
RAM 3000 Deluxe™
(AT Memory
Expansion Board)

OWNER'S MANUAL AND REFERENCE GUIDE
EV-159
(VERSION 2.1)

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Notes

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Checklist

The **RAM 3000 Deluxe** carton should include the following items:

- RAM 3000 Deluxe AT memory expansion board in an anti-static bag
- RAM 3000 Deluxe utility software diskette with the following files:

EV159.EXE configuration and diagnostics program

EMMSYS EMS software device driver

EDISK.SYS RAM disk software device driver

ESPOOL.EXE print spooler

README text file

FILELIST text file

- Owner Registration and Warranty Card
- Foam padding and packaging materials

If any of the above items are missing, consult your place of purchase.

Optional Items:

- 256-Kilobit DRAM memory chips (150 nanosecond access time or faster)

NOTE 1: Please save all the packaging materials that accompany the RAM 3000 Deluxe board; if you need to return the board to Everex Systems for any reason without proper packaging, the warranty may be affected. As with any major purchase, please keep the sales invoice.

NOTE 2: Circuit boards are easily damaged by static electricity! You can pick up a static charge in dry weather or walking on carpeted floors. To prevent static electricity damage to the RAM 3000 Deluxe board, touch the system chassis before handling the board, and handle the board by the edges only. Also, move as little as possible when you work on your computer to avoid static charge buildup.

NOTE 3: There are two text files named **README** and **FILELIST** on the RAM 3000 Deluxe software diskette. These files contain the list of files on the RAM 3000 Deluxe software diskette (**FILELIST**) and additional information regarding the RAM 3000 Deluxe (**README**). To read these files, insert the RAM 3000 Deluxe utility diskette into drive A and use the **DOS TYPE** command to read the files. For example, to read the **README** file, type the line:

TYPE A:README [Enter]

Section 1: How to Use This Manual

Checklist contains a list of items that should be inside the RAM 3000 Deluxe carton. Please make sure all listed items are included.

Section 2: Introduction describes the features of the RAM 3000 Deluxe, a detailed illustration, and an installation summary for experienced users.

Section 3: Configuration contains a list of RAM 3000 Deluxe default switch and jumper settings in Section 3.1. This section also tells you how to change the default settings by using the **EV159.EXE** program as described in Section 3.2 or by using the configuration tables in Section 3.3.

Section 4: Physical Installation provides information on installing the RAM 3000 Deluxe board into your system; it also explains how to test the board and how to run the **SETUP** program to inform your computer of the RAM 3000 Deluxe's memory expansion.

Section 5: RAM 3000 Deluxe Software describes how to install the **EMMS.SYS**, **EDISK.SYS** and **ESPOOLE.EXE** software programs on the RAM 3000 Deluxe software diskette.

Section 6: Troubleshooting gives answers to questions regarding possible problems that can occur when using the RAM 3000 Deluxe. It also provides information on how to get assistance.

Appendix 1: *Memory Basics* explains how memory works on an AT (first-time users should read this appendix).

Appendix 2: *Dipswitch Setting Table* provides tables on how to set the amount of contiguous memory defined on the RAM 3000 Deluxe (SW2 dipswitch), and the RAM 3000 Deluxe's memory starting address (SW3 dipswitch).

Appendix 3: *EMS Technical Reference* contains information on how EMS mode works (this appendix is for users who wish to write EMS-compatible software).

Appendix 4: *Regarding The AST PCnet II* provides information to ensure proper operation when an AST PCnet II network adapter board and the RAM 3000 Deluxe (if configured for EMS mode) are simultaneously installed in your AT or AT compatible.

Appendix 5: *If System Boot Fails* tells you how to remedy a possible problem if the RAM 3000 Deluxe is set for base memory upgrading.

Appendix 6: *For Extended-Memory Users* shows how to configure and test the RAM 3000 Deluxe if you plan to use this board with an extended-memory operating system.

Section 2: Introduction

2.1 Features

Congratulations on purchasing your new RAM 3000 Deluxe AT-compatible memory board. This memory board includes the following features:

- Up to 3 megabytes of RAM for base and/or extended memory upgrading.
- Up to 3 megabytes of RAM for memory addressed under the Lotus/Intel/Microsoft Expanded Memory Specification (Version 3.20).
- Allows simultaneous coexistence of base, extended, and expanded memory on the same board.
- Fully compatible with AT-compatible motherboards that use the 80286-compatible CS8220 CHIPSet.
- 16-bit EMS transfer mode available for faster EMS operation.
- A software diskette with the following programs:
 - EV159.EXE** configuration and diagnostics program
 - EMMSYS** expanded memory device driver
 - EDISK.SYS** RAM disk device driver
 - ESPOOLEXE** print spooler
 - README** text file
 - FILELIST** text file

2.2 Physical Layout

Below is a diagram of the RAM 3000 Deluxe with all the jumper and switch locations you need to know. See **Section 3.1: Default Settings** for an explanation of the dipswitches and jumpers.

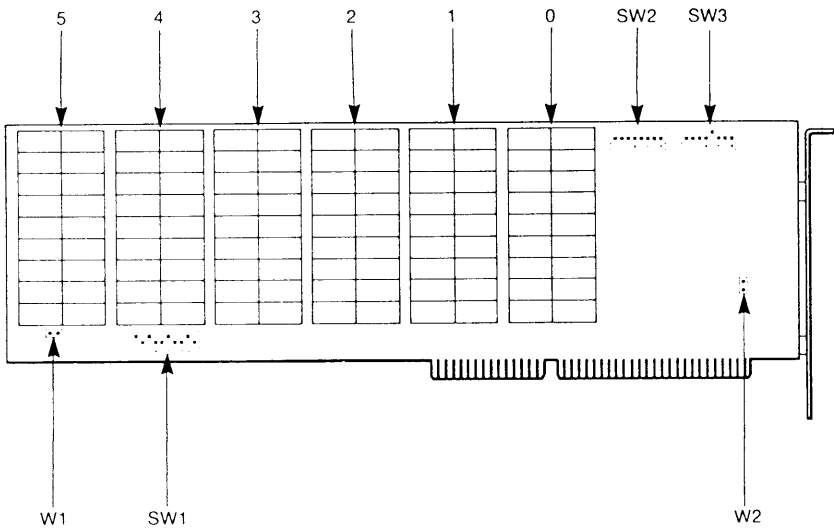


Figure 1: The RAM 3000 Deluxe

2.3 Installation Summary

1. Make any adjustments to the switches and/or jumpers on the RAM 3000 Deluxe for your chosen board configuration (see *Section 3.2: Configuring With Software* or *Section 3.3: Configuring Without Software*).
2. Physically install the DRAM chips on the RAM 3000 Deluxe board (see *Section 3.4: Installing The DRAM Chips*), then install the board in the computer (see *Section 4.1: Physical Installation*).
3. Test your RAM 3000 Deluxe board with the **EV159.EXE** program and run the SETUP program on the IBM AT Advanced Diagnostics diskette (or the equivalent program if you have an AT compatible) to inform your system of the new memory board (see *Section 4.2: Testing The RAM 3000 Deluxe*).
4. If you plan to use the RAM 3000 Deluxe for EMS mode, RAM disk, or print spooler, install the appropriate software from the RAM 3000 Deluxe software diskette (see *Section 5: RAM 3000 Deluxe Software*).

Section 3: Configuration

Please note the following helpful hints for configuring the dipswitches and jumpers on the RAM 3000 Deluxe.

Helpful Hint 1:

There are several different types of dipswitches installed on the RAM 3000 Deluxe. The following figure shows how to turn the dipswitch positions ON and OFF; note that Positions 1 to 4 are switched ON and Positions 5 to 8 are switched OFF.

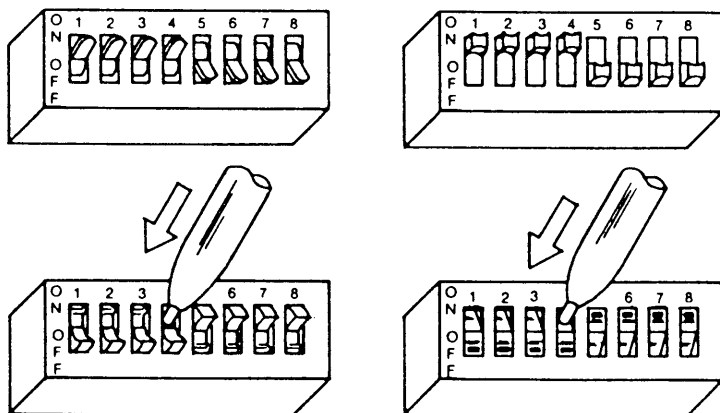


Figure 2A: The Different Types of Switches

Helpful Hint 2:

There is a hole at the top of the black plastic jumper shunts to make the removal of the jumper from the connector pins easier. To remove or adjust the placement of the jumper shunts, bend a paper clip, insert the bent end into the hole and pull the jumper up. The paper clip can also be used to insert the jumper onto the pins.

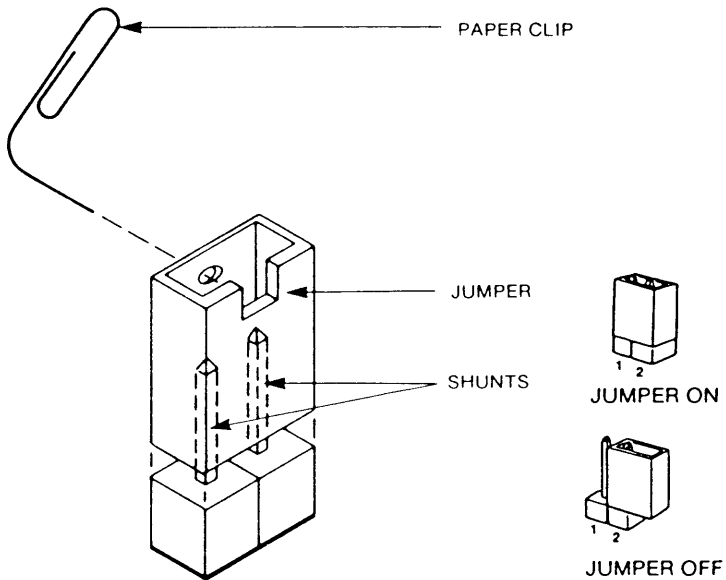


Figure 2B: Moving Jumper Shunts

3.1 Default Settings

The RAM 3000 Deluxe leaves the factory in this default configuration (see Table 1 on the following page for the jumper and dipswitch default settings):

1. There are no memory chips installed.
2. It assumes one memory bank of RAM chips are installed.
3. There is no memory space defined for base and/or extended memory upgrading.
4. The starting memory address is (100000H^{*}) or 1 MB.
5. The 2 EMS I/O Ports are set at Y258 and Y268 (where Y can be 0, 4, 8, or C) port addresses.
6. The EMS I/O Ports are disabled.
7. The EMS data transfer size is 8 bits wide.
8. The memory parity checking mode is enabled.

If you do not want to modify the default configuration, you can proceed to install your RAM 3000 Deluxe. If you need to change any settings on the RAM 3000 Deluxe, use either the **EV159.EXE** configuration program on your RAM 3000 Deluxe utility diskette (see *Section 3.2: Configuring With Software*), or utilize the tables in this manual (see *Section 3.3: Configuring Without Software* and *Appendix 2: Dipswitch Setting Table*) to help configure this board; we suggest using the **EV159.EXE** software program.

* "100000H" means 1 megabyte memory address in hexadecimal.

TABLE 1
Jumper/Switch Settings of the RAM 3000 Deluxe

SWITCH/ JUMPER	DEFAULT SETTING AND DEFINITION
W1	This jumper block selects the speed of the 256K DRAM chips installed on the RAM 3000 Deluxe. The default setting is installation of 120 nanosecond or faster chips (no jumper installed).
W2	This jumper block enables memory parity checking mode. The default setting is parity mode enabled (jumper installed).
SW1	This 10-position dipswitch selects the page frame control port addresses of EMS I/O ports 1 and 2 and activates EMS mode for these two ports. The default setting is EMS I/O port addresses 258 and 268 (Hex) with no EMS mode (SW1 positions 1, 3, 5, 6, 9 and 10 switched ON, positions 2, 4, 7, and 8 switched OFF).
SW2	This 8-position dipswitch selects the amount of contiguous memory defined on the RAM 3000 Deluxe and the number of memory banks filled. The default setting is one bank of memory installed and no contiguous memory space defined (SW3 positions 1-8 switched OFF).
SW3	This 8-position dipswitch selects the memory starting address of the RAM 3000 Deluxe and selects between 8-bit and 16-bit EMS data transfer size. The default setting is starting address at 1 MB (100000H) and 8-bit EMS data transfer size (SW3 position 5 switched ON, positions 1-4 and 6-8 switched OFF).

3.2 Configuring With Software

NOTE: If you plan to test your RAM 3000 Deluxe to ensure you did the board configuration and RAM chip installation correctly, you should follow this subsection.

1. Insert the RAM 3000 Deluxe utility diskette in Drive "A" and type:

A:EV159

<Enter>

2. You will see ten available menu selections: *Amount of Existing Base Memory*, *Amount of Existing Extended Memory*, *Amount of Base Memory to be Added*, *Amount of Extended Memory to be Added*, *EMS I/O Port Address (For The First 2M (megabytes) of EMS)*, *EMS I/O Port Address (For EMS Above 2M (megabytes))*, *EMS Fast Mode (Y/N)*, *Are DRAMs 120 ns (nanoseconds) or Faster (Y/N)*, and *Enable Parity Checking (Y/N)*.
3. Use the up and down cursor keys to select among the ten menu fields; if you need help on each field when you do your software board set up, press the [F1] function key for a help screen pertaining to that menu field.
4. When you finish configuring, press the [F2] function key for a screen representation of the board; configure the dipswitches and jumpers according to the screen representation, and note the number of memory banks

you must fill.

5. Press the **[F8]** key to save the current configuration. The **EV159.EXE** program will suggest the configuration file name **EV159.001**; press **[Enter]** to save this configuration file. You will need this saved file later when you test your RAM 3000 Deluxe board.
6. Press the **[F10]** key to leave the program; proceed to *Section 3.4: Installing The DRAM Chips* to install the DRAM chips, then go to *Section 4: Installation* to install the board into your system.

A Note About Installing Two Or More RAM 3000 Deluxe Boards:

If you install more than one RAM 3000 Deluxe board and will use the **EV159.EXE** program to configure several boards, please note the following considerations:

1. You must run the **EV159.EXE** program separately for each individual RAM 3000 Deluxe board installed in your system; when you finish the software configuration for each RAM 3000 Deluxe board, you must save a unique configuration file for each board in your system (**EV159.001** for the first board, **EV159.002** for the second board, **EV159.003** for the third board, and so on).
2. If your system needs base memory upgrading, make sure to set only *one* of your RAM 3000 Deluxe boards for this function.
3. If you plan to use the EMS mode on more than one RAM 3000 Deluxe board, please note that enabling all four EMS I/O ports on two RAM 3000 Deluxe boards means the installation of any other expanded memory boards will not be possible.

3.3 Configuring Without Software

3.3.1 Memory Configuration

Part One: Memory Starting Address

The starting address of the RAM 3000 Deluxe can begin at 0K-512K (00000H-80000H) in base memory range or 1024K-15232K (100000H-EE0000H) in extended memory range by adjusting dipswitch SW3. This means you can set the RAM 3000 Deluxe so base and extended memory coexist on the same board, even if the system motherboard has 0 bytes of base memory installed. In addition, you can set up the RAM 3000 Deluxe so it will work with AT-compatible motherboards using the CS8220 CHIPSet (upgrade base memory from 512K to 640K (80000H-9FFFFH) and upgrade extended memory beginning at 1536K (180000H)). Table 2 on the next page shows the possible starting addresses from 0K to 3072K (00000H-300000H).

NOTES:

1. The "640K" position in Table 2 will upgrade base memory from 512K-640K (80000H-9FFFFH) and start upgrading extended memory beginning at 1536K (180000H) ONLY.
2. If the RAM 3000 Deluxe memory starting address is higher than 3 M (300000H), see *Appendix 2: Dipswitch Setting Table* on how to configure SW3 for higher memory starting addresses.

TABLE 2
RAM 3000 Deluxe Memory Starting Address
(SW3 Positions 2-8)

RAM 3000 Deluxe Memory Starting Address	SW3 Position						
	2	3	4	5	6	7	8
0K (00000H)	OFF	OFF	OFF	OFF	OFF	OFF	OFF
128K (20000H)	OFF	OFF	OFF	OFF	OFF	OFF	ON
256K (40000H)	OFF	OFF	OFF	OFF	OFF	ON	OFF
384K (60000H)	OFF	OFF	OFF	OFF	OFF	ON	ON
512K (80000H)	OFF	OFF	OFF	OFF	ON	OFF	OFF
640K (A0000H)**	OFF	OFF	OFF	OFF	ON	OFF	ON
1024K (100000H)*	OFF	OFF	OFF	ON	OFF	OFF	OFF
1152K (120000H)	OFF	OFF	OFF	ON	OFF	OFF	ON
1280K (140000H)	OFF	OFF	OFF	ON	OFF	ON	OFF
1408K (160000H)	OFF	OFF	OFF	ON	OFF	ON	ON
1536K (180000H)	OFF	OFF	OFF	ON	ON	OFF	OFF
1664K (1A0000H)	OFF	OFF	OFF	ON	ON	OFF	ON
1792K (1C0000H)	OFF	OFF	OFF	ON	ON	ON	OFF
1920K (1E0000H)	OFF	OFF	OFF	ON	ON	ON	ON
2048K (200000H)	OFF	OFF	ON	OFF	OFF	OFF	OFF
2176K (220000H)	OFF	OFF	ON	OFF	OFF	OFF	ON
2304K (240000H)	OFF	OFF	ON	OFF	OFF	ON	OFF
2432K (260000H)	OFF	OFF	ON	OFF	OFF	ON	ON
2560K (280000H)	OFF	OFF	ON	OFF	ON	OFF	OFF
2688K (2A0000H)	OFF	OFF	ON	OFF	ON	OFF	ON
2816K (2C0000H)	OFF	OFF	ON	OFF	ON	ON	OFF
2944K (2E0000H)	OFF	OFF	ON	OFF	ON	ON	ON
3072K (300000H)	OFF	OFF	ON	ON	OFF	OFF	OFF

* Default Setting

** Please see note #1 on the previous page for information about this SW3 position.

Part Two: Amount Of Memory Banks Filled

Positions 1-3 of dipswitch SW2 set the number of banks of RAM chips installed on the RAM 3000 Deluxe. Although there are no memory chips installed when the board leaves the factory, the default setting is for 1 bank of memory chips installed (SW2 positions 1-3 switched OFF).

Use the following table to configure SW2 to correspond with the number of memory banks filled on the RAM 3000 Deluxe.

TABLE 3
RAM 3000 Deluxe Memory Banks Installed
(SW2 Positions 1-3)

SW2 Position			Banks Filled
1	2	3	
OFF	OFF	OFF	1*
OFF	OFF	ON	2
OFF	ON	OFF	3
OFF	ON	ON	4
ON	OFF	OFF	5
ON	OFF	ON	6

* Default Setting

NOTE: Avoid setting SW2 positions 1-3 to any other positions than those listed in Table 3.

Part Three: RAM 3000 Deluxe Contiguous Memory Space

SW2 positions 4-8 define the amount of contiguous memory space used on the RAM 3000 Deluxe for base and/or extended memory upgrading. If the RAM 3000 Deluxe is used for EMS mode only, do not define any contiguous memory space. Table 4 shows *some* of the possible contiguous memory space definitions:

TABLE 4
RAM 3000 Deluxe Contiguous Memory Space Defined
(SW2 Positions 4-8)

RAM 3000 Deluxe Contiguous Memory Space Defined	SW2 Position				
	4	5	6	7	8
0KB*	OFF	OFF	OFF	OFF	OFF
512KB	OFF	OFF	ON	OFF	OFF
1024KB	OFF	ON	OFF	OFF	OFF
1536KB	OFF	ON	ON	OFF	OFF
2048KB	ON	OFF	OFF	OFF	OFF
2560KB	ON	OFF	ON	OFF	OFF
3072KB	ON	ON	OFF	OFF	OFF

* Default Setting

NOTE: The contiguous memory space defined can be configured in 128KB increments; see *Appendix 2: Dipswitch Setting Table* on this procedure.

3.3.2 EMS Mode Configuration

You can configure the RAM 3000 Deluxe for up to three megabytes of RAM memory under the Lotus/Intel/Microsoft (LIM) Expanded Memory Specification (Version 3.20). This EMS memory is a special type of memory that allows specially-written software to access program data far larger than the 640KB limit imposed by DOS.

To configure the RAM 3000 Deluxe for EMS mode, you need to perform the following three-step process.

Step One: Enabling EMS Mode

Before enabling the EMS mode on the RAM 3000 Deluxe, make sure the contiguous memory space defined in **Section 3.3.1: Memory Configuration (Part Three)** is less than the amount of memory chips installed on the RAM 3000 Deluxe.

The RAM 3000 Deluxe has two I/O ports available for EMS data transfer; since each EMS I/O port accesses up to two megabytes of EMS memory, enabling both EMS I/O ports will allow access of up to three megabytes of EMS memory on the RAM 3000 Deluxe.

To enable the EMS I/O ports, switch OFF either SW1 position 5 (EMS I/O Port 1) and/or SW1 position 10 (EMS I/O Port 2). (See Figure 1 for location of the SW1 dipswitch).

To determine how many EMS I/O ports you need to enable, you must know how much memory on the RAM 3000 Deluxe is available for EMS mode. Use the following formula:

$$T - C = E$$

T represents the amount of memory in kilobytes installed on the RAM 3000 Deluxe, C represents the contiguous memory space defined in kilobytes on the RAM 3000 Deluxe, and E represents the memory in kilobytes available for EMS mode on the RAM 3000 Deluxe. Use the following table to determine how many EMS I/O ports you can enable:

TABLE 5
EMS I/O Port Enabling Options

If E is	Then Enable EMS I/O Ports
128-2048KB	1
2049-3072KB	1 and 2

Step Two: Selecting EMS I/O Port Address

Unlike base memory and extended memory spaces on the AT, expanded memory space is accessed by mapping each 16KB of EMS-specification memory into a specific memory address that is usable by the computer. By combining a large amount of these mapping schemes in a contiguous manner, we create a 64KB memory address space called a *window*, this is how a single 64KB window can access up to two megabytes of EMS-specification memory.

To determine the memory address where this 64KB EMS I/O port will reside, you switch Positions 1-4 and 5-9 on Dip-switch SW1 to inform the computer where to look for an open memory area to place the 64KB EMS I/O port. The RAM 3000 Deluxe is factory configured to use EMS I/O port addresses Y258 (EMS I/O Port 1) and Y268 (EMS Port 2), where Y can be 0, 4, 8, or C; you can configure SW1 so the board will use other port addresses.

Table 6 shows possible EMS I/O port address selections.

TABLE 6
EMS I/O Port Selections
(Dipswitch SW1 and SW2)

I/O Port Address	SW1 and SW2 Positions			
	1	2	3	4 ⁺
	6	7	8	9 ⁺⁺
Y2X8[*]				
Y208	ON	ON	ON	ON
Y218	ON	ON	ON	OFF
Y258 ^{**}	ON	OFF	ON	OFF
Y268 ^{***}	ON	OFF	OFF	ON
Y2A8	OFF	ON	OFF	ON
Y2B8	OFF	ON	OFF	OFF
Y2E8	OFF	OFF	OFF	ON

⁺ Positions 1-4 are for EMS I/O Port 1 (SW1).

⁺⁺ Positions 6-9 are for EMS I/O Ports 2 (SW1).

^{*} EMS I/O port addresses are selectable and a number of I/O ports have been reserved for EMS with the basic setting being Y2X8. The X value is a variable that you can select to avoid port address conflicts in your computer. Select the X variable by changing the setting of positions 1-4 and 6-9 of SW1. Y cannot be selected by the user; it has values of 0, 4, 8, and C.

^{**} 258 is the factory setting for EMS I/O Port 1.

^{***} 268 is the factory setting for EMS I/O Port 2.

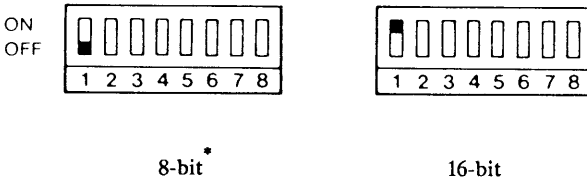
NOTES:

- 1. The factory configuration for the RAM 3000 Deluxe uses 258 and 268 EMS I/O port addresses. If you install another expanded memory board into your system (eg. another RAM 3000 Deluxe), you must not set the EMS I/O port address on your second expanded memory board for 258 or 268 addresses.**
- 2. If some or all of the EMS I/O ports need to be disabled, disable EMS I/O Port 2 FIRST, and EMS I/O Port 1 last.**
- 3. If you install two fully populated RAM 3000 Deluxe boards and will use them only as expanded memory (for a total of 6 megabytes of expanded memory), please note that four EMS I/O ports are enabled; this means you cannot access other expanded memory boards installed in your system.**

After you use an EMS I/O port address, circle it in pencil in this manual and avoid using that address for other expanded memory boards.

Step Three: EMS Mode Data Path Size

Normally, the data transfer to and from expanded memory space is done with 8-bit wide data paths. However, you can set the RAM 3000 Deluxe using 16-bit data paths for faster data transfer to and from EMS-specification memory by switching ON Position 1 of dipswitch SW3.



* Default Setting

Figure 3: EMS Data Path Size Selections

NOTE: The use of the 16-bit EMS transfer mode may not work on AT's with clock speeds of 8 MHz and higher; we suggest experimenting with the RAM 3000 Deluxe to see if it will work. For AT compatibles with very high clock speeds (10 MHz and higher), set the RAM 3000 Deluxe to the 8-bit EMS data transfer mode so EMS memory will work at the higher clock speeds.

3.3.3 Setting Chip Speed And Enabling Parity Checking

The RAM 3000 Deluxe is factory-configured for the board to use 256K-bit DRAM chips with a speed of 120 nanoseconds or faster. If you want to install 150 nanosecond 256K-bit DRAM chips, install a jumper on jumper block W1.

TABLE 7A
Selecting DRAM Chip Speed
(W1 Jumper)



DRAM Chip Speed	W1 Setting
120 nanoseconds	• • *
150 nanoseconds	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>

* Default Setting

NOTE: Make sure all the DRAM chips installed on the RAM 3000 Deluxe are of the same speed rating. Also, you must install 120 nanosecond or faster DRAM chips if your machine has a 10 MHz or faster clock speed.

Due to the large amount of DRAM chips on the RAM 3000 Deluxe and the need for parity checking to insure the integrity of the data, please leave the jumper shunt on the W2 jumper block installed. If you do want to disable parity checking, use the following table:

TABLE 7B
Enabling Parity Checking
(W2 Jumper)

Parity Mode	W2 Setting
Enabled	 *
Disabled	

* Default Setting

3.3.4 Setting The AT Motherboard

Your system's motherboard may or may not have a switch/jumper which determines the maximum amount of memory that the motherboard will accept (in the IBM PC AT the jumper is marked J18). If your system is an AT compatible, please check your system's manual to see if any such switch/jumper exists; refer to your owner's manual for instructions on how to set the switch/jumper to correspond with the amount of memory on the motherboard.

The motherboard lies on the floor of the system and contains the *central processing unit* of the computer. To set the switch, remove the cover of your system (see *Section 4.1: Physical Installation* for details on how to remove the system cover).

If you have an IBM PC AT, please set J18 in the 256K position if you have 256KB of RAM installed and in the 512K position if you have 512KB of RAM installed (remember to set the SW3 dipswitch on the RAM 3000 Deluxe board to correspond with the amount of memory on your motherboard if the RAM 3000 Deluxe is the only memory expansion board in your system). Refer to the following figure for the position of the J18 jumper block.

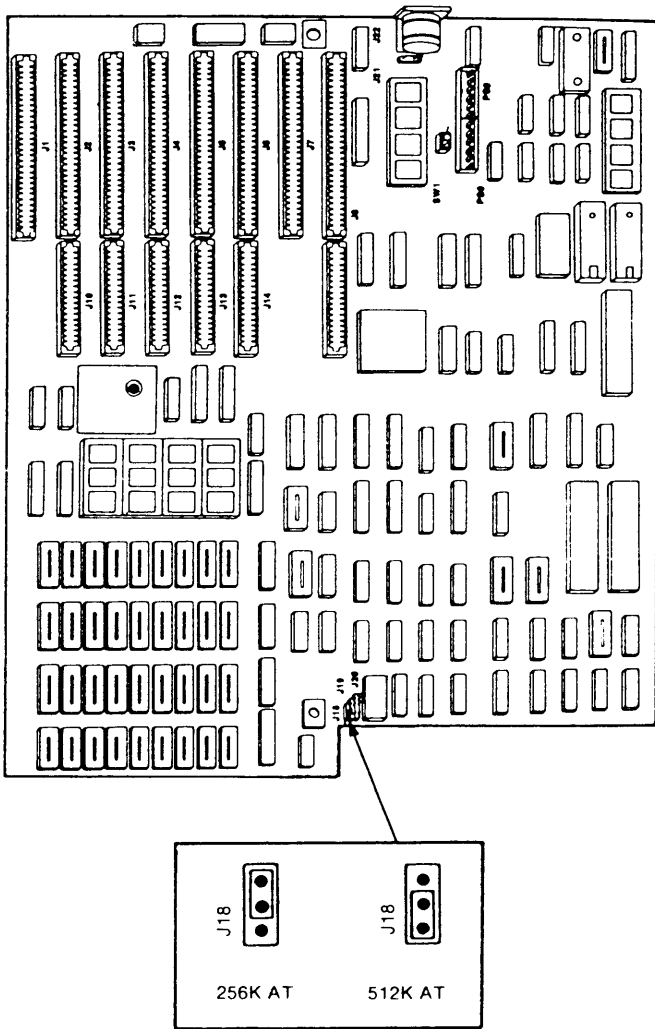


Figure 4: The IBM PC AT Motherboard

3.4 Installing The DRAM Chips

The process of adding DRAM memory chips to your RAM 3000 Deluxe is called *populating*. This may have been done by your dealer, or you can do it yourself.

The RAM 3000 Deluxe uses only 256K-bit DRAM chips with a speed of 120 nanoseconds or faster. When you buy the chips, make sure to remind the dealer of these specifications.

NOTE: You can use 150-nanosecond 256K-bit DRAM chips, but don't forget to insert a jumper shunt on jumper block W1 (see Figure 1 for the location of this jumper block).

WARNING: DRAM chips are easily damaged by static electricity! You can pick up a static charge simply by walking on carpeted floors. To rid yourself of the static charge, touch the system chassis before handling the RAM chips.

The RAM 3000 Deluxe has six banks (or vertical columns) of 18 chip sockets marked Bank 0 to Bank 5 going from right to left. (See Figure 5.)

Each of these banks must be either full or empty. You may not leave any banks partially filled. For this reason, you must buy your RAM chips in multiples of 18.

It is not necessary to fill all six banks on the RAM 3000 Deluxe. You can fill some of the banks now and fill the

others at a later date. The only consequence will be less RAM available for base and/or extended memory upgrading.

If you choose to upgrade base memory, you must fill Bank 0 if you have 128KB or more of base memory installed, and also fill Bank 1 if you have less than 128KB of base memory installed.

Before you install RAM chips on the RAM 3000 Deluxe, please note the number of banks you chose to fill on the board; this is determined by using the **EV159.EXE** program (see *Section 3.2: Configuring With Software*) or by using Table 3 in this manual (see *Section 3.3.1: Memory Configuration (Part Three)*).

Begin populating with the bank of chip sockets on the right side of the board, and move to the left for each subsequent bank. Do not skip any banks or leave any partially filled. Any empty banks should be on the far left part of your RAM 3000 Deluxe.

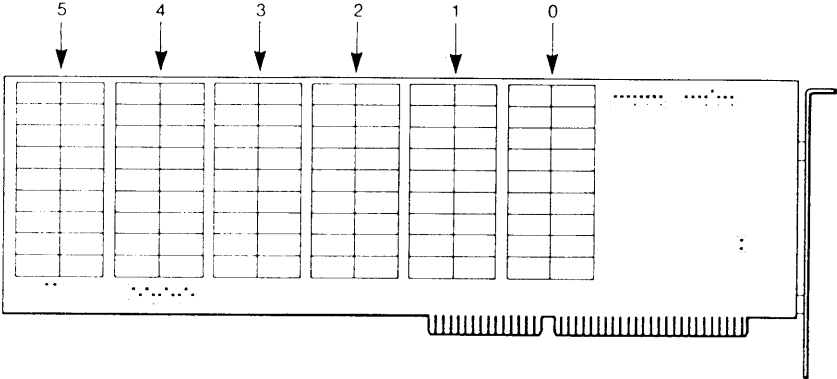


Figure 5: Populate the Chip Banks in this Order

Each 256K-bit DRAM chip has eight metal pins along each side. Each row of pins goes into a corresponding row of holes in the socket. The pins and holes must be perfectly aligned in order for the chip to work. If one pair of pins is hanging over into the socket next to it, the chip may look almost right but will not work properly.

Each chip has a notch on one end for orientation purposes (see Figure 6).

If you look closely at each chip socket on your RAM 3000 Deluxe, you will see a notch on one end of the chip socket. Be sure the notch on the chip is on the same side as the chip socket notch. This means the notch on the RAM chip must face the left side of the board.

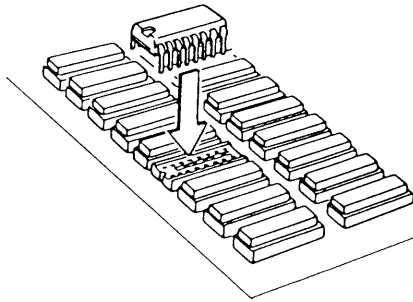


Figure 6: Installing A Chip

Install the chip by first inserting the tips of the pins into the chip socket holes and then checking the alignment of the tips. If chip alignment is correct, press the chip into the socket; it should go in easily. If you need to press hard, the chip alignment is probably incorrect and you may have bent a pin. If this happens, *carefully* remove the chip, straighten the bent pin, and try the installation again as gently as possible.

Section 4: Installation

When you finish configuring your RAM 3000 Deluxe, you can now install your board into your system.

4.1 Physical Installation

1. Turn OFF the power to the computer and disconnect all cables attached to the system unit. **Make sure NO power goes to your system.**
2. Remove the retaining screws that hold the cover on your system. Slide the cover forward. When it stops sliding, tilt the cover up and lift it away. Refer to the next figure.

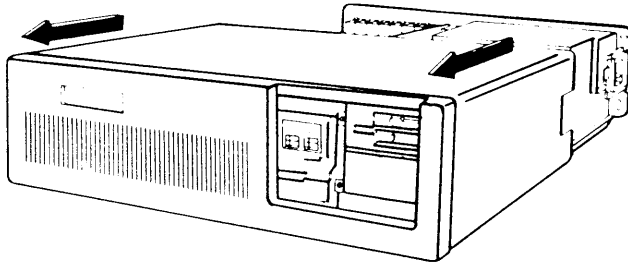


Figure 7: Removing the System Cover

-
3. Choose an open 16-bit expansion slot on the motherboard. A 16-bit expansion slot has two sets of gold-edge connector slots.

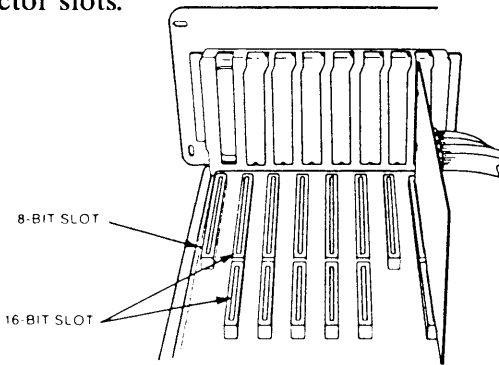


Figure 8: The Expansion Slots

4. Take off the expansion slot cover from the back of the chosen 16-bit expansion slot by first removing the screw that holds the cover in place. Keep this screw, as you will use it to secure the RAM 3000 Deluxe into place.

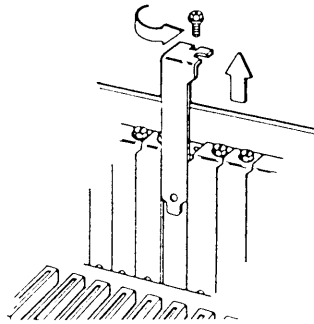


Figure 9: Removing the Slot Cover

-
5. Carefully insert the RAM 3000 Deluxe all the way into the expansion slot; remember to slide the board fully into the card guide on the front of the system chassis also.

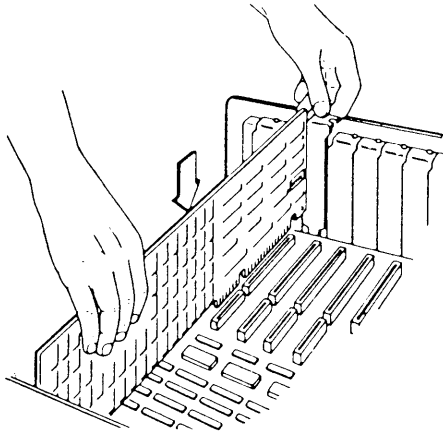


Figure 10: Inserting the RAM 3000 Deluxe

6. Reinstall the expansion slot cover screw to secure the RAM 3000 Deluxe board.
7. Reconnect the power cable and boot up your computer with DOS.

WARNING: DO NOT touch the components inside the system when it is ON; you might damage the components, and some parts can produce electrical shock.

NOTE: If you set the RAM 3000 Deluxe to upgrade base memory and the system will not boot up properly, the memory chips used to upgrade base memory may be defec-

tive. Refer to *Appendix 5: If System Boot Fails* on how to remedy this problem.

8. Run the **EV159.EXE** program to check out the board's memory chips. (See *Section 4.2: Testing the RAM 3000 Deluxe* for details).

NOTE: Skip step #8 if you did not configure the **RAM 3000 Deluxe** with the instructions in *Section 3.2: Configuring With Software*.

9. Run the **SETUP** utility program on the IBM Advanced Diagnostics diskette (or the equivalent program if you have an AT compatible) to inform the computer of the new memory expansion. (See *Section 4.2: Testing the RAM 3000 Deluxe* for details).
10. If the board checks out properly, turn the system OFF and replace the system cover.
11. If you plan to use the **RAM 3000 Deluxe** for expanded memory, RAM disk, or print spooler, install the appropriate software device drivers (see *Section 5: RAM 3000 Deluxe Software* for details).
12. Congratulations! Your **RAM 3000 Deluxe** board is now ready for use.

4.2 Testing The RAM 3000 Deluxe

The RAM 3000 Deluxe utility diskette includes a program that will test the chips on the RAM 3000 Deluxe board. This program will take several minutes to run and will ensure that the RAM 3000 Deluxe configuration was done properly and that all the RAM chips installed are functional.

To Test The RAM 3000 Deluxe's Memory

1. Boot your system with DOS; insert the RAM 3000 Deluxe utility diskette into drive "A," and type:

A:EV159

[Enter]

WARNING: DO NOT run the EV159.EXE memory test if you have valuable data loaded in expanded memory on the RAM 3000 Deluxe, as this program will overwrite all data in expanded memory.

2. Press the [F4] function key to load the configuration file you stored on disk when you finished the software board configuration in *Section 3.2: Configuring With Software* (make sure you use the right EV159.XXX configuration file for each RAM 3000 Deluxe board you will test). Press the [F2] key to bring up the screen representation, and press the [F5] key to start testing the board.

-
3. When the memory test points out the location of any bad chips (bad chips are shown blinking), check the chips at the locations represented on the screen to ensure the chips are installed correctly (did you bend or break the chip pins or improperly orient the chip?); if the chips are installed properly, you must replace the bad chips.
 4. When you finish the testing procedures, press [F10] to leave the EV159.EXE program.

Running the SETUP Program

Once the RAM 3000 Deluxe board testing is completed, run the SETUP program on the IBM AT Advanced Diagnostics diskette. This program informs the AT of the new memory expansion board so application software can access the board.

1. Boot up your system with the IBM AT Advanced Diagnostics diskette in drive "A."
2. Choose the **SETUP** option.
3. Follow the instructions as they appear on the screen.

NOTE: AT compatibles have various methods of running the **SETUP** program; please check your owner's manual to find out how to run the **SETUP** program for your particular machine.

Section 5: RAM 3000 Deluxe Software

Several utility programs are included on your RAM 3000 Deluxe utility software diskette. These programs increase the productivity of your RAM 3000 Deluxe.

- | | |
|------------|--|
| EMMSYS | Software device driver to allow access to the expanded memory configured on the RAM 3000 Deluxe. |
| EDISK.SYS | Software device driver that sets aside part of your computer's base, extended or expanded memory for a RAM disk. |
| ESPOOL.EXE | Printer spooler program that sets aside part of your computer's base, extended or expanded memory for a print spooler. |

NOTE: Please copy these programs from the RAM 3000 Deluxe utility diskette to your system disk by using the DOS COPY command; store the original diskette in a safe place.

5.1 EMM.SYS EMS Device Driver

Expanded memory did not exist when your PC and its operating system (DOS) were invented. Because of this, DOS by itself cannot recognize and use any expanded memory space defined on your memory expansion board. In order to use expanded memory space, you need a special device driver program that must be run each time you boot up the system. You also need special software that can use expanded memory space.

On the Everex software diskette that accompanies your board, there is a file called **EMM.SYS** that allows you to access expanded memory space. Regardless of how many memory boards you have installed that are capable of defining expanded memory space (up to a maximum of eight megabytes of expanded memory space defined over all your expansion boards), you only need one **EMM.SYS** program to control all the expanded memory space.

Before you install **EMM.SYS**, copy the file **EMM.SYS** to the root directory of your system disk. The following subsections show you how to install **EMM.SYS**.

5.1.1 Installing EMM.SYS

Most systems have a **CONFIG.SYS** file of "chores" for the computer to load special software device drivers each time the system is booted up. You need to add a *device = emm.sys* command line to your **CONFIG.SYS** file.

-
1. If your system disk already has a **CONFIG.SYS** file, use a text editor to add the line *device = emm.sys* to your **CONFIG.SYS** file.
 2. If a **CONFIG.SYS** file is not on the system disk, type in the following lines to create one with the **EMM.SYS** command line in it. DO NOT do this step if a **CONFIG.SYS** file already exists on your system disk as it will overwrite your old **CONFIG.SYS** file.

```
cd \                [Enter]
copy con: config.sys [Enter]
device = emm.sys    [Enter]
[F6]                [Enter]
```

3. To confirm that you properly installed **EMM.SYS**, type:

```
type config.sys     [Enter]
```

This command should display the line *device = emm.sys* on the screen.

4. Press [Ctrl]-[Alt]-[Del] to reboot your system; if no problems arise, a message similar to *Expanded Memory Manager Installed* will be displayed.

5.1.2 EMM.SYS Parameters

Though the command line *device = emm.sys* is fine for most circumstances, you can also add parameters to your **EMM.SYS** command line for special needs. The extra parameters are organized in the following format:

device = [path]emm.sys [/c] [pppp] [port,page]

The items inside "[]" designate an optional item. **NOTE: Do not type the "[]" characters themselves.**

[path] This parameter is for users that keep the **EMM.SYS** file in a subdirectory other than the root directory. If this is the case, type in the full path name of the **EMM.SYS** file on the command line. Most users will keep **EMM.SYS** in the root directory and will not use this parameter.

[/c] This parameter instructs **EMM.SYS** to chain interrupt vector 67 (Hex). For most users, this parameter is not needed, but if you have a AST PCnet II network adapter board installed (which uses interrupt 67 (Hex)) in addition to your expanded memory boards, you must add this parameter to be sure both boards will work simultaneously. See **Appendix 4: Regarding the AST PCnet II** for more information about the use of this parameter.

[pppp] This parameter tells **EMMSYS** where to look for a valid page frame. The page frame is the first address of the EMS mapping window. **[pppp]** valid values are C400, C800, CC00, D000, DC00 and E000 (Hex). For most users, C400 (default value if the **[pppp]** parameter is not specified) is fine and this parameter is not needed.

[port,page] This parameter selects the port address of the portion of the memory board configured for expanded memory and the starting logical page of expanded memory. For the **port** option, the valid addresses are 208, 218, 258, 268, 2A8, 2B8, or 2E8 (Hex); the default value is 258. When you define the **port** address 258, it will look for this address first, but will also look for **port** addresses 268, 2A8, 2B8 and 2E8 if **port** address 258 is not found. For the **page** portion, the valid values are 00 to 7F (Hex).

5.1.3 EMM.SYS Examples

1. **device = emm.sys**

This **EMMSYS** command line is fine for most users.

2. **device = emm.sys C400**

This **EMMSYS** command line looks for a starting page

frame address at C400 (Hex). If the page frame address is occupied, it will try to look for 64KB address space in ascending order up to E000 (Hex). If this fails, the "No room on motherboard for page frame" message will appear, and the search will terminate.

3. **device = \everex\emm.sys /c c800 268,30**

This **EMM.SYS** command line looks for the **EMM.SYS** file in the **\everex** subdirectory, enables interrupt 67 (Hex) chaining, and defines expanded memory at segment address C800, port address 268, page 30. If port address 268 is not found, it will try to look for port addresses 2A8, 2B8 and 2E8.

4. **device = emm.sys 258,00 268,00 208,00 218,00**

This **EMM.SYS** command line selects 258, 268, 208 and 218 (Hex) port addresses, with all ports assigned with EMS logical starting page 00 (Hex). Use this command line when you install two RAM 3000 Deluxe boards, with both boards set for EMS mode only. **NOTE: Make sure the EMS I/O ports on the first board are 258 and 268, and the second board are 208 and 218.**

5.2 EDISK.SYS RAM Disk Device Driver

The Everex utility **EDISK.SYS** is a software device driver that allows you to set aside part of the computer's base, expanded or extended memory for a RAM disk. This RAM disk is recognizable by DOS in the same manner as a hard disk or floppy disk: you can create directories and sub-directory paths on it, and can transfer and save your files just like a standard disk. DOS will assign the next available logical drive name to each RAM disk defined: for example, your first RAM disk will be defined as Drive "C" if you have no hard disks installed and as Drive "D" if you have one installed.

The RAM disk has the following advantages:

- A. Access times are very short because there are no mechanical access procedures.
- B. The RAM disk can be of any size. It can be made larger or smaller, deleted and re-created, at will.
- C. You do not need additional hardware to implement a RAM disk; this means you do not need to pay extra money in order to implement a hard disk.

The RAM disk has the following disadvantages:

- A. None of the data stored in a RAM disk is permanently saved until you store the data on a real physical disk.

The RAM disk consists of RAM only, which is volatile. Any attempt to reboot the system or loss of power to the computer will result in a loss of data from the RAM disk forever. You might forget this fact because a RAM disk resembles a real physical drive.

- B. The portion of memory defined for RAM disk use is unavailable for any other use.

Before you can use the **EDISK.SYS** program, you must identify the following memory types:

BASE memory is memory addresses 0K-640K (00000-9FFFFH). Every machine has some amount of base memory; to find out how much you have, run the DOS **CHKDSK.COM** program to get an accurate total.

EXPANDED memory refers to a special memory accessed by a bank-switching technique that overcomes the 0K-640K (00000-9FFFFH) limitation. If you have memory space defined under the Lotus/Intel/Microsoft Expanded Memory Specification (EMS), you can use **EDISK.SYS** to define a RAM disk in this memory space. **EDISK.SYS** will work with all EMS-compatible memory boards used in the IBM PC, AT and compatible computers.

EXTENDED memory exists only on the IBM PC AT and AT compatibles, where the memory addresses are 1 to 16 M (100000-FFFFFFH). Since few application software programs run in extended memory, using

EDISK.SYS is an excellent way for AT owners who have extended memory available to take advantage of this memory space.

Identify which types of memory exist in your system, and decide which one will be used for a RAM disk. **EDISK.SYS** will allow you to define as many RAM disks as you want in one or more memory types. You are limited only by the system's memory capacity.

Please note that each RAM disk defined can **ONLY** use one type of memory. You cannot define a single RAM disk to split over several memory types. However, you can define two or more RAM disks within one type of memory, as long as the RAM disks fit within the computer's limit for that type of memory.

5.2.1 Installing EDISK.SYS

Start by copying the file **EDISK.SYS** from the Everex utility diskette into the root directory of your system disk. If you prefer not to keep the program file **EDISK.SYS** in your root directory, you can instead copy it to a subdirectory; in this case be sure to read *Section 5.2.2: EDISK.SYS Parameters* for instructions on setting up the **EDISK.SYS** command line to run **EDISK.SYS** from a subdirectory. If your computer is floppy-based, the system disk is the DOS diskette that you use to boot your system; if you have a hard disk then the system disk is drive "C". We suggest copying the entire utility diskette onto another disk, and storing the original in a safe place.

Follow these steps to create a RAM disk with **EDISK.SYS**:

1. **EDISK.SYS** is called up during the boot-up process from a special file called **CONFIG.SYS** on your system disk. **CONFIG.SYS** defines a series of hardware-related "chores" that you want to perform each time you boot up the system.
2. If you already have a **CONFIG.SYS** file on the system disk, you can add the **EDISK.SYS** command line by using a text editor or word processor.
3. If you do not have a **CONFIG.SYS** file in your system, create the **EDISK.SYS** RAM disk by typing in the following lines. **DO NOT** do this step if a **CONFIG.SYS** file already exists on your system disk as it will overwrite your old **CONFIG.SYS** file.

```
cd \                [Enter]
copy con: config.sys [Enter]
device = edisk.sys  [Enter]
[F6]                [Enter]
```

Type:

```
type config.sys     [Enter]
```

to confirm the existence of the **EDISK.SYS** file, then reboot your system to install the RAM disk.

5.2.2 EDISK.SYS Parameters

You can add special parameters to change the RAM disk's buffer size, sector size, maximum number of root directory entries and the type of memory where the RAM disk is located. The **EDISK.SYS** parameters use this format:

device = [path]edisk.sys [bbb] [sss] [ddd] [/e:[n]] [/x] [/l]

The values between the "[]" symbols are optional and can be omitted. **NOTE: DO NOT type in the "[]" symbols themselves.**

- [path]** This parameter defines the location of the subdirectory where the **EDISK.SYS** file will be stored. If your **EDISK.SYS** file is in the root directory, you can omit this parameter.
- [bbb]** This parameter defines the buffer size, or capacity, of the RAM disk. If you do not define this parameter, the default buffer size will be 128KB; if you want a larger or smaller RAM disk, enter the appropriate number in KB. The smallest RAM disk size is 1KB; the largest RAM disk size is the total amount of available memory of that type. Please note that the memory space defined for a RAM disk will not be available for other uses.

If your RAM disk resides in base memory, you must leave at least 64KB of base memory free for DOS. **EDISK.SYS** will check that you have 64KB of free base memory when it is loaded; if the specified buffer size leaves less than 64KB for base memory, it will reduce the buffer size. If this still leaves less than 64KB, **EDISK.SYS** will not load.

[sss] This parameter defines the sector size. If you do not define this parameter, the sector size is 512 bytes; if you define this parameter, the valid choices are 128, 256 and 512.

[ddd] This parameter defines the maximum number of entries in the root directory of the RAM disk. If you do not define this parameter, the maximum number of entries is 64; if you do include this parameter, the valid numbers range from 2 to 512.

[/e[:n]],[/x] **EDISK.SYS** normally defines the RAM disk in base memory unless you include the **[/e[:n]]** or **[/x]** parameters on the **EDISK.SYS** command line. The **[/e]** option informs **EDISK.SYS** to load the RAM disk to AT-only extended memory. The value **[:n]** represents the number of sectors to transfer in and out of extended memory at one time. If you omit **[:n]**, the default transfer size is 8; if you in-

clude [n], the values are 1 to 8. The [/x] option informs **EDISK.SYS** to load the RAM disk in expanded (EMS) memory.

[/l] This parameter allows you to install the RAM disk with no volume label, which gives you an extra 32 bytes for other memory uses.

5.2.3 **EDISK.SYS** Examples

device = edisk.sys

This example gives you the default RAM disk: the buffer size is 128KB, the sector size is 512 bytes, and the maximum number of entries in the root directory is 64.

device = \everex\edisk.sys 512 /x

This example looks up the **EDISK.SYS** driver in the `\everex` subdirectory, then creates a 512KB RAM disk in expanded memory.

device = \everex\edisk.sys 3072 128 256 /e:6

This example looks up the **EDISK.SYS** driver in the `\everex` subdirectory, then creates a RAM disk of 3072KB buffer size, 128KB sector size, with the maximum number of root directory entries at 256. It will create the RAM disk with extended memory, and the memory block transfer size is 6.

A Note About Expanded Memory RAM Disks:

If you define your **EDISK.SYS** RAM disk in expanded memory (using the "/x" parameter), it is very important that you define the expanded memory software driver in your **CONFIG.SYS** file *before* you define your **EDISK.SYS** RAM disk.

For expanded memory RAM disks, you create the following **CONFIG.SYS** file (if you are using the **EMM.SYS** software device driver on the RAM 3000 Deluxe software diskette):

```
copy con: config.sys      [Enter]
device = emm.sys         [Enter]
device = edisk.sys /x    [Enter]
[F6]                     [Enter]
```

This **CONFIG.SYS** file will create the expanded memory space first, then create the expanded memory RAM disk.

5.3 ESPOOL.EXE Print Spooler

One of the most frustrating things about using a computer is the fact that whenever you send data out to your printer, your system is often incapable of doing any other tasks during the printing process. This problem can be especially intolerable when printing long documents, since all that time wasted by the computer just to print a long document can definitely be put to better use.

On the RAM 3000 Deluxe software diskette is a program called **ESPOOL.EXE**, which allows your computer to do other tasks while the printer is printing a long document. **ESPOOL.EXE** installs a print buffer of any size from 1KB to 15360KB on any type of memory (base, extended, or expanded), and can direct the contents of the print spooler to any parallel or serial port in your computer.

5.3.1 Installing ESPOOL.EXE

1. Use the DOS COPY command to copy the file **ESPOOL.EXE** from the RAM 3000 Deluxe software diskette to the root directory of your system disk.
2. Type:

```
ESPOOL                [Enter]
```

That's all you need to do! The print spooler is now loaded into your system and ready to use.

5.3.2 ESPOOL.EXE Parameters

When you install **ESPOOL.EXE** by typing **ESPOOL [Enter]**, the resulting print spooler will be 64KB in size, located in base memory, and direct the contents of the spooler to parallel port LPT 1. However, you can change these parameters if you want to change the size of the print spooler, locate it in another type of memory, or direct the contents of the spooler to another port besides LPT 1 parallel port. The **ESPOOL.EXE** command line uses this format:

```
[path]espool [/b:bbb] [/e] [/x] [/p:n] [/sn[b,p,d,s,h]] [/r]
```

Where:

[path] represents the subdirectory path where the **ESPOOL.EXE** program will be located. If **ESPOOL.EXE** is located in the root directory, you can omit this parameter.

[/b:bbb] represents the size of the print spooler. Valid sizes are 1KB to 15360KB; if you omit this parameter, the spooler size will be 64KB.

[/e],[/x] represents what type of memory you want to locate your print spooler in. Normally, omitting these parameters will result in the print spooler located in base memory. Use the **[/e]** parameter if you want the spooler in extended memory, and use the **[/x]** parameter if you want the spooler in expanded memory.

[/p:n] represents which parallel port the contents of the print spooler will be directed to. Normally, not including this parameter will direct the contents to parallel port LPT 1. If you include this parameter, **[/p:1]** means directing to LPT 1 parallel port, **[/p:2]** means directing to LPT 2 parallel port, and **[/p:3]** means directing to LPT 3 parallel port. Note that if you only have one parallel port in your system, we suggest using **[/p:1]**, or omitting this parameter altogether.

[/s:n] represents which serial port the contents of the print spooler will be directed to. If you use this parameter, **[/s:1]** means directing to COM 1 serial port (port address 3F8-3FF), **[/s:2]** means directing to COM 2 serial port (port address 2F8-2FF), **[/s:3]** directing to COM 3 serial port (port address 3E8-3EF), and **[/s:4]** means directing to COM 4 serial port (port address 2E8-2EF).

[/b,p,d,s,h] represents parameters you can add as part of the **[/s:n]** parameter. These parameters are: **b** (which sets the baud rate; the valid values are 110, 150, 300, 600, 1200, 2400, 4800, and 9600), **p** (which sets the parity bit; the valid values are **n** for none, **o** for odd, and **e** for even), **d** (which sets the databits; the valid values are 7 and 8), **s** (which sets the stopbit; valid values

are 1 and 2), and **h** (which enables the XON/XOFF handshaking protocol to prevent the sending of spooler contents to a serial printer if the serial printer is not ready to accept commands and spooler data).

NOTE: If you have already set the parameters for the serial port with the DOS **MODE.COM** program, we suggest excluding the [b,p,d,s,h] parameters, as these **ESPOOL.EXE** parameters will change the original parameters defined by **MODE.COM**.

[/r] represents a special parameter which allows you to check on the status of the print spooler. After you load the **ESPOOL.EXE** print spooler, when you type the command:

espool /r [Enter]

the screen will respond with a status message on the print spooler.

5.3.3 ESPOOL.EXE Examples

espool /b:32 /p:2

This enables a 32KB print spooler, with its contents directed to parallel port LPT 2.

\util\espool /b:256 /x /p:2

This looks for the **ESPOOL.EXE** program in the **\util** sub-directory, then enables a 256KB print spooler in expanded memory, and directs its contents to parallel port LPT 2.

\everex\espool /b:1024 /e /s:2,1200,e,7,1,h

This looks for the **ESPOOL.EXE** program in the **\everex** sub-directory, then enables a 1024KB print spooler in extended memory, with its contents directed to serial port COM 2. This **ESPOOL.EXE** command line tells the COM 2 serial port to use 1200 baud transfer rate, even parity, 7 databits and 1 stopbit. The XON/XOFF handshaking protocol is enabled.

Section 6: Troubleshooting

If you have trouble using the RAM 3000 Deluxe, this section contains answers to commonly asked user questions. In addition, this section tells how to get assistance if this manual does not solve your problem.

6.1 Common Questions And Answers

Q. Why is it that I cannot access extended memory defined on the RAM 3000 Deluxe?

A. In order to access the extended memory on the RAM 3000 Deluxe, you must have at least 512KB of base memory installed in your system. Also, if you have extended memory already in your system, make sure the starting address of the extended memory on the RAM 3000 Deluxe is equal to the amount of extended memory already in your system (for example, if you have 2 megabytes of extended memory already installed in your system, set memory starting address at 3072K (300000H); see *Section 3.3.1: Memory Configuration (Part One)* for instructions on adjusting the RAM 3000 Deluxe's memory starting address).

Q. Why does the system not boot properly when I configure the RAM 3000 Deluxe to upgrade base memory?

A. There are two possible explanations for this problem:

1. You forgot to run the AT SETUP program to configure the system so it recognizes the memory on the RAM 3000 Deluxe.

-
2. The chips on Bank 0 and Bank 1 (which are used for base memory upgrading) are either improperly installed or defective. See *Appendix 5: If System Boot Fails* on how to remedy this problem.

Q. *I have difficulty in accessing the expanded memory on the RAM 3000 Deluxe. What should I do?*

- A. Please make sure you followed the instructions in *Section 3.3.2: EMS Mode Configuration* in order to configure the board properly for EMS mode and the instructions *Section 5.1: EMM.SYS EMS Device Driver* to properly install the **EMM.SYS** expanded memory device driver.

6.2 How To Get Assistance

If *Section 6.1: Common Questions And Answers* does not assist you in solving the problem that occurred when using the RAM 3000 Deluxe, we suggest using the following steps:

1. Repeat the procedure that produced the problem, and see if it happens again. If this is a software procedure (e.g. using the **EV159.EXE** program to configure and test the RAM 3000 Deluxe), press the [F1] key to see the help screen for suggestions.
2. In most cases, this manual is the quickest and least expensive source of help. Make sure you read the manual *carefully*, and only seek further avenues of help when the manual can no longer assist you.
3. If you cannot resolve the problem yourself, contact the dealer where you purchased the RAM 3000 Deluxe board.
4. In the event the dealer cannot satisfactorily solve the problem, you can call us directly. Our Technical Support hours are 8 a.m. to 5 p.m. (Pacific Time), Monday through Friday.

-
5. In order to simplify the troubleshooting of your RAM 3000 Deluxe, the Technical Support Department suggests you give the following details when you place your call:
 - The Owner's Manual you are currently reading (include the version number).
 - The name of the operating system you are using and its version number.
 - The contents of your AUTOEXEC.BAT file.
 - The contents of your CONFIG.SYS file.
 - The brand name and model of the computer you are using.
 - The brand name and model of all external peripherals attached to the computer (monitors, modems, and printers).
 - The brand name and model of all internal peripherals installed in the computer (internal modems, multifunction cards, video adapters, etc.).

 6. In addition, you should note any other facts or circumstances that seem strange or relevant to you.

 7. If it determined that the RAM 3000 Deluxe board must be returned to Everex for service, we will need the following information:
 - The serial number of the board (located on a small white sticker on the back side of the board).
 - A photocopy of the sales invoice.
 - The date and place of purchase.

-
8. Finally, try to be near your system when you call, so you can follow the suggestions from Technical Support while on the phone in order to solve your problem.

Appendix 1: Memory Basics:

A1.1 Description Of Memory

The RAM 3000 Deluxe is designed to provide up to three megabytes of extended memory for AT-compatible machines. In addition, up to three megabytes of memory on the RAM 3000 Deluxe can be addressed as expanded memory under the Lotus/Intel/Microsoft EMS specification (Version 3.20). This board can also be used to upgrade base memory to the 640K (9FFFFH) base memory limit imposed by DOS. If you are not familiar with the distinction between base, extended and expanded memory, refer to the following explanations.

Base memory – memory from the 0 byte memory address up to the 640K limit (00000H-9FFFFH). This memory area is usable by DOS for programs and data.

Extended memory – memory from 1 to 16 megabyte memory address (100000H-FFFFFFH). This area can be used by the AT or AT compatible to store data and programs. DOS does not recognize this memory space, but certain programs can use this memory space (notably the **EDISK.SYS** RAM disk utility and the OS/2 disk operating system).

Expanded memory – memory (specification developed by a joint project of Lotus, Intel and Microsoft) that can be accessed by specially-modified software in order to overcome the DOS-imposed 0K-640K (00000H-9FFFFH) memory address limit for program data.

This type of memory allows program data to be as large as eight megabytes in size when several boards that meet this memory specification are installed in the computer. (See *Appendix 3: EMS Technical Reference* for details).

Note that the memory addresses of 640K to 1024K (A0000H-FFFFFH) cannot be addressed by the user. This area is reserved for programs used by the system in order for the computer to function. (It is also used as the I/O port address area for expanded memory.) Also, the memory addresses of 16256K to 16384K (FE0000H-FFFFFFFH) are also reserved for system use.

A1.2 AT Memory Line

Figure 11 shows how memory is allocated on the AT and highlights the locations of base, extended and system reserved memory.

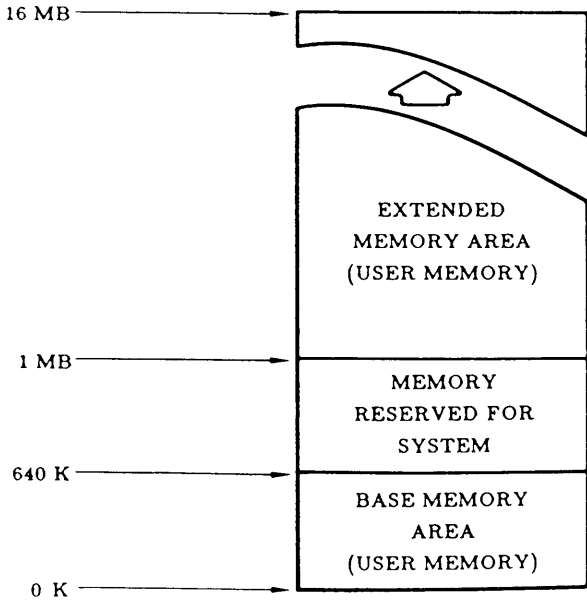


Figure 11: AT Memory Address Line

EMS expanded memory space is not linear, but addressed through I/O port-controlled memory addresses called **pages**. This means that on the EMS board, data is divided into 16KB pages, and then mapped into a 64KB address space of the CPU memory called a **window**. By varying the page number register, any one of the 16KB pages in a 2048KB expanded memory space can be mapped into this window. Figure 12 shows how this mapping is done.

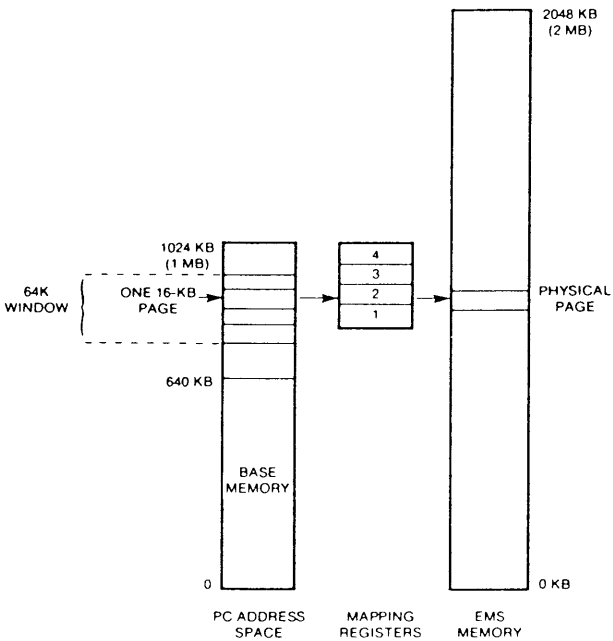


Figure 12: EMS Page Frame Addressing

Appendix 2: Dipswitch Setting Table

A2.1 Dipswitch SW2

TABLE 8
SW2 Functions

POSITION	FUNCTION
1-3	Selects number of 512KB memory banks filled (see <i>Section 3.3.1: Memory Configuration (Part Two)</i> on setting these positions).
4-5	Selects contiguous memory space in 1 MB increments.
6-8	Selects contiguous memory space in 128KB increments.

The actual contiguous memory space defined for the RAM 3000 Deluxe will always be the amount represented by positions 4-5 added to the amount represented in positions 6-8.

TABLE 9
Position 4-5 of SW2

Memory Represented (1 MB increments)	Position	
	4	5
0 MB	OFF	OFF
1 MB	OFF	ON
2 MB	ON	OFF
3 MB	ON	ON

TABLE 10
Position 6-8 of SW3

Memory Represented (128KB Increments)	Position		
	6	7	8
0KB	OFF	OFF	OFF
128KB	OFF	OFF	ON
256KB	OFF	ON	OFF
384KB	OFF	ON	ON
512KB	ON	OFF	OFF
640KB	ON	OFF	ON
768KB	ON	ON	OFF
896KB	ON	ON	ON

Configuration Examples

If you want 896KB of contiguous memory:

You choose the "896KB" option from Table 10; switch SW3 positions 6-8 ON.

If you want 2432KB of contiguous memory:

You choose the "2 MB" option from Table 9 and the "384KB" option from Table 10; switch SW3 positions 4, 7, and 8 ON.

A2.2 Dipswitch SW3

TABLE 11
SW3 Functions

POSITION	FUNCTION
1	Selects between 8 bit (OFF) and 16 bit (ON) EMS transfer mode.
2-5	Selects RAM 3000 Deluxe starting address in 1 M increments.
6-8	Selects RAM 3000 Deluxe starting address in 128K increments.

The actual starting address for the RAM 3000 Deluxe is the amount represented by positions 2-5 added to positions 6-8.

TABLE 12
Positions 6-8 of SW3

RAM 3000 Deluxe Starting Address (128K Increments)	Position		
	6	7	8
0K (00000H)	OFF	OFF	OFF
128K (20000H)	OFF	OFF	ON
256K (40000H)	OFF	ON	OFF
384K (60000H)	OFF	ON	ON
512K (80000H)	ON	OFF	OFF
640K (A0000H)	ON	OFF	ON
768K (C0000H)	ON	ON	OFF
896K (E0000H)	ON	ON	ON

TABLE 13
Positions 2-5 of SW3

RAM 3000 Deluxe Starting Address (1 M Increments)	Position			
	2	3	4	5
0 M (000000H)	OFF	OFF	OFF	OFF
1 M (100000H)	OFF	OFF	OFF	ON
2 M (200000H)	OFF	OFF	ON	OFF
3 M (300000H)	OFF	OFF	ON	ON
4 M (400000H)	OFF	ON	OFF	OFF
5 M (500000H)	OFF	ON	OFF	ON
6 M (600000H)	OFF	ON	ON	OFF
7 M (700000H)	OFF	ON	ON	ON
8 M (800000H)	ON	OFF	OFF	OFF
9 M (900000H)	ON	OFF	OFF	ON
10 M (A00000H)	ON	OFF	ON	OFF
11 M (B00000H)	ON	OFF	ON	ON
12 M (C00000H)	ON	ON	OFF	OFF
13 M (D00000H)	ON	ON	OFF	ON
14 M (E00000H)	ON	ON	ON	OFF
15 M (F00000H)	ON	ON	ON	ON

Configuration Examples

If you have 256KB of base memory on the motherboard:

You choose the "256K" option from Table 12; switch SW3 position 7 ON. This will upgrade base memory from 256K to 640K (40000H-9FFFFH) and upgrade extended memory from 1024K (100000H).

If you have a CS8220-based AT motherboard with 512KB base and 512KB extended memory installed:

You choose the "640K" option from Table 12; switch SW3 positions 6 and 8 ON. This will upgrade base memory from 512-640K (80000H-9FFFFH) and upgrade extended memory from 1536K (180000H).

If you have 7680KB of extended memory already installed in your system:

You choose the "512K" option from Table 12 and the "7 M" option from Table 13; switch SW3 positions 3-6 ON. This will upgrade extended memory from 7680K (780000H).

NOTES:

1. Avoid configuring SW3 so it will result in starting addresses of 768K (C0000H) and 896K (E0000H); these addresses are reserved for system memory use. The "640K" position from Table 12 is ONLY for CS8220-based AT motherboards that split 512KB base and 512KB extended memory on the motherboard.
2. Make sure you have at least 512KB of base memory installed in your system, or your system will not be able to access extended memory space.

Appendix 3: EMS Technical Reference

Applications programmers writing software for the EMS mode on the RAM 3000 Deluxe should refer to the Lotus/Intel/Microsoft (LIM) specification, Version 3.20, released September 1985. Use of this document will facilitate portability to all EMS-compatible expanded memory cards.

A3.1 Expanded Memory Definition

Expanded memory is a bank switching technique that increases the memory capacity of the PC up to eight megabytes beyond the present DOS memory addressing range of 0K-640K (00000H-9FFFFH). A 64KB window (called a *page frame*) is located between the 640K and 960K (A0000H-EFFFFH) reserved area boundaries. The page frame is divided into four contiguous 16KB pages. The EMS mode on the RAM 3000 Deluxe is divided into 128 16KB blocks, totaling two megabytes. By sending commands to the control circuitry on the RAM 3000 Deluxe, the EMM.SYS expanded memory manager can map any one of these blocks into any of the four pages. Refer to the Lotus/Intel/Microsoft (LIM) Expanded Memory Specification (Version 3.20), September 1985 if you need a more detailed explanation of expanded memory.

A3.2 Page Frame Addressing And Register Output

"Paging" is a method of memory mapping that allows a computer to utilize more memory than it can physically address. Paging works because EMS memory divides the physical memory on an EMS board into pages consisting of 16KB each. These pages are subsequently mapped into an address space of the CPU; this address is known as a **window**. By varying the values of the mapping registers, any one of the 16KB physical memory pages on the EMS board can be mapped into the window. The following figure shows how the mapping is completed.

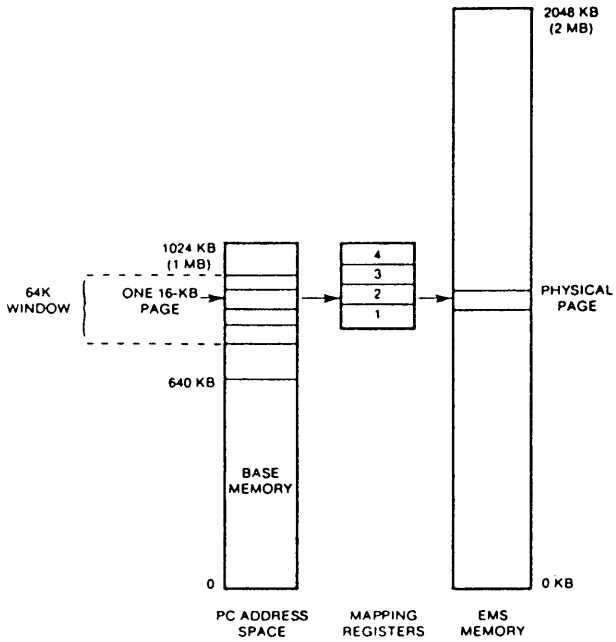


Figure 13: EMS Page Frame Addressing

A3.3 EMS I/O Port Address Selections

EMS uses I/O ports to set up mapping information. These I/O ports are selectable and a number of I/O ports have been reserved for EMS memory. These ports are:

Mapping Registers	Page Frame Registers
02X8: page 1	02X9
42X8: page 2	42X9
82X8: page 3	82X9
C2X8: page 4	

where the variable X is selectable in a range from 0 to E.

The page frame registers determine the starting address of the EMS window in the CPU addressing space, while the mapping registers determine which 16K page of physical memory of the EMS board is to be mapped into the window.

Each RAM 3000 Deluxe has four 16K pages that map into the 64K window, yet at any one time there should not be more than one active page in the same page location within the window. By controlling the MSB of the mapping register, one can enable or disable the corresponding page. As a result, more than one EMS card can be used. According to specification, EMS can support up to 8MB of memory.

A3.4 Mapping Registers

Every page of EMS memory is 16KB in size. By setting the mapping registers to values from 0 to 127, one of the 16KB pages in a two-megabyte EMS memory board can be mapped into the page frame window. With bit 0 to bit 6 accounting for the 0 to 127 range, the last bit (MSB) in the mapping register can be used as an enable/disable flag for that particular page. Each mapping register can handle up to 2 megabytes of EMS memory (16KB x 128 = 2M). Since each page frame is 64K, four such pages can be mapped into the window at any time. These four mapping registers are located in the following addresses:

02X8
42X8
82X8
C2X8

X is the variable selected by dipswitch SW1 and SW2 (EMS I/O port address select). In theory, SW1 and SW2 can select X from 0 to F; but in order to avoid conflicts with other I/O devices, the Everex EMM.SYS device driver will accept only these X values:

0, 1, 5, 6, A, B, E

For those who wish to write their own software to use expanded memory, all 15 values (0 to E) can be used as the X variable as long as the resulting port addresses do not conflict with other I/O devices. The contents of the mapping registers can be read by doing an I/O read from the same address location they were written to.

The following figure represents how the contents of the mapping registers can be used:

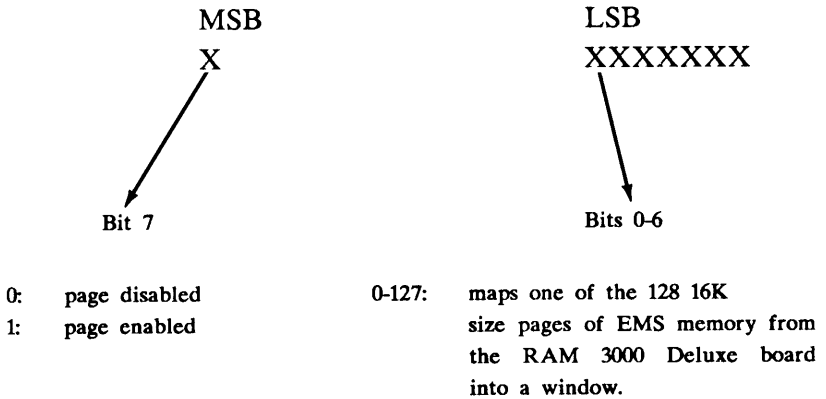


Figure 14: Mapping Registers

A3.5 Page Frame Registers

The page frame registers are used to store the mapping values which determine the starting address for the page frame in the physical memory space of your computer. These registers are write only. Choose one of the eight possible starting addresses by writing different values to the page frame registers. Only bit 7 (MSB) is used to set up these registers. Table 14 gives the values that should be assigned to a particular page frame register with respect to a page frame starting address.

TABLE 14
Page Frame Registers

Page Frame Register MSB			Page Frame Starting Address	
82X9	42X9	02X9		
Where D is bit 7				
D	D	D		
0	0	0	C4000	784K
0	0	1	C8000	800K
0	1	0	CC000	816K
0	1	1	D0000	832K
1	0	0	D4000	848K
1	0	1	D8000	864K
1	1	0	DD000	880K
1	1	1	E0000	896K

NOTE: Bit 0 to Bit 6 are don't cares.

Generally, all EMS boards should have the same values in their page frame registers so that they all use the same 64K window in the physical memory space of a computer. However, if you wish to write your own software, use the page register that best suits your specific applications.

The Everex **EMMSYS** device driver provided to manage EMS memory automatically tries to find a contiguous 64K space between C4000 and F0000 if no user-specified address is supplied (it will set the page frame register accordingly). However, if the page frame software registers are to be set directly with the user's own software, they must be set prior to accessing any of the mapping registers.

NOTE: Writing to the page frame registers will destroy the contents of the mapping registers.

Appendix 4: Regarding the AST PCnet II

If you enable the RAM 3000 Deluxe for EMS mode and also install the AST PCnet II network adapter board, a software conflict will occur involving the use of the interrupt vector 67 (Hex). The **EMMSYS** expanded memory device driver uses this interrupt vector; however, some hardware and software applications (notably the PCnet II board) will use this interrupt vector also. To prevent this conflict from happening, the **EMMSYS** command line in your **CONFIG.SYS** file includes a "/c" parameter so several applications (including the AST PCnet II board) can share the 67 (Hex) interrupt vector.

To ensure the RAM 3000 Deluxe and the PCnet II boards will work together in the same system, you should add the **EMMSYS** command line with the "/c" parameter as the last line in your **CONFIG.SYS** file (see *Section 5.1.1: Installing EMM.SYS* on how to install the **EMMSYS** device driver). However, if you define any special applications in expanded memory space that require a driver in the **CONFIG.SYS** file, be sure the command line for the expanded memory application device driver comes after the **EMMSYS** command line in your **CONFIG.SYS** file.

Appendix 5: If System Boot Fails

If you have set the RAM 3000 Deluxe to upgrade base memory and have installed the board, some AT compatibles may not start up during the bootup process. This is due to the possibility that the chips used for upgrading base memory may be improperly installed or are defective.

If this occurs, remove any other extended memory boards installed in your AT; then set the board's memory starting address to either 1 M (100000H), 1408K (160000H), or 1536K (180000H), depending on the design of your AT motherboard.

Reboot the system; if the SETUP program reports a memory mismatch, inform it of only the base memory already in your system before you install the RAM 3000 Deluxe board. Then run **EV159.EXE** to find the location of any bad chips. Check if the chips are improperly inserted (did you bend or break the chip pins and/or improperly orient the chips?); if the chips are properly inserted, the RAM chips are defective and must be replaced.

Appendix 6: For Extended Memory Users

If you plan to use the RAM 3000 Deluxe in conjunction with an extended-memory only operating system (for example OS/2 and Xenix), please note that you cannot use the **EV159.EXE** configuration and diagnostics program on the RAM 3000 Deluxe software diskette when running these operating systems.

In these cases, we suggest doing the following:

1. Bootup your system with a PC-DOS or MS-DOS Version 3.x system diskette in drive A.
2. Replace the system diskette with the RAM 3000 Deluxe software diskette and run the **EV159.EXE** program to configure and test your board.

This will ensure that the RAM 3000 Deluxe board will work properly when running extended-memory programs.

Addendum
Expanded Memory Manager (EMM.SYS)
Driver to Support EMS Version 4.0

Everex Systems is shipping a new software device driver that recognizes your computer's expanded memory space, and conforms to the new Lotus/Intel/Microsoft (LIM) Expanded Memory Specification 4.0, dated October 20, 1987. The material in this addendum replaces the information in the product manual that refers to the software driver EMM.SYS supporting EMS version 3.20.

The new EMM.SYS device driver that conforms to the EMS 4.0 specification is backward compatible, and can be used with software designed to make use of expanded memory written with EMS 3.2 specifications. The main feature of the new EMM.SYS program conforming to the LIM EMS 4.0 specification is that it recognizes up to **32 megabytes** of expanded memory.

The EMM.SYS program defaults to certain operating parameters when it is loaded. However, you can explicitly reconfigure EMM.SYS for your system by specifying command line parameters within the CONFIG.SYS file. For more details on the EMM.SYS command line, refer to the last section of this addendum called "EMM.SYS Command Line Arguments."

If you have an Everex memory board with model numbers EV-165, EV-165A, or EV-173, you must use the following EMM.SYS command line:

DEVICE = EMM.SYS

If you have any other Everex memory board model numbers, you must use the [port,page] parameter in the EMM.SYS command line as follows:

DEVICE = EMM.SYS [PORT,PAGE]

For the [PORT,PAGE] parameter, type in the port address of the EMS memory, beginning at a specific logical page (indicate the port and page in hexadecimal values). For example, you would type in a command line like the following:

DEVICE = EMM.SYS 258,00

In this example, the port address of the EMS memory begins at 258, with the logical page starting at 00. All of these parameters are explained in more detail in the last section of this addendum called, "EMM.SYS Command Line Arguments."

NOTE: If you have a combination of Everex memory boards, for example, an EV-165 and an EV-158A, you would use the more comprehensive EMM.SYS command line similar to the following:

DEVICE = EMM.SYS 258,00

Installing the EMM.SYS Program

Expanded memory in your computer can only be accessed when it is managed by the expanded memory manager program EMM.SYS. This program is provided on the Everex Systems utility diskette. Most systems have a CONFIG.SYS file of "chores" for the computer to perform automatically every time it boots up. You need to add the line **device = emm.sys** to the CONFIG.SYS file.

1. Insert the Everex Systems utility diskette into floppy disk drive A and type:

```
cd\ [enter]
copy a:emm.sys c:\ [enter]
```

2. We recommend using a line editor or your word processing application program to load the file called CONFIG.SYS; this file is stored in the root directory of your system disk. You need to add the device driver emm.sys into CONFIG.SYS so your expanded memory will always be accessible. If you do not have a line editor or word processing program to modify or create the CONFIG.SYS file, create one now with the DOS command COPY CON CONFIG.SYS.

-
3. Once the CONFIG.SYS file is loaded, add the following line:

For Everex memory boards with model numbers EV-165, EV-165A, and EV-173:

```
device = emm.sys [enter]
```

For Everex memory boards with any other model numbers:

```
device = emm.sys 258,00 [enter]
```

Where 258 and 00 are the port address, and logical starting page of the EMS memory.

4. Save the CONFIG.SYS file and reboot the system. The EMM.SYS program will report the status of the expanded memory in your computer. If everything is operating correctly, a message similar to "Expanded Memory Manager Installed" will be displayed.

Using the DOS COPY CON Command to Create or Modify the CONFIG.SYS File

We recommend using your editor or word processing program to create or modify the CONFIG.SYS file. However, if you do not have an editor or word processing program, you can use the DOS COPY CON command to add the EMM.SYS device driver.

1. Make sure you are in the root directory of your system disk. At the DOS prompt type:

```
cd\ [enter]
type config.sys [enter]
```

If the message "File not found" appears, go on to step 2.

If one or more command lines appear, get a pencil and paper and copy down the line(s) exactly as they appear on your screen.

2. **WARNING:** This step will overwrite any existing config.sys file! At the DOS prompt type:

```
cd\ [enter]
copy con: config.sys [enter]
```

-
3. Type in one of the following EMM.SYS command lines depending upon which Everex memory board you have:

For Everex memory boards with model numbers EV-165, EV-165A, and EV-173 type:

device = emm.sys **[enter]**

For Everex memory boards with any other model numbers type:

device = emm.sys 258,00 **[enter]**

Where 258 and 00 are the port address, and logical starting page of the EMS memory.

4. If you wrote down the contents of a previous config.sys file, type the previous contents back in now.

[F6] **[enter]**

Pressing the [F6] function key and the [enter] key will save your new config.sys file.

5. To confirm that "device=emm.sys" is now in the config.sys file, type: **TYPE CONFIG.SYS [ENTER]**. This command will list the contents of your config.sys file.
6. Reboot your system and the EMM.SYS program will report the status of the expanded memory. If everything is operating correctly, a message similar to

"Expanded Memory Manager Installed" will be displayed.

EMM.SYS Command Line Arguments

Although the command line "device=emm.sys" with its default values is fine for most users, the EMM.SYS expanded memory manager lets you specify certain parameters in the CONFIG.SYS command line. The format of the command line is as follows:

```
device = [\path]emm.sys [/c] [pppp] [port,page]* [/v(:nnn)] [/d] [/h(:nnn)]
```

The [] characters are for your reference only; do NOT type in the [] characters.

* Do NOT use the [port,page] parameter in the command line with Everex memory board model numbers EV-165, EV-165A, or EV-173. In contrast, the [port,page] parameter is NOT optional for all the other Everex memory board model numbers.

Where:

- \path** defines the location of the directory where the EMM.SYS program is stored for those who prefer not to have the program in their root directory. If you would like EMM.SYS in your root directory, omit the **\path** option altogether.
- /c** informs EMM.SYS to chain interrupt vector 67 Hex. If you have another device that uses interrupt vector 67 Hex, such as AST's PC-NET II adapter, include the **/c** option in your command line. The LIM EMS specification defines this vector as a means of performing EMS service calls.
- pppp** informs EMM.SYS to start searching for a page frame at a particular segment address. The page frame is the first valid address of the EMS memory mapping window. If the specified page frame is occupied (for example, by a ROM or a RAM), EMM.SYS will scan starting from the next page frame address for an alternate unused 64 kbyte area. The

search will continue up to, and including, address E000. If the search fails to find an unused 64 kbyte area, a message is printed and the search terminated. Valid page frame addresses are C400, C800, CC00, and D000. The default value is C400.

NOTE: Four additional page frame addresses are available and these are D400, D800, DC00, and E000. However, these four addresses do not work in AT computers whose BIOS and BASIC ROMs occupy address segments below F000.

port,page

communicates to EMM.SYS that an Expanded Memory board is addressable at a given port, beginning at a specific page. Do NOT use this parameter if you have an Everex board model number EV-165, EV-165A, or EV-173. Valid port addresses are 208, 218, 258, 268, 2A8, 2B8, and 2E8. Valid logical page values range from 00 to 7F (HEX).

NOTE: If you have used an Everex memory board to upgrade your computer's system board memory, for example, from 512K to 640K, do NOT

use logical pages 00-07; these pages are used for the memory upgrade. The next available logical page would be 08.

/V:nnn informs EMM.SYS to use the Extended Memory found on the IBM PS/2 2 Megabyte Expansion board and other compatible cards as Expanded Memory. **nnn** is the number of 16 kbyte pages to use for this purpose, with the pages ranging from 1 to 896.

/D tells EMM.SYS *not* to check the default page frame. As a result, the page frame will not be checked for a possible RAM or ROM.

/H:nnn informs EMM.SYS of the maximum number of Expanded Memory handles to support. Using fewer handles reduces the amount of base memory the Expanded Memory Manager will occupy. **nnn** is the number of handles, and ranges from 64 to 255. The default value is 64.

Examples of Optional Command Lines:

1. **DEVICE = EMM.SYS CC00 [ENTER]**

This command line locates the page frame address at CC00. If the page frame address you specify is occupied (for example, by a ROM or RAM), EMM.SYS will scan from the next valid address for an alternate unused 64K area. The search will continue up to (and including) address E000. If the search does not find a valid 64K area, the message "No room on motherboard for page frame" will appear, and the search will terminate.

2. **DEVICE=EMM.SYS D000 2A8, 08 [ENTER]**

This command line begins page frame addressing at D000, selects the EMS port address at 2A8, and assigns the logical EMS starting page at 08H. In this example, we assume that the computer's base memory was 512K, and that the Everex memory board was used to upgrade the base memory from 512K to 640K. In this case, the first 8 logical pages from 00-07 Hex are already being used. Therefore, we assign the EMS memory the next available logical page at 08H.

