (from the hard disk or boot diskette) and get to the DOS prompt.

2. Remove the boot diskette from drive A, if necessary, and insert the Kingston Option Diskette. At the prompt, type:

    A:

    and press [ENTER].

3. Start the INSTALL program by typing:

    INSTALL

    and press [ENTER]. You will see the following display on your terminal screen:

```
                    INSTALLATION Version 1.10
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    F1  Install Configuration Files onto Reference Disk

    F2  Install KEMM.SYS EMS Driver onto a Working Disk.

    F3  Change Existing EMS Driver Parameters.

    F4  Exit and Back to DOS

```

Press [F1] (Function Key F1) and follow the screen instructions to install the Kingston Configuration files from the Kingston Option Diskette onto your backup copy of the IBM Reference Diskette.

Now you have created a Configuration Diskette that contains both IBM and Kingston files.

4. Keep the Kingston Configuration Diskette you just created, in a safe place while you perform the next two steps: "Installing the SIMM Modules" and "Installing the KTM-PS64 Board in Your PS/2."

5. Installing the SIMM Modules

If the Single In-line Memory Modules (SIMMs) are already installed on the KTM-PS64 board when you receive the board, and you do not plan to add or remove any SIMMs, you can SKIP THIS SECTION, and go directly to Section 6, "Installing the KTM-PS64 Board in Your PS/2."

The KTM-PS64 board has four sockets labeled P1, P2, P3, and P4 into which you can plug from one to four SIMMs. The SIMMs are available in four different memory capacities:

              2MB   (KTM-2000/M70)
              4MB   (KTM-4000/M70)
              8MB   (KTM-8000/M70)
             16MB   (KTM-16000/M70)

The SIMMs can be installed in any of the four sockets, and in any order. Follow these steps:

1.   Install the first SIMM on your KTM-PS64 board. Notice that the SIMM plugs into the socket at an angle as shown in Figure 2.

Figure 2: Installing the SIMM Modules

2. Carefully push the SIMM into the socket until it is firmly seated. Then push the SIMM
    gently toward the memory board until the tabs shown in Figure 3 snap over each end of
   the module.

Figure 3: Latching the SIMM Modules in Place

3. If you have another SIMM to install, plug it onto the KTM-PS64 board. Use the same
    technique you used to install the first. Follow the same procedure for each SIMM you
    wish to install.

6. Installing the KTM-PS64 Board in Your PS/2

Now you're ready to install the KTM-PS64 Memory Expansion Board inside your PS/2 computer. Keeping in mind the precautions on static electricity and magnetized tools, turn off power to the computer and position it is a convenient, well-lit area. If this involves moving it very far from its normal location, you will need to unplug its various terminal and printer cables. Be sure to label them so you can easily reinstall them when you're done.

1. Unlock the computer.

2. Remove the cover from the unit. Refer to the IBM Quick Reference for detailed instructions, if necessary.

3. Choose any available 32-bit expansion slot and carefully insert the KTM-PS64 into the guide channels. Push the board down gently until it's firmly seated on the system board connector. (Make a note of which expansion slot you chose, you will need that information later.)

4. Replace the cover and tighten the screws that hold it in place. Make sure the cover is securely in place.

5. Lock the cover and remove the key.

6. Return the computer to its normal location, and reattach any cables you removed earlier.

7. Now you are ready for "Configuring the System."

7. Configuring the System

The most difficult part of this installation process is behind you now, and soon you'll be up and running. The end is in sight. But first you have to use the Kingston Configuration Diskette you created at the beginning of this procedure to reallocate the memory in your PS/2.

If your PS/2 runs under OS/2, you should allocate all the new Kingston memory as **extended** memory, since OS/2 can address all added memory directly, and does not require expanded memory.

If your PS/2 runs under DOS, you can allocate the new Kingston memory as either **extended** or **expanded** or a combination of both. Appendix A, "Extended vs. Expanded Memory" discusses the differences between the two types of memory allocation.

You may decide to change the allocations at any time, so keep the Kingston Configuration Diskette handy for future use. You'll also want to use the Configuration Diskette whenever you need to see a display of the system configuration.

1.   Insert the Configuration Diskette in drive A.

2.   Turn on the computer, the terminal, and any other attached devices. The computer will begin to boot, and you should see the size of base memory displayed on your screen.

3.   Next the number 165 appears on your screen to let you know the system has detected a device which hasn't been defined yet. After five or ten seconds, the IBM logo appears.

4.   Press [ENTER] to see the next screen.

5.   After a lengthy explanation of error 165, you will be asked if you want to run auto-configuration. Press [Y] for yes.

6.   When the "Set Configuration Menu" appears, select "Change Configuration" and press [ENTER].

7.   On the "Change Configuration Screen," move the cursor to the number of the slot in which you installed the KTM-PS64 board, and you will see:

```
Slot x - Kingston KTM-PS64 Memory Expansion Adapter
          Expanded Memory ---------------- [Disabled]
```

Now use the [F5] and [F6] Functions keys to specify the amount of memory you want to allocate as **expanded** (paged) memory. The remaining added memory, if any, is automatically allocated as **extended**.

NOTE: You can only specify expanded memory in increments of 1MB. **If you want all the added memory to be extended, "Disable" the expanded memory.**

8.   Press [F10] to save the configuration information in CMOS memory.

9.   Press [ENTER] to continue, and press [ESC] (Escape Key) to exit from the Set Configuration Screen.

10.   Press [ESC] again to return to the main menu.

11.   Remove the Configuration Diskette from drive A.

12.   You are ready to reboot with the newly configured memory, so insert your standard boot diskette in drive A, if necessary, and press [ENTER] to reboot the computer.

13.   Now as the system boots, you will see the total amount of base and **extended** memory displayed on the terminal screen.

NOTE: Because **expanded** (paged) memory requires special software to manage the paging, the amount of memory you allocated as expanded won't appear until you load the Kingston EMS driver program in the next section.

If your PS/2 uses the OS/2 operating system, or if you allocated all the new memory as **extended** in this section, the job is done. You can use your PS/2 as usual, with the added power and capacity of the Kingston Memory Expansion.

8. Installing the Kingston EMS Driver

You only need to perform the instructions in this section if you allocated some or all of the new memory as **expanded**.

The Kingston EMS driver you are about to install is the program that manages the paging of 16KB segments of memory into and out of the 64KB page frame located in reserved high memory.

1. Make sure your PS/2 is booted from your standard DOS diskette in drive A, or from the hard disk, drive C. Remove the boot diskette from drive A, if necessary, and insert the Kingston Option Diskette into drive A. At the DOS prompt, type:

    A:

    and press [ENTER].

2. To start the INSTALL program, type:

    INSTALL

    Now when you press [ENTER], the following screen appears:

    ```
                     INSTALLATION Version 1.0
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       F1  Install Configuration Files onto Reference Disk

       F2  Install KEMM.SYS EMS Driver onto a Working Disk.

       F3  Change Existing EMS Driver Parameters.

       F4  Exit and Back to DOS
    ```

3. Press [F2] (Function Key F2) to copy the EMS driver from the Kingston Option Diskette onto the boot disk.

4. When the next screen appears, press [F1] if your computer boots from a floppy diskette in
    drive A, or press [F2] if your computer boots from the internal hard disk, drive C. Then
    press [ENTER] to continue.

```
              INSTALLATION Version 1.0
    (C) Copyright 1990, Kingston Technology Corporation


   Install EMS Driver onto a New Drive and Configure


   F1  Drive A: if system is booted up from floppy diskette
   F2  Drive C: if system is booted up from hard disk

```

5. Next, the INSTALL program asks for the pathname of the subdirectory where you want to
    store the EMS driver. For example, to store the EMS driver under ABC on your hard disk,
    type:

    C:\ABC

    Press any key to continue.

```
              INSTALLATION Version 1.0
    (C) Copyright 1990, Kingston Technology Corporation


   Install EMS Driver onto a New Drive and Configure


   F1  Drive A: if system is booted up from floppy diskette
   F2  Drive C: if system is booted up from hard disk


             Path [C:\ABC        ]
```

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6. If your computer boots from a floppy diskette, remove the Kingston Option Diskette from drive A, and insert your standard DOS boot diskette. Press any key to continue.

```
                    INSTALLATION Version 1.0
         (C) Copyright 1990, Kingston Technology Corporation


          Install EMS Driver onto a New Drive and Configure


          Insert Kingston Option Diskette into Drive A:
                    Press Any Key to Continue

```

The INSTALL program now copies the EMS driver from the computer's memory onto the disk you specified as your boot device.

7. The next screen asks you to select the memory segment of Reserved High Memory where you want to place the paging area. We recommend that you choose the default selection, D000, by pressing [F4].

NOTE: The memory segment map requires 64KB of contiguous memory starting at location D000 (DEFAULT). This means that segments D000-DFFF cannot be occupied by any other adapters. Therefore, if any other adapters occupy any portion of this space, they must be relocated via the IBM Setup Program.

The KTM-PS64 memory segment map can also be relocated as described below.

```
                    INSTALLATION Version 1.0
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          Install EMS Driver onto a New Drive and Configure


          F1  A000  Only if MONOCHROME CARD is installed in your system
          F2  B000  Reserved
          F3  C000  Reserved
          F4  D000  Default Selection

```

8. Two additional choices now appear on your screen.

```
                    INSTALLATION Version 1.0
        (C) Copyright 1990, Kingston Technology Corporation


   Install EMS Driver onto a New Drive and Configure


   F1  A000  Only if MONOCHROME CARD is installed in your system
   F2  B000  Reserved
   F3  C000  Reserved
   F4  D000  Default Selection


   F1  YES if you would like to update the config.sys file
   F2  NO if you do not want to update the config.sys file
```

- If you want to proceed, press [F1] to update the CONFIG.SYS file.

- If you think you missed a step and need to do this procedure over again, press [F2] to bypass updating the CONFIG.SYS file.

9. Press any key to return to the Installation Menu screen, then press [F4] to return to the DOS prompt.

10. Now reboot the computer as usual. As the computer reboots, you will see displayed on the screen the total amount of memory minus any that you allocated as expanded memory. When the EMS driver initializes, it will display the amount of expanded memory.

Now that the Kingston EMS driver is properly installed, you are ready to begin using your PS/2 computer system to run programs and applications with the additional memory capacity of the Kingston KTM-PS64 Memory Expansion Board.

9. Changing Existing EMS Driver Parameters

Any time you want to change the location of the paging area in reserved high memory, you can rerun the INSTALL program.

1. Make sure your PS/2 is booted from your standard DOS diskette in drive A, or from the hard disk, drive C. Remove the boot diskette from drive A, if necessary, and insert the Kingston Option Diskette into drive A, and at the DOS prompt, type:

    A:

    and press [ENTER].

2. To start the INSTALL program, type:

    INSTALL

    Now when you press [ENTER], the following screen appears:

```
                    INSTALLATION Version 1.0
       (C) Copyright 1990, Kingston Technology Corporation

       F1  Install Configuration Files onto Reference Disk

       F2  Install KEMM.SYS EMS Driver onto a Working Disk.

       F3  Change Existing EMS Driver Parameters.

       F4  Exit and Back to DOS
```

3. Press [F3] (Function Key F3) to change the existing EMS driver parameters.

4. The next screen asks you to select the memory segment of Reserved High Memory where you want to place the paging area. Press the function key that corresponds to the starting address where you want the paging area to be located.

```
                    INSTALLATION Version 1.0
         (C) Copyright 1990, Kingston Technology Corporation


          Install EMS Driver onto a New Drive and Configure


          F1  A000  Only if MONOCHROME CARD is installed in your system
          F2  B000  Reserved
          F3  C000  Reserved
          F4  D000  Default Selection
```

5. Two additional choices now appear on your screen.

```
                    INSTALLATION Version 1.0
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          Install EMS Driver onto a New Drive and Configure


          F1  A000  Only if MONOCHROME CARD is installed in your system
          F2  B000  Reserved
          F3  C000  Reserved
          F4  D000  Default Selection


          F1  YES if you would like to update the config.sys file
          F2  NO if you do not want to update the config.sys file
```

- If you want to proceed, press [F1] to update the CONFIG.SYS file.

- If you think you missed a step and need to do this procedure over again, press [F2] to bypass updating the CONFIG.SYS file.

6. Press any key to return to the Installation Menu screen, then press [F4] to return to the DOS prompt.

7. Now reboot the computer as usual. If the paging area has been successfully relocated, there will be no visible indication. Your system should operate as usual.

10. Changing the System Configuration

Normally, you should never have to change memory allocation on your PS/2, but if a situation does arise (such as the addition or removal of hardware devices or software applications), you may wish to redistribute the amount of memory you have allocated as either extended (linear) or expanded (paged).

Remember, if your PS/2 runs under OS/2, all system memory should be allocated as **extended** memory, since OS/2 can address all added memory directly.

If your PS/2 runs under DOS, you can allocate the new Kingston memory as either **extended** or **expanded** or any combination of the two. You may want to review Appendix A, "Extended vs. Expanded Memory," which discusses the differences between the two types of memory allocation.

Adding or Removing SIMMs

1. Insert the Kingston Configuration Diskette in drive A.

2. Reboot the computer. The number 164 appears on your screen during boot-up. (The number 164 indicates a memory size mismatch in the system.) After 5 to 10 seconds, the IBM logo appears.

3. Press [ENTER] to see the next screen.

4. Press [Y] for yes to automatically configure the system.

5. When the "Set Configuration Menu" appears, select Change Configuration, and press [ENTER].

6. On the Change Configuration Screen, move the cursor to the number of the slot where the KTM-PS64 board is located, and use the [F5] and [F6] functions keys to specify the amount of memory you want to allocate as **expanded** (paged) memory. The remaining memory, if any, is automatically allocated as **extended**.

7. Press [F10] to save the configuration information in CMOS memory.

8. Press [ENTER] to continue, and press [ESC] (Escape Key) to exit from the Set Configuration Screen.

9.   Press [ESC] again to return to your system prompt.

10. Remove the Configuration Diskette from drive A.

11. You are ready to reboot with the newly configured memory, with boot disk in drive C or A.

12. As the system boots, you will see the total amount of memory minus the amount allocated as expanded displayed on the screen. When the EMS driver initializes, it will display the amount of memory allocated as expanded memory.

Changing the Amount of Expanded Memory

1.   Insert the Kingston Configuration Diskette in drive A.

2.   Reboot the computer.

     NOTE: No error occurs during boot-up, and therefore, auto-configure is not asked for.

3.   When the "Set Configuration Menu" appears, select Change Configuration, and press [ENTER].

4.   On the Change Configuration Screen, move the cursor to the number of the slot where the KTM-PS64 board is located, and use the [F5] and [F6] functions keys to specify the amount of memory you want to allocate as **expanded** (paged) memory. The remaining memory, if any, is automatically allocated as extended.

5.   Press [F10] to save the configuration information in CMOS memory.

6.   Press [ENTER] to continue, and press [ESC] to exit from the Set Configuration Screen.

7.   Press [ESC] again to return to your system prompt.

8.   Remove the Configuration Diskette from drive A.

9.   You are ready to reboot with the newly configured memory, with boot disk in drive C or A.

10. Now as the system boots, you will see the total amount of memory minus the amount allocated as expanded displayed on the screen. When the EMS driver initializes, it will display the amount of memory allocated as expanded memory.

Appendix A - Extended vs. Expanded Memory

There are two ways you can define the newly added memory in your PS/2 computer system. You can define it as extended memory or expanded memory, or as a combination of the two. To understand the difference between the two ways you can configure memory, we need to take a step back in time.

Some History

When the PC was first designed, everyone thought that 640KB would be more memory than anyone could possibly use for their programs and data. The IBM PC originally contained an 8088 microprocessor which could address 1MB of memory, and the DOS operating system was designed to recognize only that much memory. Of the 1MB available, 640KB was devoted to running application programs. This portion of memory is also referred to as **conventional** or **base** memory.

The remaining 384KB of addressable memory, between 640KB and 1MB, is referred to as **reserved high memory**. This area of memory was devoted to video RAM, ROM BIOS (the Read Only Memory Basic Input/Output System), and other system and peripheral functions.

The next stage in the evolution of the PC was the PC AT which contains an 80286 microprocessor capable of addressing 16MB of memory. Current IBM PS/2 Model 50 and Model 60 computers also use this processor.   However, DOS retained its 1MB addressing limitations so it would still be compatible with the older systems.

Extended (Linear) Memory

The original 640KB of memory was still available for use by DOS-compatible application programs, while the memory above 1MB (the extended memory) could be used by the processor for print spoolers and RAM disks.

Because the memory addresses continue sequentially from beginning to end, this memory is known as linear memory. Both conventional and extended memory are classified as linear memory.

Expanded (Paged) Memory

The development of the Expanded Memory System (EMS) was a software solution to the memory limitations of DOS. EMS uses a 64KB area of reserved high memory (the area between 640KB and 1MB that DOS is able to get to), and copies four 16KB "pages" of data back and forth as needed from the higher areas of memory that DOS cannot get to. The EMS acts as a messenger to locate and retrieve the segments of memory DOS requests and place them within its reach.

EMS software allows you to allocate up to 32MB of memory as expanded memory since it is not restricted by the 1MB limit of DOS or the 16MB limit of the processor.
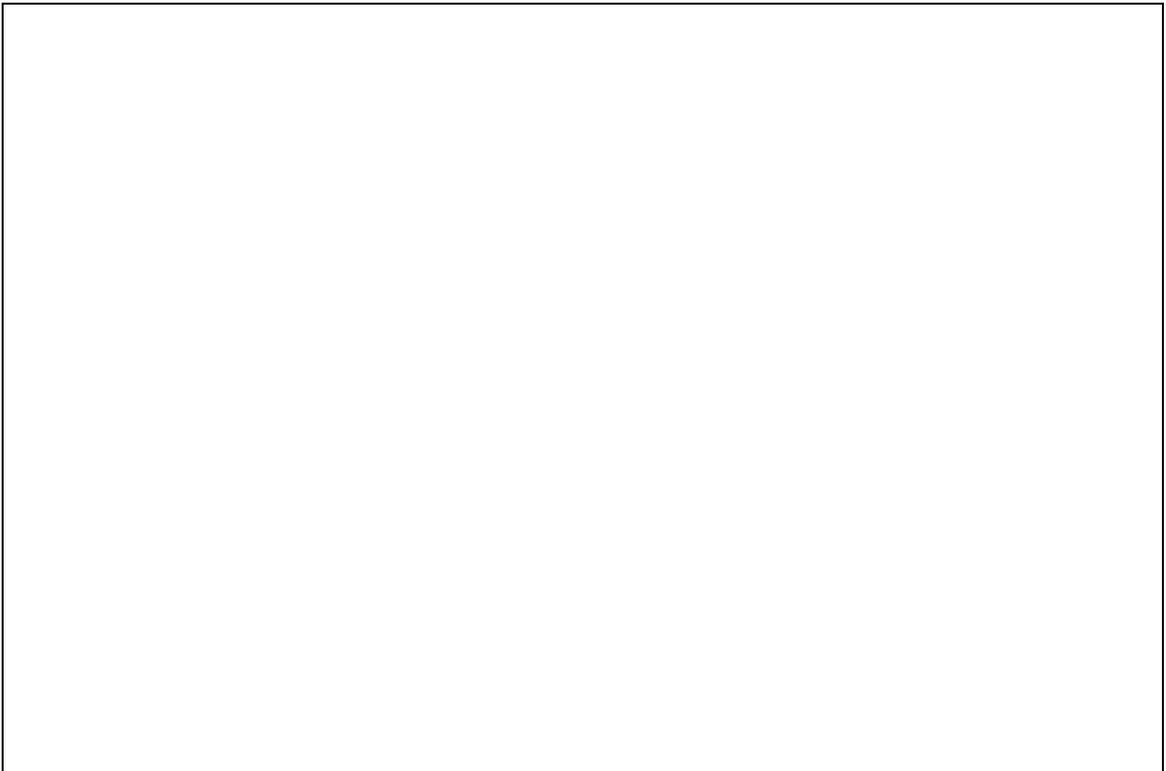
Figure 4: Extended and Expanded Memory Configuration

Appendix B - Modifying CONFIG.SYS

Caution: In very rare and special situations, the configuration of your PS/2 computer system may require that you modify the CONFIG.SYS file directly. Please do not attempt to update this file unless you're extremely confident of modifying this file.

Installing the Driver

Before attempting to install the device driver, make sure that the computer has expansion memory installed, and that the additional memory is allocated as **expanded** memory. In addition, verify the following:

- Total amount of system memory (check when booting the system).

- That the system is not currently using any other EMS drivers. (You must remove these device drivers before attempting to install the Kingston EMM driver.)

- That a standard installation and setup procedure has been carried out before installing the Kingston EMM driver (Section 6 and 7).

- The Kingston EMM driver must be loaded as part of the boot sequence when the computer is turned on or restarted. Installation of the device driver is accomplished by placing a command in the computer's CONFIG.SYS file, which is the file the computer's operating system reads when the system is turned on or restarted. The CONFIG.SYS file must be in the root directory of the diskette or hard disk drive from which the computer boots.

Use your favorite text editor to modify CONFIG.SYS. The CONFIG.SYS file should contain the following command line:

```
device = d:[path]\KTCEMM.SYS [options]
```

where d: and [path] represent the drive and path where the driver is located, and [options] represents those parameters described in the "Command Line Options" section later in this appendix. If you leave the options out of the command line, default values are used.

Testing the Kingston EMM Driver

Restart the computer to activate the Kingston EMM driver. When the driver is active, the
following message appears:

>   **Kingston Expanded Memory Manager Version 1.00**
>
>   **Kingston EMS Add-in Board Installed**
>   **1 Alternate Register Set(s) Found**
>   **256 EMS Pages Found (4096KB)**
>   **Total Memory Available for EMM Use = 4096KB**

If an error message appears, refer to Appendix C, "Troubleshooting."

Using EMS 4.0

Environments such as Windows and DESQview detect the presence of the Kingston EMM driver
when the computer is turned on. These environments use the driver and the computer's
expanded memory automatically, so that other than noticing an improvement in performance, you
will not be aware of how the memory is being used. You can check the amount of system
memory by looking at the screen when you turn on the computer.

Command Line Options

Optional command line parameters are provided for customizing the Kingston EMM driver for
different environments. Options must be separated by one or more spaces. Spaces are optional
before and after the '-' and '=' symbols.

The options are as follows:

HANDLES = hhh
Specifies the number of handles and names available. Handles are the values the memory
manager assigns to identify a block of memory requested by an application program. Each
application that uses extended or expanded memory requires at least one handle. Some need
more than one, and they let you know if they run out of handles. The parameter hhh must be in
the range 16 to 255. Note than each handle/name increases the amount of memory required and
decreases the amount available to the application program. The default (64) should be adequate
for most purposes.

EXCLUDE = xxxx [-cccc]
Specifies an area of memory that should not be under the control of the driver. The parameters xxxx and cccc specify the range of memory to be excluded. The xxxx parameter should be a multiple of 16KB (that is, end in 00). For example if a network card had memory at address CC00, then EXCLUDE = CC00-CFFF should be used. Note that the driver checks for the presence of ROM/RAM in the range A000-FFFF, so there is not usually any need to use EXCLUDE. The area F000-FFFF is always occupied by system ROM.

INCLUDE = xxxx [-cccc]
Specifies the memory to be included under the control of the driver. Parameters are similar to the EXCLUDE option above. For example, if an EGA video adapter is installed in the computer, the monochrome graphics section of memory might not be used. So INCLUDE B000-B7FF could be used to allow the driver to make use of this area of memory.

> **NOTE:**   If you are editing the command line yourself, the EXCLUDE and INCLUDE options may be used several times to exclude or include several areas of memory, though at least 64KB of memory above 640KB (A000) should remain. The facility is not available using the setup program. If you specify the same area of memory in an EXCLUDE and an INCLUDE statement, the command line order determines which statement will take effect.

FRAME = aaaa
Specifies the page frame address (i.e., the address of the 64KB segment through which the expanded memory is mapped). The parameter **aaaa** must be one of the following values: C000, C400, C800, CC00, D000, D400, D800, DC00, or E000. Specifying FRAME overrides the automatic choice of page frame, which is based on your hardware configuration. We recommend that you do not change it.

IOADDR = aaaa
Overrides the default base I/O address at which the EMS hardware should be configured. The parameter **aaaa** must be one of the following values: 0208, 0218, 0258, 0268, 02A8, 02B8, or 02E8. The default is 0208 (hex). You should not change this unless you are sure that you have a conflict with another card.

SCAVENGE = xxxx [-cccc]
Specifies an area of system shadow RAM in the range A000-FFFF to be used for EMS memory. Normally, the shadow RAM is used to overlay system ROM regions, for the purpose of speeding up code execution from those areas. Not all of the shadow RAM is used, however. The areas that are not used may be scavenged for use as EMS memory with the SCAVENGE option. In most cases, SCAVENGE = A000-FFFF is sufficient; however, some systems may experience

problems. In cases where problems are encountered, specific areas such as video adapters may have to be avoided (SCAVENGE = C800-FFFF).

Appendix C - Troubleshooting

Once installed, Kingston Memory Expansion Boards are virtually trouble-free. You never need to give them a second thought. However, during the installation and configuration process, you may encounter situations that will test your diagnostic skills as well as your patience.

Error Messages
This section contains explanations of messages that may appear as a result of changes you made while using the INSTALL program, or as the result of changes you made directly to your CONFIG.SYS file. As a general rule, you should reboot the computer with the configuration diskette, fix the problem, and then reboot the computer from its standard diskette or hard drive.

In the event you see one of the hardware-related messages, you need to review the procedure you used to install the memory modules on the circuit board and the procedure you used to install the circuit board into the computer chassis.

An equal sign (=) was expected.

This message indicates you left out a required equal sign from one of the command options in the CONFIG.SYS file. Review the changes you made to CONFIG.SYS and correct the error.

Cannot detect mapping hardware.

This message indicates a possible hardware problem. Review the steps you took to install the SIMMs on the Kingston Memory Expansion Board (see Section 5), and the steps you took to install the memory board in the computer (see Section 6). Make sure the SIMMs are installed in the correct sequence on the memory board, and that all the SIMMs and memory boards are seated firmly in their sockets.   Reboot from your standard DOS diskette or hard drive.

The command line is incomplete.

You modified the CONFIG.SYS file, but something is missing from one of the command options. Check each option you added or changed, and make sure each has the appropriate argument.

Decimal number overflow error.

Only the HANDLES option accepts a decimal argument; the other options require hexadecimal arguments. Check the CONFIG.SYS file to make sure you have specified arguments for each option in the appropriate notation.

FATAL ERROR - Memory manager not installed.

You have specified all or part of the new memory to be used as expanded (paged) memory, but you have not installed either the Kingston EMS driver with the INSTALL program, or the Kingston EMM driver by modifying the CONFIG.SYS file directly. Reboot your computer using the configuration diskette, and use either the INSTALL program (see Section 8), or modify the CONFIG.SYS file (see Appendix B). When the appropriate driver for your expanded memory is in place, you can reboot from your standard DOS diskette or hard drive.

Faulty or missing memory detected.

This message indicates a possible hardware problem. Review the steps you took to install the SIMMs on the Kingston Memory Expansion Board (see Section 5), and the steps you took to install the memory board in the computer (see Section 6). Make sure the SIMMs are installed in the correct sequence on the memory board, and that all the SIMMs and memory boards are seated firmly in their sockets.   Reboot from your standard DOS diskette or hard drive.

Hardware does not support EMS version 4.

This message indicates a possible hardware problem. Review the steps you took to install the SIMMs on the Kingston Memory Expansion Board (see Section 5), and the steps you took to install the memory board in the computer (see Section 6). Make sure the SIMMs are installed in the correct sequence on the memory board, and that all the SIMMs and memory boards are seated firmly in their sockets.   Reboot from your standard DOS diskette or hard drive.

Interrupt 67 vector already allocated.

You modified the CONFIG.SYS file to include the Kingston EMM driver. Now, the Kingston EMM driver is trying to use an interrupt vector already being used by some other driver. Check the CONFIG.SYS file to make sure no other EMS drivers are being used. If you find another driver in CONFIG.SYS, remove it, and reboot from your standard DOS diskette or hard drive.

Invalid hex number or number not divisible by 16.

The EXCLUDE, INCLUDE, and FRAME options in CONFIG.SYS require hexadecimal arguments. Reboot your computer with the configuration diskette, and check CONFIG.SYS to make sure these options, if present, have hexadecimal arguments. The allowable values are described in Appendix B, "Modifying CONFIG.SYS." You may also see this message if the end address is less than the start address in an EXCLUDE or INCLUDE option.

Invalid page frame address.

The page frame address in the FRAME option in the CONFIG.SYS file must be one of the following values:

C000, C400, C800, CC00, D000, D400, D800, DC00, or E000

Check your CONFIG.SYS file and make sure it contains a valid FRAME address. (We recommend that you do not use the FRAME option. Delete the FRAME option, and let the Kingston EMM driver automatically set the page frame address for you.)

I/O address specified is not one of the permitted values.

The I/O address in the IOADDR option of your CONFIG.SYS file must be one of the following values:

0208, 0218, 0258, 0268, 02A8, 02B8, or 02E8

If you omit the IOADDR option, the Kingston EMM driver uses the default address value of 0208. You only need to specify this option if you are sure there is an address conflict with another circuit board.

No working memory can be found. EMM aborted.
Initialization Error. Memory Manager NOT Installed.

This message indicates that no expanded memory is available. The likely cause is that none has been allocated. (See Section 7.)

Number of handles is invalid or out of range.

The number of handles specified in your CONFIG.SYS file must be a decimal number in the range 16 to 255. (If you did not specify the HANDLES option, the default value is 64.) Reboot your computer with the configuration diskette, and check the CONFIG.SYS to make sure you specified a valid number of handles.

Unrecognized option/command in invocation line.

There is a typographical error in one of the options you added or changed in the CONFIG.SYS file. Check the option formats in Appendix B, "Modifying CONFIG.SYS" to make sure your CONFIG.SYS file is correct.

WARNING: Problems encountered in setting default page frame address.

This message indicates a possible hardware problem. Review the steps you took to install the SIMMs on the Kingston Memory Expansion Board (see Section 5), and the steps you took to install the memory board in the computer (see Section 6). Make sure the SIMMs are installed in the correct sequence on the memory board, and that all the SIMMs and memory boards are seated firmly in their sockets.   Reboot from your standard DOS diskette or hard drive.

Appendix D - Working With Quarterdeck's QEMM 50/60 Memory Manager

In order to use the Quarterdeck QEMM 50/60 Expanded Memory Manager, you must have QEMM version 6.0 with KTM-PS64 Plus revision C or later.

NOTE: When using QEMM 50/60, you must configure the KTM-PS64 memory as **extended** memory. Refer to Section 7 of the this manual for details.

Order Information

Kingston P/N	IBM P/N	Description
KTM-2000/M70	6450604	2MB SIMM
KTM-4000/M70	34F2933	4MB SIMM
KTM-8000/M70		8MB SIMM
KTM16000/M70		16MB SIMM
KTM-PS64-2	6450609	2-14MB Memory Board
KTM-PS64-4	6450609	4-16MB Memory Board