

# JRAM

USER'S MANUAL



**TALL TREE SYSTEMS**  
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by Tall Tree Systems

Tall Tree Systems, the brainchild of John Henderson, is a growing company that creates and manufactures both hardware and software for use on the IBM PC, XT, AT and other compatible machines. We focus solely on computers compatible with the IBM Personal Computer and are widely respected as specialists in this field.

Tall Tree Systems welcomes you to the world of high speed computing and megamemory using RAM disks and/or expanded memory. We know that your concern is for efficient, effective computing whether you work in your home, in a small business, or in a large corporation. Every product we make builds upon the last, creating a system with unmatched speed, storage capacity, and flexibility.

**HARDWARE:** We feature JRAM multifunction memory boards. The JRAM boards couple all of the most popular I/O functions - serial ports, parallel ports, and a clock/calendar - with Tall Tree's added dimensions - big memory and first class software. Using both the 64K and the 256K chips, the JRAM has a memory capacity ranging from 512K to 2 Megabytes - in one slot! The JRAM is also a modular multifunction board. You can purchase only those options that you need.

The JDISKETTE controller, which is available either as a module or a stand-alone board, allows you to put 1.2 megabyte diskette drives in the IBM PC or XT for the ultimate in diskette storage and IBM AT compatibility. We also have the JRAM-AT board, a multifunction memory board specifically designed for the IBM AT.

**SOFTWARE:** We have created several software products designed to expand your computer's memory and keep apace of the advancing technology while allowing you to switch memory size easily between the operating system and the RAM disks. In order to meet the changing needs of our users and allow them to customize their systems we keep adding new features to our software:

JETDRIVE provides up to four RAM disks plus JET -- the industry's fastest file transfer program for DOS 2.0 and above.

JFORMAT-2 lets you use quad (96 tpi) and high density diskette drives in a PC or compatible. Put 800 K, 1.2 Mb, or more on one diskette.

JSPool, a redirectable printspooler, works with serial and parallel ports.

One or more of these installable device drivers will work with your system and can be used with local area networks. We include the source code for all of our device drivers to enable you to tailor them to meet your specific needs.

This manual was written by Janet Bein, Bruce Owen, and John Swen.

# JRAM-AT

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## SECTION ONE HOW TO USE THIS MANUAL

### 1.1: "MODULAR" MANUALS

In keeping with our hardware's modular flexibility, we have adopted a system of "modular" manuals. Each manual is made up of numbered sections, which are independently paginated. This allows us to update manuals more frequently. Please note that we have purposely skipped numbers to allow for possible additions to the major parts or divisions of the manual. The Table of Contents lists both the sections you should have received for your particular order, and the sections that go with the piggyback modules and software packages that often accompany our memory boards.

General information regarding the JRAM-AT and possible Modes of Operation is in Section 10. Once you have selected the Mode of Operation that best suits your needs, you can refer to the installation section for that Mode--Section 11A for Mode One or Section 11B for Mode Two.

If you are installing your own RAM, you will find information on how to populate the board and test your memory in Section 12. If you have bought a fully populated board from Tall Tree Systems, there is no need to run the MEMTEST memory diagnostic.

Although information regarding MEMTEST is included with this manual, *you do not need* to run MEMTEST when you install the JRAM-AT as a standard memory expansion card (Mode One). When you use the board in Mode One, the IBM memory diagnostic will test all the memory in your computer, including the memory on the JRAM-AT. Therefore, the MEMTEST program is not automatically packaged with our boards. It is included with the JRAM combo software disk.

If you have any piggyback modules, you will find the necessary information beginning in section 20. Information regarding the JETDRIVE software package begins in section 30; the JSPOOL software package begins in section 40. If you have ordered the JRAM-AT board, you will not receive the sections for JETDRIVE and JSPOOL unless you have also ordered the software package. If you decide to order the software after you have received the board, these sections of the manual will be sent to you together with the distribution diskette. A coupon for the JRAM COMBO disk is included with this manual.

*NOTE: The warranty on our boards has been extended to include unpopulated boards. All our boards are guaranteed for one year.*

## JRAM-AT ERRATA

The JRAM-AT has a new revision of the board. The new board has a switch block in the upper right corner, #U117, (rather than shunts/jumpers) to determine the page and board select. Disregard the directions in the manual for setting shunts P5, P6, and P7, and please refer to the following chart for information on setting Switch Block U117.

CARD #	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	BANK SELECT REGISTER MEMORY ADDRESS
1	ON	-	-	-	ON	-	E800
2	-	ON	-	-	ON	-	E400
3	-	-	ON	-	ON	-	E200
4	-	-	-	ON	ON	-	E100
5	ON	-	-	-	-	ON	F800
6	-	ON	-	-	-	ON	F400
7	-	-	ON	-	-	ON	F200
8	-	-	-	ON	-	ON	F100

### SUMMARY AND PROCEDURE:

To set the board to page 14 (E hex), keep switches 1 and 5 ON, and all the others off.

To set the board to page 15 (F hex), keep switches 1 and 6 ON, and all the others off.

Use the other settings for additional boards. If your first board is set as card #1, set your second board as card #2. If your first board is set as card #5, set your second board as card #6. And so on...

## SECTION TEN

### INTRODUCTION TO THE JRAM-AT

#### 10.1: WHAT IS THE JRAM-AT?

JRAM-AT is a high capacity 16 bit memory expansion and multifunction board designed specifically for the IBM PC AT computer. The JRAM-AT incorporates the traditional Tall Tree features: megamemory and modular flexibility.

#### 10.2: MEGAMEMORY

JRAM-AT can give you up to two megabytes of memory in only one expansion slot, using 256K RAM chips.

Like our other memory boards, the JRAM-AT is capable of handling either 64K or 256K chips. However, unlike our JRAM-2 and JRAM-3 boards, the JRAM-AT does not allow you to mix chips on the same board.

#### 10.3: MODULAR MULTIFUNCTIONS

The JRAM-AT is available with either of the following I/O modules:

- 1) one serial and one parallel port
- 2) two serial ports

#### 10.4 LOWER MEMORY AND EXTENDED MEMORY

The IBM AT can address up to 16 Mb of memory. It divides this memory into two regions: 1) LOWER MEMORY up to 1Mb; and 2) EXTENDED MEMORY above 1Mb.

1) LOWER MEMORY is vital to the computer's operation. It is used for DOS, ROM, and the image and display screen.

1a) BASE MEMORY is the portion of lower memory from zero to 640K, which can normally be used for DOS.

2) EXTENDED MEMORY can be used for extra workspace as a "virtual disk", i.e., a RAM disk. A virtual disk simulates a disk drive and you can use it the same way, except that it works much faster than a hard disk or diskette drive. RAM disk storage, however, is "volatile"--everything on the RAM disk disappears when you turn off the computer. So when you finish your work, you must copy it onto a physical diskette or hard disk.

### 10.5 SPLIT MEMORY ADDRESSING

With the JRAM-AT, you can allocate additional memory to both the lower memory region and the extended memory region. This feature is called "split memory addressing", because there are addresses in between DOS memory and the 1Mb boundary that are dedicated to the display and ROM functions.

If you install more than one JRAM-AT board, only the first one will have to perform this split memory addressing function. Additional boards would be entirely allocated to the extended memory area, since the lower memory region would already be full.

### 10.6: MODES OF OPERATION

You may select to use the JRAM-AT in one of the following modes of operation:

1) MODE ONE: In Mode One, the JRAM-AT functions exactly like an ordinary IBM memory expansion board for the AT. Once you have run IBM's SETUP program, the AT will recognize all the memory on your JRAM-AT.

**You do not need to install any additional software to use the JRAM-AT in Mode One.**

We recommend using Mode One unless you intend to use our JETDRIVE RAM disk, our JSPOOL print spooler, or the MULTILINK multitasking system by Software Link.

2) MODE TWO: This mode allows you to use the "bank switching" capabilities of the JRAM-AT. If you want to use our JETDRIVE RAM disk package or JSPOOL print spooler, or MULTILINK, you must use Mode Two.

NOTE: The JRAM-AT performs bank-switching in 64K blocks. It does not support the *expanded memory specification*. If you want to use EMS software, ask for our JRAM-AT3 board.

If you do select to use the JRAM-AT in Mode Two, you will have to limit your DOS size to 576K.

To use the JRAM-AT in Mode Two, you must install JBOOT.BIN, which is part of our JETDRIVE software package. A discount coupon for JETDRIVE and JSPOOL is included with this manual.

If you are using Multilink, you will not need to purchase the JETDRIVE/JSPOOL software package. Multilink has been licensed to include JBOOT.BIN with their own software.

### SUMMARY COMPARISON OF MODE ONE AND MODE TWO

MODE ONE	MODE TWO
*Use to fill out DOS and extended memory. *Use with VDISK	*Use for DOS plus bank-switching JETDRIVE RAM disk, JSPOOL spooler buffer, Multilink
*Use without JRAM software.	*JBOOT.BIN required.
*P3 connected.	*P3 disconnected.

NOTE: If you wish to install the JRAM-AT for Mode One, please read Section 11A. If you want to install the JRAM-AT for Mode Two, go directly to Section 11B.

3) MODE THREE: This is a highly specialized mode for very particular applications. It allows the computer to

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address "normal" memory with bank "overrides". This technique, which combines modes one and two, will allow JRAM-AT to have both a 640K DOS and bank switching capabilities. The Mode Three bank selection technique is more rigid than the bank switching technique used by JRAM-2, since only specific banks can be assigned to a specific set of addresses. This mode is designed primarily for the use of programmers developing specialized applications. If you wish to use the JRAM-AT card in Mode Three, consult the Tall Tree Systems Technical Support Department (415-964-1397). This manual does not include information on how to use Mode Three.

**10.7: MEMORY OPTIONS**

JRAM-AT can be purchased without any RAM chips installed or with any number of banks up to the full eight. Since the AT is a 16 bit computer, you must populate the board with an even number of banks, i.e., two, four, six or eight banks.

For information on installing RAM and running the MEMTEST memory diagnostic, please refer to Section 12.

You can add a JRAM-AT memory board to your AT whether you have a fully populated 512K motherboard or a 256K motherboard. Simply set the switches on the JRAM-AT board according to the instructions in Section 11A(for Mode One) or 11B(for Mode Two).

**10.8: TECHNICAL SPECIFICATIONS**

Maximum supply currents	+5 volts	+12 volts	-12 volts
JRAM-AT, 512K or 2Mb, no I/O	900 ma	-	-
Serial-Parallel Module	330 ma	13 ma	20 ma
Serial-Serial Module	300 ma	24 ma	42 ma
Maximum total current possible ma'	1230 ma	24 ma	
Maximum access time	150 nanoseconds		
Board length	13.3 inches		
Board height w/o edge terminals	4.5 inches		
Board height with edge terminals	4.75 inches		

RAM required: 64K or 256K chips, not slower than 150 nanoseconds

**SECTION ELEVEN A  
INSTALLING THE JRAM-AT BOARD  
FOR MODE ONE**

**11A.0: INSTALLATION CHECK-LIST**

MODE ONE
*Use to fill out DOS and extended memory.
*Use for VDISK
*Use without JRAM software.
*P3 connected.
I) Prepare computer.
II) Set Switches #1-3. Refer to table.
III) Check Switches #4-7. Only SW7 is ON.
IV) Check P3 connected.
V) Disable the Page Select Shunt. Put P7 on one pin.
VI) Check piggyback module if you have one.
VII) Insert JRAM-AT.
VIII) Close up and plug in.
IX) Run SETUP.
<b>INSTALLATION IS COMPLETE!!</b>

*NOTE: These instructions are for one JRAM-AT. If you have more than one JRAM-AT or if you have other memory expansion cards installed, please refer to section 11A.4.*

**11A.1: INSTALLING THE JRAM-AT FOR USE IN MODE ONE**

**I) Prepare computer.**

Turn off and unplug the computer. Remove the cover, and remove the metal slot cover from the desired expansion slot. Save the screw.

**II) Set switches 1-3 on the JRAM-AT. Refer to Table 11A.1.ii.**

Switches one through three indicate the type of RAM chips on your JRAM-AT board (64K or 256K), the amount of base memory already in your computer, and mode of operation for the JRAM-AT (Mode One versus Mode Two). Set these switches according to the table below, where a "-" indicates that the switch should be off, and "On" indicates that the switch should be on.

Table 11A.1.ii: Mode One Installation

BASE MEMORY	JRAM-AT CHIPS	Switch One	Switch Two	Switch Three
256K	256K	-	On	On
512K	256K	-	On	-
640K	256K	On	On	On
256K	64K	-	-	-
512K	64K	-	-	On
640K	64K	On	On	-

**III) Check Switches #4-10 on the JRAM-AT. Only Switch #7 is ON for the first JRAM-AT.**

Switches four through ten indicate the starting address for the extended memory on the JRAM-AT. On the first board, these switches should always be set to 0001000, that is, only switch seven is ON. For additional boards, see Section 11A.4.

**IV) Check that shunt P3 is connected.**

A shunt (or jumper) is a small black plastic hood that contains a metal contact. It makes a connection between two pins, thereby enabling various options.

Shunt P3 is the lone shunt located below the furthest right column of RAM on your JRAM-AT. When this shunt

is connected, you do not need any additional software to access the memory on your JRAM-AT. The memory is controlled by the hardware.

**V) Disable the Page Select Shunt. Put P7 on one pin.**

The page-select shunt is located at the top right edge of the JRAM-AT. It is labeled P7 (or P6 on prior revisions of the board) and marked for positions E and F.

The purpose of this shunt is to control the JRAM software. You will not be using the JRAM software in Mode One, and there are occasional errors when the Page Select is enabled without JRAM software installed. You should disable P7 by slipping it onto a single pin.

To move the shunt, stick the end of a bent paper clip into the small hole and slide it off the pins. Then slide it onto a single pin to reserve it in case you should ever decide to use the JRAM-AT for Mode Two.

*NOTE: You can disregard the shunt to the left of the Page Select Shunt. This is the Board Select Shunt. The six pins of the Board Select are labeled P5 and P6 (on prior revisions of the board, they may be labeled P4 and P5). The Board Select is irrelevant in Mode One, but it will not interfere with the board's functioning in any way. We suggest that you leave it set as it is shipped in case you should ever decide to use the JRAM-AT for Mode Two.*

**VI) Check the piggyback module if you have one. (The piggyback module is a smaller board that fits on top of the JRAM-AT for additional ports.)**

Make sure the piggyback module is firmly seated into the sockets on your board. See the sections of the manual that deal with your particular module for detailed instructions and information.

**VII) Insert the JRAM-AT.**

Slide the JRAM-AT into the desired expansion slot. Make sure that you plug the edge connector (the gold plated section that projects from the bottom of the board) firmly into the expansion slot connector, and that the board is well seated in the support bracket in the front panel of the computer.

Attach the JRAM-AT's bracket to the rear panel with the screw that held the expansion slot cover in place.

**VIII) Close up the AT and plug it in.**

Replace the cover of the AT and plug in the computer.

**IX) Run SETUP.**

You must run the IBM setup program, so that the computer will recognize the additional memory you have installed. For additional information using SETUP, please see Section 11A.2.

**\*\*\*YOU HAVE COMPLETED THE HARDWARE INSTALLATION!\*\*\***

**11A.2: SETUP WITH THE JRAM-AT IN MODE ONE**

You need to inform the computer that JRAM-AT is installed by inserting some new data in IBM's SETUP program.

**1) Insert the IBM Diagnostics diskette.**

Put the Diagnostics diskette, which you received in your IBM AT *Guide to Operations* manual, into drive A:

**2) Boot up the computer.**

**3) Press F1 and follow the instructions on your screen.**

**4) You will receive a MEMORY SIZE ERROR.**

The screen will show the amount of base memory that was present when you last ran SETUP, typically, either 256K or 512K (that is, the amount of memory on your motherboard). The base memory refers to the amount of memory that you have installed from 0K to 640K. Now that you have installed a JRAM-AT, you obviously have more memory in your computer than you have on your motherboard, and you also have more base memory.

NOTE: The JRAM-AT must completely fill the base memory of 640K before it can allocate any memory to the extended memory region. When you have set the switches as described in the installation procedure, the JRAM-AT will automatically fill base memory to 640K. You are not free to allocate a lesser amount of memory to base memory.

**5) When SETUP asks if the base memory information is correct, type NO.**

**5a) If total memory < 640K, base memory = total memory.**

If the total memory on the motherboard and the JRAM-AT board is less than 640K, enter that amount as the new

amount of base memory.

5b) If total memory = or > 640K, base memory = 640K.

If the total memory on the motherboard and the JRAM-AT board is equal to or greater than 640K, enter 640 as the new amount of base memory.

6) When the screen asks for the amount of EXPANSION MEMORY, enter the total amount of memory on your motherboard and on the JRAM-AT MINUS 640K.

If TOTAL MEMORY MINUS 640K is < 0, enter 0.

Your selection is not limited to the amounts of expansion memory that appear in the table on your screen. Calculate your expansion memory as follows:

```

<#>K TOTAL MEMORY
-640K BASE MEMORY
<#>K EXPANSION MEMORY
    
```

For example,

```

512K motherboard      2560K Total Memory
+2048K JRAM-AT (2Mb) - 640K Base Memory
2560K TOTAL MEMORY    1920K EXPANSION MEMORY
    
```

or

```

256K motherboard      1280K Total Memory
+1024K JRAM-AT (1Mb) - 640K Base Memory
1280 TOTAL MEMORY     640K EXPANSION MEMORY
    
```

EXIT FROM SETUP AND REBOOT.

### 11A.3: INSTALLING VDISK

DOS 3.0 allows you to use a portion of the computer's memory as an electronic disk, that is, a "virtual disk" or "VDISK" for short. An electronic disk is a part of memory set up to simulate a diskette drive. Since the virtual disk operates at electronic speed rather than mechanical speed, it is much faster than a hard disk or floppy drive. However, an electronic disk is limited to temporary storage. When you finish you must copy the contents of the electronic disk onto a physical diskette or hard disk. The contents of the electronic disk will be lost when the computer is turned off. You can find additional information on VDISK in your DOS 3.0 manual.

Extended memory in the AT can be used for a virtual disk. To create a VDISK, simply install VDISK.SYS in a CONFIG.SYS file. A CONFIG.SYS file (for CONFIGure your SYStem) is a file on your system diskette or the root directory of your hard disk (if you boot from a hard disk) that instructs DOS to load any installable device drivers into memory each time you boot up.

First make a copy of your system diskette if you have not already done so. Then put the copy of your system diskette in drive A:. (If you boot from a hard disk, log onto the root directory of your hard disk.)

1) Check to see if you already have a CONFIG.SYS file, by typing:

```
A>TYPE CONFIG.SYS
```

2) If you see the "File not found" message, then you will have to create a new CONFIG.SYS file as described below. If a file is displayed, you will simply type everything in your old CONFIG.SYS, and then add a new line to install VDISK.

3) If you would like a virtual disk of 512K within the

extended memory region, you could use the following CONFIG.SYS. To create a virtual disk of a different size, simply type a different number after VDISK.SYS.

```
A>COPY CON CONFIG.SYS
DEVICE=VDISK.SYS 512/E
<F6> (Screen will show ^Z)
```

The "COPY CON CONFIG.SYS" line tells the computer to create a file called CONFIG.SYS that will contain whatever is typed in from the keyboard (CONsole) until the <F6> key is pressed.

4) If you do not have sufficient memory to create a virtual disk within the extended memory region, you may create a virtual disk within the lower memory region. Simply omit /E from the DEVICE=VDISK.SYS line. For example, to create a virtual disk of 128K within the lower memory region, type:

```
A>COPY CON CONFIG.SYS
DEVICE=VDISK.SYS 128
<F6> (Screen will show ^Z)
```

5) Reboot the computer by pressing <Ctrl><Alt><Del>. This installs everything in CONFIG.SYS and displays a message telling you what is now installed in your system.

**11A.4: INSTALLING MORE THAN ONE JRAM-AT**

**11A.4.0: INSTALLATION CHECK-LIST**

MULTIPLE JRAM-ATs in MODE ONE
I) Note the total memory already installed.
II) Set Switches #1-3. Refer to table 11A.4.ii.
III) Set Switches #4-10. Refer to table 11A.4.iii.
IV) Check P3 connected.
V) Disable the Page Select Shunt. Put P7 on one pin.
VI) Insert JRAM-AT.
VII) Close up and plug in.
VIII) Run SETUP.
<b>INSTALLATION IS COMPLETE!!</b>

**11A.4.1: INSTALLING TWO OR MORE JRAM-ATs**

I) Note the total amount of memory already installed. You must fully populate existing memory expansion boards before adding a JRAM-AT.

You should first note down the amount of memory you already have installed. You will need to know this amount in order to set Switches #4-10.

If you have not yet disassembled your computer, boot it up and write down the amount of memory that appears on your monitor. If your count is not one of the following amounts, you probably have a memory expansion card that is not fully populated. Fully populate your memory expansion card(s) before you proceed.

POSSIBLE COUNT AMOUNTS: 640, 1280, 1536, 1664, 1792, 2048, 2176, 2304, 2560, 2688, 2816, 3072, 3200, 3328, 3584, 3712, 3840, 4096, 4224, 4352, 4608, 4736.

If your computer is already open, count up the RAM on your motherboard and the memory expansion cards you

## Installing Multiple JRAM-ATs for Mode One

have already installed. Fully populate your other memory expansion card(s) before you proceed.

### II) Set Switches #1-3.

Switches #1-3 on the JRAM-AT indicate the address range, mode selection, and the type of chips (64K or 256K) being used.

Table 11A.4.ii: Mode One Switches #1-3  
for Multiple JRAM-ATs

JRAM-AT CHIPS	SWITCH #1	SWITCH #2	SWITCH #3
64K	On	On	Off
256K	On	On	On

### III) Set Switches #4-10.

Table 11A.4.iii: Mode One Switches #4-10  
for Multiple JRAM-ATs

COUNT	Switch Four	Switch Five	Switch Six	Switch Seven	Switch Eight	Switch Nine	Switch Ten
640	-	-	-	On	-	-	-
1280	-	-	-	On	-	On	-
1536	-	-	-	On	On	-	-
1664	-	-	-	On	On	-	On
1792	-	-	-	On	On	On	-
2048	-	-	On	-	-	-	-
2176	-	-	On	-	-	-	On
2304	-	-	On	-	-	On	-
2560	-	-	On	-	On	-	-
2688	-	-	On	-	On	-	On
2816	-	-	On	-	On	On	-
3072	-	-	On	On	-	-	-
3200	-	-	On	On	-	-	On
3328	-	-	On	On	-	On	-
3584	-	-	On	On	On	-	-
3712	-	-	On	On	On	-	On
3840	-	-	On	On	On	On	-
4096	-	On	-	-	-	-	-
4224	-	On	-	-	-	-	On
4352	-	On	-	-	-	On	-
4608	-	On	-	-	On	-	-
4736	-	On	-	-	On	-	On

Switches #4-10 set the starting address for the extended

## Installing Multiple JRAM-ATs for Mode One

**NOTE:** You can disregard the shunt to the left of the Page Select Shunt. This is the Board Select Shunt. The six pins of the Board Select are labeled P5 and P6 (on prior revisions of the board, they may be labeled P4 and P5). The Board Select is irrelevant in Mode One, but it will not interfere with the board's functioning in any way. We suggest that you leave it set as it is shipped in case you should ever decide to use the JRAM-AT for Mode Two.

**VI) Check the piggyback module if you have one.** (The piggyback module is a smaller board that fits on top of the JRAM-AT for additional ports.)

Make sure the piggyback module is firmly seated into the sockets on your board. See the sections of the manual that deal with your particular module.

**VII) Insert the JRAM-AT.**

Slide the JRAM-AT into the desired expansion slot. Make sure that you plug the edge connector (the gold plated section that projects from the bottom of the board) firmly into the expansion slot connector, and that the board is well seated in the support bracket in the front panel of the computer.

Attach the JRAM-AT's bracket to the rear panel with the screw that held the expansion slot cover in place.

**VIII) Close up the AT and plug it in.**

**IX) Run SETUP.**

You must run the IBM setup program, so that the computer will recognize the additional memory you have installed. For additional information on SETUP, Section 11A.2. For information on VDISK, see Section 11A.3.

**\*\*\*YOU HAVE COMPLETED THE HARDWARE INSTALLATION!\*\*\***

## SECTION ELEVEN B INSTALLING THE JRAM-AT FOR MODE TWO

### 11B.0: INSTALLATION CHECK-LIST

MODE TWO
*Use for DOS plus bank-switching JETDRIVE RAM disk, JSPOOL spooler buffer, Multilink
*JBOOT.BIN required.
*P3 disconnected.
I) Prepare computer. Multilink partitions >128K move J18 on motherboard.
II) Set Switches #1-10 on JRAM-AT. A) For 256K motherboard, SW1 and SW7 are ON. B) For 512K motherboard, SW1, SW3 and SW7 are ON.
III) Disconnect Shunt P3.
IV) Check Board Select Shunt (P5 and P6).
V) Check Page Select Shunt (P7).
VI) Check piggyback module if you have one.
VII) Insert JRAM-AT.
VIII) Close up and plug in.
IX) If motherboard memory reduced, run SETUP.
X) Install JBOOT.BIN and other JRAM software.

### 11B.1: INSTALLING THE JRAM-AT FOR MODE TWO

Use Mode Two if you wish to use our JETDRIVE RAM disk, or JSPOOL, or some multi-tasking application such as Multilink by Software Link.

**NOTE:** If you select Mode Two, you will be limited to 576K of DOS.

**I) Prepare computer.**

Turn off and unplug the computer. Remove the cover, and remove the metal slot cover from the desired expansion slot. Save the screw.

\* If you plan to use the JRAM-AT with Multilink and you have a 512K motherboard, you will probably want to adjust shunt J18 on your motherboard to disable 256K of the motherboard memory. This is necessary if you intend to use background partitions that are greater than 128K each.

J18 is located close to the front panel of your computer underneath the diskette controller board. You may have to lift up your diskette controller board in order to see it.

Move the shunt to position 2 & 3 (toward the rear). This step frees a block of addresses so that Multilink can create background partitions of up to 384K. (If you do not have an IBM AT, consult your computer's manual to see if and how you can disable some of the motherboard memory.)

**II) Set Switches #1-10 on the JRAM-AT.**

**A) For 256K motherboard, SW1 and SW7 are ON.**

If you have moved shunt J18 to disable 256K from the motherboard, set the switches for a 256K motherboard.

**B) For 512K motherboard, SW1, SW3 and SW7 are ON.**

In Mode Two, the switch settings differ only on the basis of the motherboard size. JBOOT.BIN automatically distinguishes the type of RAM chips on your JRAM-AT (64K or 256K). Use the same switch settings for one or more JRAM-ATs.

*Note: If you do not have an IBM AT, and your computer has a different size motherboard, you may call our Technical*

Support Department (415)964-1397 for the appropriate setting for your system.

**III) Disconnect Shunt P3.**

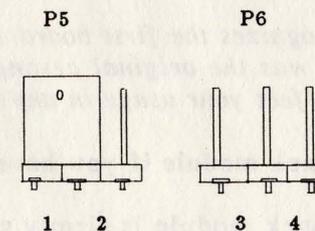
A shunt (or jumper) is a small black plastic hood that contains a metal contact. It makes a connection between two pins thereby enabling various options.

Remove shunt P3 from the JRAM-AT board. This shunt is located just below the bottom right hand RAM socket on the JRAM-AT. When it is installed, it controls "dialed-in" memory on the JRAM-AT. It does not permit bank-switching. We suggest slipping the shunt connector onto just one of the pins for possible future use.

**IV) Check the Board Select Shunt (P5 and P6). For the first JRAM-AT, leave shunt as shipped in position 1.**

The six pins of the board-select shunt are located at the top right edge of the JRAM-AT board. One black shunt connector serves all six of these pins. Positions one through four are marked on the board just below the shunts. The latest revision of the board labels these shunts P5 and P6. On prior revisions of the board, they may be labeled P4 and P5. In either case, the position numbers one through four are marked on the board.

Figure 11B.1.iv: Board-Select Shunt Shown in Position One



The JRAM-AT comes with the board select shunt set for one board. Leave the shunt on your first board as it is in

the number one position.

You will have to move the board-select shunt on additional JRAM-AT boards.

*(If you have memory expansion cards other than JRAM-AT, their presence will not affect the board select. You may leave the board select and page select set for one board).*

Move the shunt on the second JRAM-AT to position two, the shunt on the third JRAM-AT to position three, and the shunt on the fourth JRAM-AT to position four. Leave the shunt on your fifth board in position one. Move the shunt on your sixth board to position two, and so on.

**V) Check the Page Select Shunt (P7). Leave (P7) in position "F" for the first four JRAM-ATs.**

If you have five or more boards, you should move the page-select shunt, which is labeled P7 (or P6 on prior revisions of the board) and located to the right of the board-select shunt.

Shunt P7 comes set for one to four boards in position "F". For your fifth and subsequent boards, move shunt P7 to position "E". We are shipping boards set to the "F" page to be consistent with our other current JRAM boards. In the AT, both page "E" and "F" are occupied by ROM, but in the PC and XT, users may find it convenient to have page "E" left free as a possible swapping page.

*NOTE: MEMTEST recognizes the first board set to page "F" as card #5, since that was the original arrangement for the boards. This will not affect your usage in any way.*

**VI) Check the piggyback module if you have one.**

Make sure the piggyback module is firmly seated into the sockets on your board. See the sections of the manual that deal with your particular module for details.

**VII) Insert the JRAM-AT.**

Slide the JRAM-AT into the desired expansion slot. Make sure that you plug the gold plated sections that project from the bottom of the board firmly into the motherboard, and that the board is well seated in the support bracket in the front panel of the computer.

*NOTE: The two gold edge connectors on the bottom edge of the JRAM-AT are the identifying mark of the JRAM-AT board. The Memtest diagnostic requires that you indicate which board you have installed and the documentation refers to these two gold edge connectors as the identifying marks of the JRAM-AT, but at that point you will already have the board installed and your computer closed up.*

Attach the JRAM-AT's bracket to the rear panel with the screw that held the expansion slot cover in place.

**VIII) Close up the AT and plug it in.**

If you have disabled 256K of your motherboard memory, run SETUP and specify 256K of base memory, as described in section 11B.2. To use your JRAM-AT board, you will have to install JBOOT.BIN. This program is part of our JETDRIVE package and is also included with Multilink. See the JETDRIVE/JSPOOL sections of this manual for detailed information on these programs.

**IX) If you reduced the motherboard memory, run SETUP and specify 256 for base memory.**

See Section 11B.2 for details.

**X) Install JBOOT.BIN (obligatory) and other JRAM software (optional).**

When shunt P3 is removed, the memory on the JRAM-AT is controlled by the software. You must install JBOOT.BIN

in order to use the JRAM-AT in Mode Two.

You may also wish to install our JDRIVE RAM disk and JSPOOL spooler buffer at this point. For detailed information on JETDRIVE and JSPOOL, please refer to the JETDRIVE and JSPOOL sections of the manual.

1) First make a copy of your system diskette. Copy JBOOT.BIN and any other programs that you wish to install to your boot diskette or the root directory of your hard disk.

2) Put your copy of your boot boot diskette in drive A: and log onto A:, or log onto C: if you boot from your hard disk. Type:

```
A>TYPE CONFIG.SYS
```

2a) If you see a file displayed, then you already have a CONFIG.SYS file, and you will have to edit the file (You can edit a CONFIG.SYS file with Wordstar.), or rewrite it to include both JBOOT.BIN and the lines you already have. If you would like to save your old CONFIG.SYS as a backup, use the DOS command REN to rename your old file, for example:

```
A>REN CONFIG.SYS CONFIG.BAK
```

See your DOS manual for further details.

*NOTE: JBOOT.BIN must be the first item listed. If you already have a CONFIG.SYS file, move or retype the lines you already had after the JBOOT.BIN line. Please note that the JRAM-AT requires an additional parameter after JBOOT.BIN. The /S=9B parameter moves the swapping page for JBOOT.BIN to the ninth bank of addresses, so that it has access to the AT's 16-bit data bus. Since you are moving JBOOT.BIN to the ninth page, you must limit your DOS to a*

maximum of 576K.

2b) If you see the message "File not found", then you do not have a CONFIG.SYS file, and you will have to create one from scratch. To create a CONFIG.SYS file, type:

```
A>COPY CON CONFIG.SYS <ENTER>
```

The COPY CON line tells the computer to create a file called CONFIG.SYS that will contain everything you type in from the CONsole until you press <F6> or Ctrl Z.

### CONFIG.SYS FOR JBOOT.BIN AND A RAM DISK

A typical CONFIG.SYS file might allocate 512K to DOS and leave the rest of the memory for a RAM disk. If you would like a similar configuration with a different memory allocation, simply substitute a different multiple of 64K after JBOOT.BIN.

For example, type:

```
DEVICE=JBOOT.BIN 512K /S=9B <ENTER>
DEVICE=JDRIVE.BIN <ENTER>
<F6> <ENTER>
```

This CONFIG.SYS file allocates 512K to DOS and leaves the rest of the memory to a single RAM disk. For other possible configurations, consult the JETDRIVE sections of this manual.

### CONFIG.SYS FOR MULTILINK

If you wish to use the JRAM-AT with Multilink, you must use two parameters after JBOOT.BIN as follows. Use /S=9B as described above, plus -D to avoid conflicts between Multilink and JBOOT.BIN.

For example, if you would like to create a foreground partition of 256K, leaving rest of your JRAM-AT memory available for background partitions, you could use the

following example. If you would like a different size foreground partition, simply substitute a different <#>K after JBOOT.BIN. You can specify any of the following sizes for the foreground partition: 256K, 320K, 384K, 448K, 512K, or 576K. The actual usable size of the foreground partition will be 60K to 75K less than the specified value, due to the memory resident portions of DOS, Multilink overhead, and any memory resident programs installed before calling Multilink.

```
DEVICE=JBOOT.BIN 256K /S=9B -D <ENTER>
<F6> (Screen will show ^Z) <ENTER>
```

If you have the JRAM combo disk, you can also create up to four RAM disks, as described in the JETDRIVE sections. These RAM disks will be available from every partition, just like your physical drives. You must specify a size for the last RAM disk, so that there is memory left over for background partitions.

### 11B.2: SETUP WITH THE JRAM-AT IN MODE TWO

You do not need to run SETUP to use Mode Two unless you have disabled 256K of your motherboard memory by moving shunt J18. If you have reset shunt J18, you must run SETUP to indicate the reduced amount of base memory.

#### 1) Insert the IBM Diagnostics diskette.

Put the Diagnostics diskette, which you received in your IBM AT *Guide to Operations* manual, into drive A:.

#### 2) Boot up the computer.

#### 3) Press F1 and follow the instructions on your screen.

#### 4) If you have changed shunt J18, you will receive a MEMORY SIZE ERROR.

The screen will show the amount of base memory that was present when you last ran SETUP, which should be 512K since that was the amount of memory you had in your motherboard.

#### 5) When SETUP asks if the base memory information is correct, type NO.

#### 6) Your base memory = 256K.

The amount of base memory in this mode should be the amount of memory on the motherboard. Since you have reduced the amount of memory that the computer can recognize on your motherboard by moving shunt J18, type 256 as the new amount of BASE MEMORY.

#### 7) EXPANSION MEMORY = 0

When SETUP asks for the amount of EXPANSION MEMORY, enter 0.

SETUP refers here to the amount of extended memory. In Mode Two, you will be using bank-switched memory rather than extended memory. All the memory above your motherboard will be handled exclusively by JBOOT.BIN.

*NOTE: Since you have no "extended memory", you will not be able to use IBM's VDISK except within DOS. Instead, you should use the JDRIVE RAM disk, which has several more desirable options. Please refer to the JETDRIVE sections in this manual for further information on installing and using the JDRIVE RAM disks.*

## SECTION TWELVE RAM INSTALLATION AND MEMTEST MEMORY DIAGNOSTIC

### 12.0: INSTALLING OR ADDING YOUR OWN RAM

You may buy the JRAM-AT without RAM chips and install the RAM chips yourself. You can also order the board only partially filled and add RAM chips later as your needs grow. But be aware of this: when you buy a populated JRAM board, all the RAM is thoroughly tested before the board is shipped out. We have found that many memory related problems occur due to improper insertion of RAM chips or a bad batch of RAM.

You cannot mix 64K and 256K chips on the JRAM-AT board.

If you do buy your own RAM, we recommend the plastic chips, which are cheaper than ceramic chips and more compatible with our boards. We have also found best results when the board is populated with the newest possible chips of the same date code. The date code is printed on each chip by year and week. For example, 8525XXX signifies that the chip was manufactured in the 25th week of 1985. If you wish, you may contact our Customer Service Department for some chip brands that we are currently using in our boards.

### 12.1: FILLING ONLY PART OF THE BOARD

You do not have to fill the whole board, but you do need to fill the board with an EVEN NUMBER of banks. You must install the chips in a particular pattern. Follow pattern 12.1.A unless you are using 64K chips with a 256K motherboard. If you are using 64K chips with a 256K motherboard, follow pattern 12.1.B.

**PARTIALLY POPULATING JRAM-AT/PATTERN 12.1.A**

Starting with the vertical column furthest to the right (labelled U64-U72 at the top of the board), you must insert the banks in pairs as follows:

**USE WITH 512K MOTHERBOARD**

U1-9	U10-18	U19-27	U28-36	U37-45	U46-54	U55-63	U64-72
4	3	2	1	4	3	2	1

In other words, if you choose to fill the board with two banks of RAM, you would have to insert those banks in the two columns specified as #1 (labelled U64-U72 and U28-U36) and so on.

**PARTIALLY POPULATING JRAM-AT/PATTERN 12.1.B**

USE WITH 256K MOTHERBOARD & 64K CHIPS ON JRAM-AT

U1-9	U10-18	U19-27	U28-36	U37-45	U46-54	U55-63	U64-72
4	1	2	3	4	1	2	3

*NOTE: You must fully populate the memory expansion boards that you have already installed before adding another JRAM-AT.*

**12.2: INSERTING RAM CHIPS**

Each RAM chip **MUST** be inserted so that the small semi-circular notch on one end of the chip is over the small semi-circular groove on one end of the socket. This groove is marked in white on the JRAM-AT board itself, to remove any possible doubt.

Insert the chips gently by lightly resting the row of pins further away from you in the socket and carefully pressing the chip toward them until the row of pins closer to you can set down onto the contacts. Then push the chip

straight down and seat it firmly in the socket.

After inserting your RAM chips, go back and inspect each one for pins bent under the chip or outside the socket. If you find a bent pin, pull the chip out by gently working a small screwdriver under it, straighten the pin, and carefully reinsert it correctly.

RAM chips are MOS devices, and like all MOS devices, they are subject to damage by static electrical discharges.

You should always assume that your body is carrying a static charge, and carefully discharge yourself by firmly touching a grounded metal surface such as the chassis of the computer before handling your RAM chips.

**12:3 MEMTEST****12.3.0 MEMTEST AND THE JRAM-AT**

If you are experiencing "bad JRAM" messages or other memory errors, you may run MEMTEST to help pinpoint a bad chip. We do not advise running MEMTEST as part of the normal routine. If you have set up the JRAM-AT for Mode One, the IBM memory diagnostic will test the memory on the JRAM-AT when you boot up. If you have set up the JRAM-AT for Mode Two, JBOOT.BIN will test all the memory on the JRAM-AT when you boot up.

If you do wish to use MEMTEST, you must configure the board for Mode Two and install JBOOT.BIN.

MEMTEST is designed to identify a single bad chip rather than a whole bank. However, the 16-bit data bus causes an echo effect, so when MEMTEST is used with the JRAM-AT it indicates two chip numbers for a single bad chip. The pattern of the echo effect coincides with the pattern used for populating the board. It is probably easiest to replace the two chips that are indicated. If you prefer, you can replace only one of the pair. Note the IC number of the chip that you replace, and run MEMTEST again. If you continue to get a bad chip error, simply replace the other chip.

The IC numbers are marked on the boards at the top of each bank. For example, column U1-9 includes IC numbers 01-09.

NOTE: We have found that MEMTEST has better results with the JRAM-AT when JBOOT.BIN is installed.

**12.3.1: STARTING MEMTEST**

- 1) If you have been using RAM disks, first save everything from your RAM disks onto a physical diskette, because MEMTEST destroys everything in memory.
- 2) Copy the MEMTEST.COM file from your Tall Tree Systems distribution diskette onto a system diskette if you have not already done so. Put your distribution diskette safely away.
- 3) Then put the copy into drive A: and type:

A>MEMTEST<ENTER>

The program will instruct you to enter the necessary information, but some of the terms are idiosyncratic to MEMTEST. We suggest that you briefly read through this section before you continue.

=====

\*Enter # of Banks of Non-JRAM Memory (1-9):

This refers to the memory that you have on your motherboard plus the memory you might have on any other non-JRAM expansion card.

Memtest uses the word "bank" here to indicate 64K bytes. If you have 640K (10 banks) or more, you should use the hex equivalents of the numbers.

IF TOTAL NON-JRAM MEMORY = 256K, ENTER <4>.

IF TOTAL NON-JRAM MEMORY = 512K, ENTER <8>

IF TOTAL NON-JRAM MEMORY = 640K, ENTER <A>

=====

\*Enter swapping page 9=640K A=704K D=896K

FOR THE JRAM-AT, SELECT SWAPPING PAGE <9>.

=====

=====

\*Enter type 0=JRAM, 1=JRAM-2A, 2=JRAM-2B or JRAM-3, 3=JRAM-AT

MEMTEST lists various models of our JRAM memory boards. The two gold fingered connectors on the bottom of the board, which we pointed out in the installation section, identify the JRAM-AT. ENTER <3>.

=====

**12.3.2: MEMTEST PRELIMINARY REPORT**

- 1) After you have entered your answers to these three

prompts, you should receive a preliminary report. The screen should display the following message:

**Testing for JRAM banks**  
The following banks were found ...

This message should be followed by a complete listing of your JRAM boards with card number(s), segment number(s), bank number(s), type of chip and a series of address numbers.

If the Preliminary Report indicates an accurate number of banks (i.e., the same number of banks that you have populated on the board) followed by a series of 0's, this means that no bad banks were found on the first run-through.

\*Press the carriage return to start the diagnostic for a thorough check of the memory.

You will have to wait between 10 and 20 minutes (depending on how much JRAM memory you have installed) while the diagnostic runs through a complete cycle.

\*If the memory checks out okay, you will see a single asterisk appear on your screen. Each time it runs through the cycle, another asterisk will appear as long as no bad memory is found. You may also see occasional periods.

\*If any bad memory is found, an IC number will appear at the far right of the line. Because of the echo effect in the AT, you will receive two IC numbers for any single bad chip.

\*It is usually sufficient to run the diagnostic for a half hour per half megabyte of RAM. But if you want to be sure to have a thorough and complete test of the memory, let it run longer (even overnight).

The diagnostic will continue to run indefinitely until YOU STOP IT BY PRESSING <Ctrl C>.

2) This listing is a preliminary report. If you do not receive any list of banks found, please call our Technical Support Department (415)964-1397. For example,

2a) call Technical Support if you see

**Testing for JRAM banks**

*without any list.*

2b) or if you received no listing before the message

**JRAM Memory Diagnostic Running.....**

This message should only appear *after* the preliminary report listing the number of banks found.

3)If the initial report does not indicate an accurate number of banks, chances are that you have a bad chip or a badly stuffed chip in one or more of your banks.

3a)Press <1> to add a bank. DO NOT PRESS THE CARRIAGE RETURN AFTER THE ONE. If you do press the carriage return at this point, MEMTEST will ignore the missing bank and start testing the RAM on the other banks. If you do press the carriage return inadvertently before you have added the missing bank(s), press <Ctrl C> to abort the program and start MEMTEST again.

3b)After you have pressed the carriage return, you will receive some additional prompts, which are relatively self-explanatory.

3c)When the program asks for which segment to use, select a segment that was not on the list that appeared in the

initial report. For example, you could enter D.

3d)The program will then ask you to enter <1> if you have 256K chips. If you have 64K chips, just press carriage return.

3e)The screen will display a list of banks similar to the initial report except that it will have added the additional bank that you requested. Now press the carriage return to start the diagnostic.

### 12.3.3: READING THE PRELIMINARY REPORT/ERROR MESSAGES

#### 1)"bank"

1a)In the Preliminary Report, MEMTEST refers to the physical banks of chips on your JRAM board.

1b) MEMTEST numbers the eight JRAM banks 0 - 7 starting with the bank to the furthestmost left of the board, that is, the bank furthest from the logic section).

*This is just the opposite of the way that JBOOT numbers the banks! JBOOT numbers the banks starting with the bank to the furthestmost right, starting with the bank closest to the logic section of the board.*

1c) Check to see if the number of banks listed corresponds to the number of banks you have populated. If there are less banks listed than you have populated, this indicates a memory error. Press <1> to add a bank as described above.

#### 2)"card"

2a) If you have left the Page Select Shunt (or switches if you have a JRAM-3 or JRAM-AT3) set as shipped to page "F", MEMTEST will refer to your first board as card #5. This page setting is for purposes of consistency with our other boards and will not interfere with your card's

functioning in any way.

#### 3)"seg"

3a) If you see a zero after "seg", this indicates a memory error. Check the rest of the line for further error messages.

3b) If the preliminary report does not list all the banks you have populated, you will be able to add a bank, which may help to pinpoint the problem. To add a bank, you will have to select a segment that has not appeared on the original list.

#### 4)"64K" "256K" or "1 bit"

4a)Beside the column of banks, you should see another column indicating the type of chips you have used to populate the board, either "64K" or "256K". If you see "1 bit" instead, this indicates a memory error. Check the rest of the line for further error messages.

#### 5)zeroes

Beside the column listing the type of chip, you should see a couple of columns that are typically all zeroes.

The column immediately next to the type of chip shows the pass count and error center for each bank.

The following column usually has 8 zeroes followed by a slash and another zero. These digits reflect the bits in the bank. If you see any "ones" instead of "zeroes", this indicates a memory error. Check the rest of the line for further error messages.

### 12.3.4: CONTINUING THE DIAGNOSTIC

After you have pressed the carriage return, the screen will begin to scroll repetitively. Stop the screen by pressing

## MEMTEST

Ctrl S, and look at the far right of the line for the IC number. This is the most significant error message.

For other possible error messages, see Section 12.3.3 above.

*NOTE: If you have more than one JRAM board in your computer, you can use MEMTEST to test them all at one time. But if you find a bad chip, you must test the board that you suspect is faulty by itself, with the board select shunt set to one. AFTER YOU HAVE FINISHED MEMTEST, BE SURE TO REBOOT YOUR COMPUTER.*

## SECTION FOURTEEN HOW JRAM BOARDS WORK

### 14.1: INTRODUCTION: WHAT JRAM BOARDS DO

In the IBM PC and IBM XT, the microprocessor has direct access to one megabyte of memory.\* This means that there are roughly one million "locations" for the computer to put data in or read data from. Each location holds one byte of data, and each location has a unique address. To read or change the contents of any particular memory location, the computer simply specifies which of the one million addresses it wants to deal with, and then reads from or writes to that location.

\*The IBM AT can access 16Mb of address space, but actually the extra 15Mb of memory functions much like the "limbo" area used by the JRAM-2 in the PC and XT. In the AT, you are still limited to 640K DOS, but you can use the additional memory for IBM's own electronic disk, VDISK.

In fact, not all of these one million addresses are really available for use. Large blocks of memory addresses are reserved for special purposes, such as holding information used by the monitor screen or holding programs used to boot the computer when you first turn it on. When you subtract all the reserved addresses from the one million possible addresses, you are left with 640K addresses that are available for programs to use.

640K addresses sounds like enough, but it often turns out to be a real limitation. One reason that people use floppy diskette and hard disk drives is to make more storage available to the computer. Unlike addressable memory, however, these forms of storage involve mechanical devices that are very slow by the computer's standards.

JRAM offers a different way to get around the addressable memory limit. JRAM boards use a special, flexible addressing method that lets a very large number of memory locations share the limited number of addresses. With JRAM boards, you can have the storage

capacity of diskette or hard disk drives, without sacrificing the speed of electronic memory.

#### **14.2: HOW IT WORKS: AN OVERVIEW**

The one million addresses that identify memory locations are commonly thought of as being divided into sixteen "pages". Each page has 64K addresses. The sixteen pages are numbered (in hexadecimal) 0 through F.

Most data stored in addressable memory actually resides in electronic devices called RAM (Random Access Memory) chips. These RAM chips are, in turn, organized into "banks" of nine chips each. With the most common type of RAM chip, each bank holds 64K memory locations.

In memory other than JRAM, the memory locations in each bank of RAM chips are permanently set to respond to a particular page of addresses. A physical switch near the RAM banks specifies which page of addresses will access which RAM bank. If there is one bank (64K) of RAM chips on the computer's "motherboard", then the memory locations in those chips will be set to have the first page of memory addresses. The memory locations in the second bank of RAM chips will have the second page of memory addresses. When all the pages of memory addresses have been used up, you cannot add any more RAM banks. That is all you can have.

JRAM boards are different. Unlike an ordinary memory bank, each bank of a JRAM board's RAM chips can be made to answer to any page of addresses, or not to answer to any address at all. You can make any desired bank appear in or disappear from any address page with a single command.

This flexibility is what makes JRAM boards so powerful.

You can have up to sixteen megabytes of JRAM RAM banks hanging in limbo with no addresses at all. But when you want to read from or write to any of those banks, you simply command it by its code to appear at a convenient

page of addresses, and it is available for use. When you are through, you can send the bank back into limbo and call up another one. When you call the first one back, whatever you stored in it will still be there, completely unaffected by its temporary stay in the twilight zone.

The JRAM combo disk software comes with an installable device driver, JBOOT.BIN, which sets up the JRAM banks and keeps track of what is stored in them. This software package also includes JDRIVE.BIN, which can make some of the RAM memory simulate a diskette drive. This simulated disk is called a RAM disk or electronic disk, and for most applications it is the most convenient and useful way to take advantage of the large RAM memory made possible by JRAM's flexible bank addressing scheme.

There are, however, other ways to use JRAM's flexible bank switching capabilities. A PC using JRAM boards could have several programs effectively running simultaneously, each in a block of JRAM memory being switched in and out of address space by a special multi-tasking program. Graphics or animation programs could have megabytes of stored images, all available instantly in any address page with a single command, and with no distracting reading-in process to show on the screen.

To use JRAM memory in ways other than as an electronic disk, you have to buy or write special software to control the bankswitching. The next sections cover the details of controlling the JRAM banks. If you are familiar with assembly language programming, you may want to try controlling your JRAM memory yourself.

#### **14.3: THE NITTY-GRITTY: THE BANK SELECT REGISTER**

On every JRAM board there is a special RAM chip called the bank select register. The contents of the bank select register control which RAM banks on the JRAM board appear at which address pages, and which do not answer

to any addresses at all.

When you installed your JRAM board, you set the board select shunt. If you installed more than four boards, you set a second shunt. These shunts established the address of the bank select register on each JRAM board. Between these two shunts, there are eight possible bank select register addresses, allowing up to eight JRAM boards to be installed in one computer. Here are the eight bank select register addresses:

Board	Board select shunt position	Page select shunt position	Bank select register address
1	1	E	E800:0000
2	2	E	E400:0000
3	3	E	E200:0000
4	4	E	E100:0000
5	1	F	F800:0000
6	2	F	F400:0000
7	3	F	F200:0000
8	4	F	F100:0000

Each bank select register has just a single address. We will see later how the sixteen memory locations can be written to individually.

The JRAM installation instructions currently have you set the bank select registers' addresses to begin in page F. This is purely a matter of convenience. Any order or combination of bank select register addresses will work equally well. If you intend to use page E as memory space (in the PC or XT), for example, you can set your bank select registers to have addresses in page F, where you will not inadvertently write to them while using page E.

Pages E and F are both reserved for ROM, although the PC comes with ROM installed only in page F. The reason that the bank select registers can have addresses in these pages has to do with their special function and the fact

that pages E and F are reserved specifically for ROM only.

Unlike ordinary RAM chips, the bank select registers cannot be read. They do not respond to read commands when the computer calls out their addresses. There is no way for the computer to check the contents of the bank select register. The only thing that ever gets to see the contents of a bank select register is the logic circuit on the JRAM board that uses the data stored in the bank select register to determine which bank of RAM on the board will respond to which page of addresses.

Because the bank select registers cannot be read by the computer, they do not interfere when the computer reads the ROM installed at the same addresses. Likewise, because pages E and F are reserved specifically for ROM, the computer can write data to the bank select registers' addresses without affecting the data stored in ROM at those addresses. It is impossible to write new data into ROM. So, even though the computer attempts to write new data into both the bank select register and the ROM installed at the same address, only the bank select register actually gets written into.

Each bank select register has sixteen memory locations, each of which effectively holds four bits, or a single hexadecimal digit. The sixteen memory locations are numbered 1 through F (hexadecimal), and they represent the sixteen pages of the address space. The hexadecimal digit stored in each location indicates which RAM bank on the board will respond to addresses in the page represented by that location. Each bank on a JRAM board has a one-digit identifying code. So, for example, if the bank select register's memory location A contains the code 4, then the bank code-named 4 is set to respond to addresses in page A.

If several bank select register memory locations contain the same bank code, then that bank will appear at several

different address pages. On the other hand, since each location can only hold a single bank code, the only way to make two banks appear at the same address page is to put valid bank codes into the same bank select register location on two different boards. Incidentally, making two banks appear in the same address page in this way, or having a JRAM bank appear at an address page already occupied by an ordinary RAM or ROM bank, will result in either meaningless scrambled data, or the slightly corrupted contents of only one of the competing banks appearing when the computer tries to read the shared addresses. Fortunately, the contents of the banks are not damaged, and they can be used again as soon as they are assigned to different address pages.

Here are the codes for the eight RAM banks on each JRAM board, from left to right:

D, C, 9, 8, 5, 4, 1, 0

#### 14.4: WRITING TO THE BANK SELECT REGISTER

We saw in the previous section that the bank select register on each JRAM board has a single unique address. In order to write a bank code into a particular bank select register memory location, you specify which location you want in the **data** you write to the bank select register's address.

Specifically, you "write" two hexadecimal digits to the bank select register's address, even though each memory location can only hold one digit. The first digit is the desired bank code. The second is the address page at which that bank is to appear. Some tricky circuitry on the JRAM board splits off this second digit and uses it to determine into which of the sixteen memory locations in the bank select register to write the first digit. For example, if you want the first bank on the second JRAM board to appear at address page 9, you write D9 (where D is the code for the first bank, and 9 is the desired address

page) to E400:0000 (the address of the bank select register on the second JRAM board).

This is the "Appear" command. To summarize, the syntax of the "Appear" command is:

Write: <bank code><desired address page>  
To: <bank select register address>

If you are writing an assembly language program to control JRAM banks, you do this with a MOV command. In BASIC, you use a POKE statement. Or, you can write directly to a bank select register by using DEBUG.

The "Appear" command is complemented by the "Disappear" command. In order to send a JRAM bank back into no-address limbo, you write an invalid bank code over the code of the bank you want to send into limbo. There are eight valid bank codes (D, C, 9, 8, 5, 4, 1, 0), which leaves eight invalid bank codes (F, E, B, A, 7, 6, 3, 2). Any one of these invalid codes will do.

The syntax for the "Disappear" command is:

Write: <invalid bank code><address page to be emptied>  
To: <bank select register address>

You may want to try switching some JRAM banks by using DEBUG to write to the bank select registers.

A few cautions are in order. Remember that you generally do not want to make two JRAM banks, or a JRAM bank and an ordinary bank, appear in the same address page. You will not be able to successfully read either bank. However, you will be able to write to both banks simultaneously, if for some strange reason you want to load multiple banks with identical data.

Also, you do not want to put a JRAM bank in page E (unless you have set your bank select register addresses to page F), because sooner or later you will inadvertently write to the bank select registers and send some or all of your JRAM banks unpredictably into limbo or other address pages.

If you put a JRAM bank in page B, it will be overwritten by the monitor control system. This will usually not affect the display, but it wipes out the contents of the JRAM bank.

Finally, if you booted up with JBOOT.BIN in your CONFIG.SYS file, remember that JBOOT initially fills any empty address space up to page 9 with JRAM banks. Before you command another bank into one of these pages, send the first one into limbo. And before you do that, realize that the DOS programs reside in part of DOS memory. If you have only a few banks of non- JRAM memory installed, some of DOS is probably stored in your lower JRAM banks. If you command these banks into limbo, you will lose part of DOS and probably lose control of your computer.

Of course, you can always reboot, or cold boot if necessary.

#### 14.5: INITIALIZING JRAM MEMORY

When you first turn your computer on, the bank select register (like any other RAM) comes on containing random data. To prevent JRAM banks from appearing in random address pages and possibly crashing your machine, each JRAM board comes in the "board disabled" state. In the "board disabled" state, no banks on the board can appear in address space, regardless of the contents of the bank select register. Your initializing program (or ours, JBOOT.BIN) first writes "disappear" commands to every location in each bank select register, then enables the board. This procedure overwrites all the potentially dangerous random data in the bank select register. You

can also disable any JRAM board yourself by issuing the "board disable" command.

To disable a JRAM board, write a command to the bank select register's address segment **plus one**. For example, to turn off the first JRAM board, you might write D9 to E801:0000. If you are initializing the JRAM board, it will already be disabled. The board will remain disabled as long as the commands you write to it are sent to the bank select register's address segment plus one. To enable the board, write a command to the usual address (not the segment plus one). Continuing our example, to enable the board, you might write 4A to E800:0000. Either an "appear" or a "disappear" command will do. All the commands written to the bank select register segment plus one address, and the command written to the usual address, take effect at once when the board is enabled.

Your initializing program, then, starts by writing an invalid bank code (3, for example) for every address page (0 through F) to every bank select register's address segment plus one. For example, if you have one JRAM board set so that the bank select register's address is E800:0000, your initializing program would write 30 to E801:0000, 31 to E801:0000, 32 to E801:0000...3F to E801:0000. Then, it would write the "appear" commands appropriate for your application to E800:0000. The first command written to E800:0000 enables the board and causes the desired bank to appear in the desired page.

The "board disable" and "board enable" commands are also useful for complex bankswitching schemes that involve switching multiple banks or entire boards at once. Your program can issue the "board disable" command, reshuffle the banks in any way, and then issue the "board enable" command. All the commands sent while the board was disabled (written to the bank select register's address segment plus one), and the last command written to the usual bank select register address, take effect immediately when the "board enable" command is issued. Disabling and

enabling the board have no effect on the contents of the JRAM banks or the bank select register.

The syntax for the "Board disable" command is:

Write: <any bank code><any address page>  
To: <bank select register segment plus one>

The syntax for the "Board enable" command is:

Write: <any bank code><any address page>  
To: <bank select register address>

#### 14.5.1: SETTING PARITY

If you initialize the JRAM board by booting up with JBOOT.BIN, our program will also set and check parity for you. We recommend that you let JBOOT.BIN do this work for you and then you can take over with your own application program.

However, if you do decide to write your own initializing program, you may want to set parity by writing zeros to all bytes.

#### 14.6: CONTROLLING 256K CHIPS

This discussion so far has assumed that the JRAM boards are populated with 64K RAM chips. They can also be populated with 256K RAM chips, so that each physical bank of RAM actually contains not one, but four 64K banks of memory.

To specify which quarter of the physical bank you want to make appear or disappear with a JRAM command, you write the command to the appropriate one of four bank select register addresses. Using 64K chips, the third most significant digit (hexadecimal) of the segment of the bank select register address is always zero. This tells the JRAM board that your command applies to the first 64K of memory in the physical bank specified by the bank code.

If the board is populated with 256K chips, you write commands for the second 64K of memory in the physical bank to the same bank select register address segment **plus 10**. Write commands for the third 64K to the address segment **plus 20**, and for the fourth 64K to the address segment **plus 30**.

For example, if your first JRAM board is populated with 256K chips, to make the first **quarter** of the first bank on the first JRAM board appear in page A, you write a command exactly as you would to make the first **bank** on the first JRAM board appear if it were populated with 64K chips:

Write DA to E800:0000

To make the third quarter of the same 256K bank appear at the same address page,

Write DA to E820:0000

To make a bank disappear, you write an invalid bank code to the bank select register exactly as you did for 64K chips. It does not matter what quarter bank of memory you specify; all that counts is the address page to be emptied and the invalid bank code.

Briefly, here is how the bank select register actually works. There is only one bank select register on each JRAM board, and it has just sixteen memory locations. Section 14.3, however, implied an oversimplification about these locations. Each bank select register location actually holds six bits. Four of these bits hold the bank code. The third most significant bit of the bank code is used to make the specified bank appear or disappear (zero or one). The remaining two bits in each bank select register location are filled with the value of the third most significant hexadecimal digit in the bank select register address, which must be zero, one, two, or three, specifying which



## SECTION TWENTY INSTALLING PIGGYBACK MODULE OPTIONS

### 20.1: INTRODUCTION TO PIGGYBACK MODULES

Each JRAM board has sockets for one piggyback module. Tall Tree Systems currently offers six such modules:

- 1) Clock/calendar module
- 2) Parallel port, serial port module
- 3) Parallel port, serial port, clock/calendar module
- 4) Serial port, serial port module
- 5) Serial port, serial port, clock/calendar module
- 6) JDISKETTE controller

JRAM boards can be bought with the desired module already attached. piggyback module or you are adding or changing a module on a JRAM The connectors on the piggyback module are delicate. If you have to remove or insert a module, read the section on Removing and Attaching Modules.

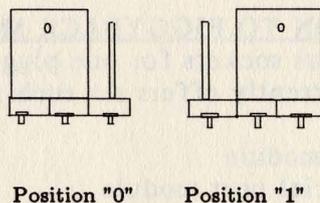
To install any piggyback module other than the simple clock/calendar, you may have to change some of the options from the way they are set-on the module as delivered. Refer to the specific section for your module, explaining the installation details.

**WARNING:** When attaching a module to a JRAM board, always check the sex of the 25-pin connector on the JRAM expansion slot bracket. A serial-parallel module must go **only** on a board with a female 25-pin connector. A serial-serial module must go **only** on a board with a male 25-pin connector. Failure to observe this rule voids your warranty, and use of the port connected to the incorrect 25-pin connector may damage the port or your peripheral device. If you require an exchange for the proper sex

connector, call Tall Tree Systems.

## 20.2: HOW TO SET SHUNTS

Figure 20.2: THE TWO SHUNT POSITIONS



All piggyback module hardware options are selected by moving "shunts". The shunts are small black plastic hoods that contain metal contacts. Each shunt connects two of three metal pins. The shunt slips onto either the left pair or the right pair of either set of pins, selecting one option or another. To move the shunt, stick the end of a bent paper clip in the small hole and slide it off one pair of pins, then slide it onto another. The shunts are labelled, but the labels are hidden until you slip the black hoods off. When the shunt connects the left-hand pair of pins, it is in position 0; when it connects the right-hand pair of pins, it is in position 1. These positions are marked on the board.

## SECTION TWENTY-ONE REMOVING AND ATTACHING MODULES

### 21.1: NOTES ON REMOVING AND ATTACHING MODULES

If you have to remove or attach a JRAM piggyback module, please read the following. Properly handled, the modules can be inserted and removed hundreds of times without any problem. However, the connecting pins are fragile, and it is easy to bend and break off one of the pins. If you do bend a pin, contact Tall Tree Systems for service information. If the repair is not covered by the warranty, we will charge you a reasonable repair fee.

### 21.2: REMOVING SERIAL-PARALLEL-CLOCK OR SERIAL-SERIAL MODULES

To remove the serial-parallel-clock/calendar module or the serial-serial module, carefully snap the upper left corner of the module off the plastic spacer. Gently pry up on the upper right and lower left corners of the board (where the rows of terminals end). After these corners have pulled up slightly, lift the lower right corner a little. Keep alternating back and forth between the ends of the terminal rows and the corner of the terminal rows until the module pulls straight up off the JRAM board.

### 21.3: REMOVING THE CLOCK/CALENDAR MODULE

To remove the clock/calendar module, carefully snap the module off the plastic spacer in the center of the module. Gently pry up on the lower right corner of the module, then pry up on the lower left corner. Keep alternating between the two ends of the terminal row until the module pulls straight up off the JRAM board.

### 21.4: ATTACHING SERIAL-PARALLEL-CLOCK OR SERIAL-SERIAL MODULES

To attach the serial-parallel-clock/calendar module or the serial-serial modules, press the supplied plastic spacer over the hole in the upper left corner of the non-RAM section

## *Removing and Attaching Modules*

of the JRAM board. Hold the module at an angle to the JRAM board and set the single row of terminal pins lightly on the single row of sockets. Rotate the module down until the double row of terminal pins sets lightly onto the double row of sockets. Look closely at all the sockets to make sure that all the pins are sitting inside the socket cups. If any of the pins are not in the socket cups when you press the module down, you will bend them and possibly break them off.

Once you are satisfied that all the pins are properly aligned, gently press down on the upper right and lower left corners of the module. Then press down on the lower right corner, and keep alternating between the ends of the terminal rows and the corner until the module is firmly seated in the sockets. Note that some of the narrow part of the pins will still show when the module is fully inserted. Finally, snap the remaining plastic spacer into the hole from the module side.

### **21.5: ATTACHING THE CLOCK/CALENDAR MODULE**

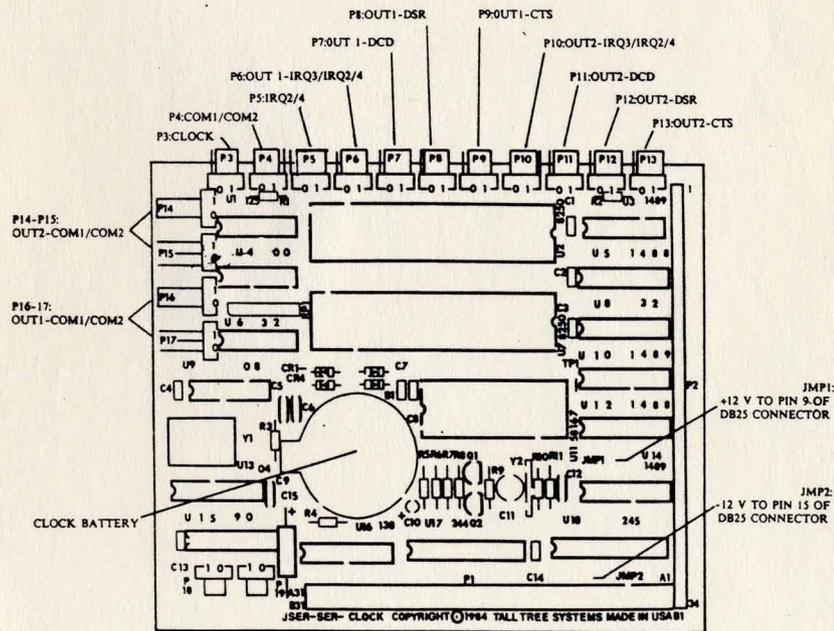
To attach the clock/calendar module, press the supplied plastic spacer into the lower center section of the non-RAM part of the JRAM board. Then carefully set the module terminal pins into the double row of sockets on the JRAM board.

Note: there are two plausible-looking ways to insert this module. The wrong one will burn out two chips on the PC motherboard (we know!). So, be absolutely certain that the hole in the center of the clock/calendar module lines up with the spacer attached to the JRAM board. This will position the leftmost module pins in the leftmost sockets. Also verify that all the pins are inside the socket cups, or they will bend or break when you press the module down.

When you are satisfied with the module's placement, gently press down alternately on one end of the terminal row and the other until the module is firmly seated in the sockets. Note that some of the narrow part of the pins will still show when the module is fully inserted. Finally, press the hole in the center of the module onto the plastic spacer.

SERIAL-SERIAL CLOCK MODULE  
ERRATA SHEET  
7/31

Please note that in Figure 23.1 on page 23-1, Shunt 5 should be set to position one.



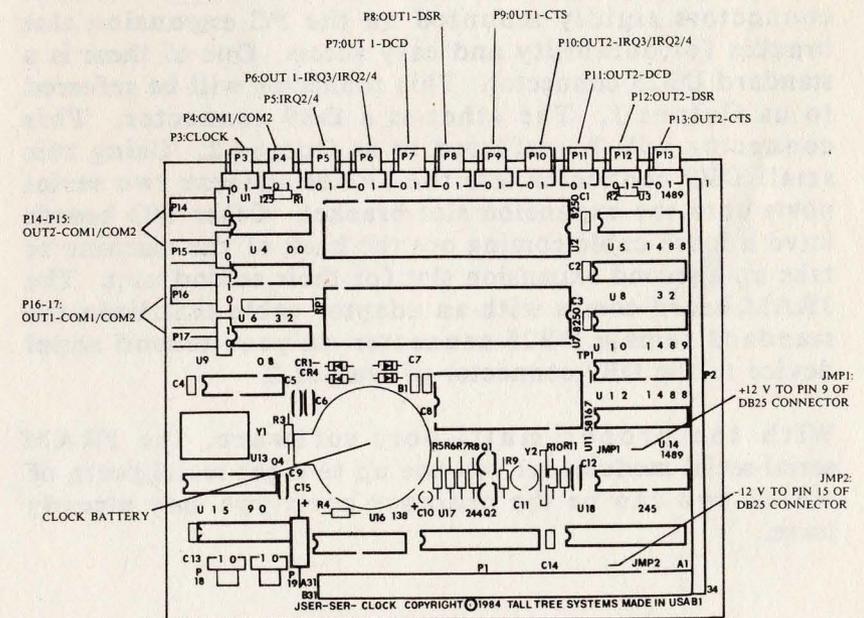
SECTION TWENTY-THREE  
THE SERIAL-SERIAL MODULES

23.1: LOCATION OF SHUNTS

This section applies to both the serial-serial module and the serial-serial-clock/calendar module. The two modules are identical except that one has the clock/calendar components.

The shunts on the serial-serial modules are located along the top edge, left-hand edge, and lower left corner of the module. The shunts on the top edge are numbered 3 to 13, from left to right. The shunts on the left edge are numbered 14 through 17, from the top down. The shunts in the lower left corner are numbered 18 and 19, from left to right. The shunts are labeled on the edge of the module, but the labels are obscured when the shunts are in place.

Figure 23.1: Serial-Serial-Clock/Calendar Module



For a summary of the serial-serial module and serial-serial- clock/calendar module shunt settings, see section 23.4.

**WARNING:** Be sure that this module is connected to a JRAM board with a male 25-pin connector on the expansion slot bracket. Do not use a serial-serial module with a female 25-pin connector, because this would make it possible to plug a parallel device into the serial port, possibly damaging the parallel device. Using a serial-serial module with a female 25-pin connector voids the module's warranty. If you are adding a serial-serial module to an existing JRAM board with a female 25-pin connector, contact Tall Tree Systems to exchange the JRAM board for one with the correct sex connector.

## **23.2: THE SERIAL PORTS**

### **23.2.2: SERIAL PORT SPECIFICATIONS**

Both of the serial (asynchronous communications) ports on the serial- serial modules are RS-232C interfaces with male connectors rigidly mounted on the PC expansion slot bracket for durability and easy access. One of these is a standard DB25 connector. This connector will be referred to as Output 1. The other is a DB9 connector. This connector will be referred to as Output 2. Using this small DB9 connector lets the JRAM squeeze two serial ports onto the expansion slot bracket. Other I/O boards have a loose cable coming out the back of the machine or take up a second expansion slot for their second port. The JRAM board comes with an adaptor cable that links the standard female DB25 connector on your second serial device to the DB9 connector of Output 2.

With the proper multi-port software, the JRAM serial-serial modules let you use up to eight serial ports, of which two can be the ordinary ports you may already have.

### **23.2.2: SETTING THE SERIAL PORT SHUNTS**

To install the serial ports, read each section below. Each of these sections includes a brief explanation of what one or more shunts does, and instructions about how you should set it. You will also find a section describing various ways to use your serial ports.

For a summary of shunt settings, see section 23.4. The shunt settings for port name assignments are shown in a table in Section 24. For an illustration of the shunt locations, see figure 23.1.

#### **23.2.2.1: ASSIGN PORT NAMES**

The IBM PC normally allows two serial ports, COM1 and COM2. The JRAM serial-serial modules allow up to eight separate serial ports. Two additional ports, COM3 and COM4, can be used through JSPOOL. To use more serial ports, you will have to purchase or write your own special software.

For information about configuring the serial-serial module to use more than two ports in your system, see Section 24.

The port names (COM1, COM2...) are assigned to the two output connectors according to the settings of shunts P14 through P17 (the ones on the left edge of the module) and the setting of shunt P4. A single shunt connector serves for both P14 and P15; another single shunt connector serves for P16 and P17. That is, if P14 is set to position 1, then there is no shunt connector at all on P15. If P17 is set to position 0, then there is no shunt connector on P16. Shunt P4 must always be set to either position 1 or position 0. Do not remove shunt P4.

\* If you do not have any serial ports already, just leave the port name assignment shunts as they were shipped: P14 in position 0, P16 in position 0, and P4 in position 0. These settings will cause Output 1 (the 25-pin connector) to be COM1, and Output 2 (the 9-pin connector) to be COM2.

\* If you already have one serial port, you will have to change the shunts to make Output 1 (the 25-pin connector) to be COM2, and Output 2 (the 9-pin connector) to be COM3. To do this, move P14 to position 1, and move P4 to position 1. Leave P16 in position 0. COM3 will only be usable through JSPOOL or other special multiple-serial port software. For details about serial ports beyond COM2, see Section 24.

#### 23.2.2.2: ASSIGN INTERRUPTS

DOS allows two interrupts for use by serial ports, IRQ3 and IRQ4. These interrupts are expected to correspond to COM2 and COM1, respectively.

The serial-serial module comes set so that Output 1 (the 25-pin connector) uses interrupt IRQ4, and Output 2 (the 9-pin connector) uses interrupt IRQ3.

\* If you have no other serial ports, you can leave these settings as they are: P5 in position 1, P6 in position 1, and P10 in position 0.

\* If you already have a serial port, you should already have set the JRAM serial-serial module ports to COM2 and COM3. In order to keep your ports as standard as possible, we suggest assigning IRQ3 to COM2, and disabling the interrupt on COM3. To do this, leave shunt P5 set to 1, move shunt P6 to position 0, and remove shunt P10. We suggest slipping the shunt on a single pin so it will not get lost.

The serial-serial module allows a variety of other serial port interrupts for specialized applications. See section 24 for details.

#### 23.2.2.3: DISABLE READY LINES (OPTIONAL)

\* If you plan to use store-bought cables designed to connect your particular peripherals to standard IBM PC serial ports, or if you plan to use the serial ports for modems, or both, verify that the following shunts are all

in position 1: P7, P8, P9, P11, P12, P13. The ready lines CTS, DSR, and DCD are enabled on both the serial ports, in accordance with the IBM serial port standard.

\* If you are an experienced technician who is planning to make cables or reuse existing cables to connect serial devices to the JRAM serial ports, you may want to disable (force true) some of the RS-232C ready lines. Read on for a brief discussion of ready lines and instructions about how to disable one or more of them.

The RS-232C interface standard includes three "ready" lines, CTS (Clear To Send), DSR (Data Set Ready), and DCD (Data Carrier Detect, or just CD, for Carrier Detect). Virtually all modems use all the RS-232C lines in the same, simple way. A modem will plug directly into the serial port DB25 connector and work. There is only the loosest of standards, however, for other serial devices. Different devices use different ready lines, and some use lines that are not defined in RS-232C at all. To use these devices, you must use either a special cable made to connect the particular device to the serial port used by the IBM PC, or make one of the "universal" cables described at the end of this section. The JRAM serial port allows one additional possibility: if you know exactly what you are doing, you may be able to use an existing cable by disabling (forcing true) some of the ready lines on the JRAM module itself. Check your device's manual to see what ready line(s) it uses.

The JRAM serial-serial ports come set in the standard IBM serial port configuration, with all three ready lines enabled on both ports. To disable (force true) any of the ready lines, move the shunts as indicated in the table below. All of these shunts must be in either position 0 or position 1. Do not remove them completely.

Table 23.2.2.3: Disabling Ready Lines

Output 1 (25-pin connector):

P7 position	1: DCD used 0: DCD not used (forced true)
P8 position	1: DSR used 0: DSR not used (forced true)
P9 position	1: CTS used 0: CTS not used (forced true)

Output 2 (9-pin connector):

P11 position	1: DCD used 0: DCD not used (forced true)
P12 position	1: DSR used 0: DSR not used (forced true)
P13 position	1: CTS used 0: CTS not used (forced true)

**23.2.2.4: POWER OPTIONS**

A few peripherals, such as the Summagraphics digitizer pad and mouse, get their plus and minus 12 volts power from the computer by way of the serial port. Some other devices use the same connector pins for signals. The JRAM serial-serial modules allow you to use both types of devices. If you do not have one of the special serial devices that is powered in this way, skip this section.

To bring plus 12 volts to pin 9 of the 25-pin connector, you or a dealer must solder a jumper wire in the position marked JMP1 on the serial-serial module. To bring minus 12 volts to pin 15 of the 25-pin connector, solder a jumper wire in the position marked JMP2 on the serial-serial module. These jumper locations are illustrated in figure 23.1.

Do not plug anything other than the device for which this modification was made into the 25-pin connector. The voltage on pins 9 and 15 could damage peripherals that are not designed to use it.

**23.2.3: USING THE SERIAL PORTS**

There are two ways to use your serial ports. You can use the DOS MODE command, or you can use JSPOOL, the printspooler that comes on the JRAM distribution diskette.

**MODE:** The IBM PC normally sends all its printer output to LPT1. With MODE, you can redirect the printer output to your serial port by typing

```
A>MODE LPT1:=COM1:
```

```
--or--
```

```
A>MODE LPT1:=COM2:
```

depending on whether or not you have renamed your port. If you have special software that initializes more than two serial ports, MODE can redirect printer output to those, as well.

You then have to specify how the data is to be sent to your particular printer. See your printer manual and the DOS manual. As an example, if your COM1 printer required a baud rate of 9600, no parity, eight data bits, and one stop bit, you would type

```
A>MODE COM1:9600,n,8,1
```

If you specify everything correctly, all printer output will be properly sent to your serial device.

You will probably want to put these MODE commands in an AUTOEXEC.BAT file. This file should be on all of your system diskettes (diskettes that you use to boot up your machine). See the DOS manual about AUTOEXEC.BAT files and the MODE command.

**JSPOOL:** The MODE command works, but JSPOOL is better. JSPOOL lets you control up to eight printers, four serial and four parallel, directly from the keyboard. It allows you to continue working with your computer while

it is printing out files. JSPOOL also allows you to select a variety of printer features, from margins to pauses, to tailor your printing to your needs. See the JSPOOL manual and programs on your distribution diskette.

**23.2.4: SERIAL PORT ADDRESSES AND PINOUTS**

Port	Addresses
COM1	3F8-3FF (hex)
COM2	2F8-2FF
COM3	3E8-3EF
COM4	2E8-2EF
COM5	368-36F
COM6	268-26F
COM7	348-34F
COM8	248-24F

Most multiple port software will let you specify the addresses of each port, in the event that these do not match the default addresses.

Output 1 is the 25-pin connector on the JRAM expansion slot bracket. Output 2 is the 9-pin connector on the JRAM expansion slot bracket. The connector pins and the wires of the adapter cable are connected as shown in Table 23.2.4 below.

Table 23.2.4: Pinouts for Serial-Serial Modules  
(DB9 is the 9-pin connector, and DB25 is the 25-pin connector)

Signal Name	OUT 1 DB25	OUT 2 DB9	Cable Wire	Cable DB25
TX (Transmit Data)	2	5	9	2
RX (Receive Data)	3	9	8	3
RTS (Request To Send)	4	4	7	4
CTS (Clear To Send)	5	8	6	5
DSR (Data Set Ready)	6	3	5	6
GND (Ground)	7	7	4	7
DCD (Data Carrier Detect)	8	6	2	8
DTR (Data Term Ready)	20	2	3	20
RI (Ring Indicator)	22	1	1	22
GND (Shield Ground)	1	-	-	-
+12 volts (only if JMP1 installed)	9	-	-	-
-12 volts (only if JMP 2 installed)	15	-	-	-

**23.4: SUMMARY TABLE OF SHUNT SETTINGS**

Shunt	Function	Delivered	Positions	Removed
P3	Clock	enabled	0 disabled 1 enabled	Same as 0
P4	COM1/COM2...	(see table in section 24.2.2.1)		Do not remove
P5	OUT1-IRQ2/4	position 1	0 IRQ2 to shunts P6 and P10 1 IRQ 4 to shunts P6 and P10	
P6	OUT1-IRQ3/4	IRQ4	0 IRQ3 1 IRQ4 or IRQ2 as selected by P5	No interrupt on IRQ2, IRQ3, or IRQ4
P7	OUT1-DCD	DCD used	0 DCD forced true 1 DCD used	Do not remove
P8	OUT1-DSR	DSR used	0 DSR forced true 1 DSR used	Do not remove
P9	OUT1-CTS	CTS used	0 CTS forced true 1 CTS used	Do not remove
P10	OUT2-IRQ3/4	IRQ3	0 IRQ3 1 IRQ4 as selected by P5	No interrupt on IRQ2, IRQ3, or IRQ4
P11	OUT2-DCD	DCD used	0 DCD forced true 1 DCD used	Do not remove
P12	OUT2-DSR	DSR used	0 DSR forced true 1 DSR used	Do not remove
P13	OUT2-CTS	CTS used	0 CTS forced true 1 CTS used	Do not remove
P14-15	COM1/COM2	OUT2-COM2 (see section 23.2.2.1)		OUT2 disabled
P16-17	COM1/COM2	OUT1-COM1 (see section 23.2.2.1)		OUT1 disabled
P18*		Removed	0 IRQ12 1 IRQ15	No interrupt on IRQ12 or IRQ15
P19*		Removed	0 IRQ10 1 IRQ11	No interrupt on IRQ10 or IRQ11
JMP1	+12 PIN 9	0 V PIN 9	Open: 0 volts to pin 9 Jumped: +12 volts to pin 9	
JMP2	-12 PIN 15	0 V PIN 15	Open: 0 volts to pin 15 Jumped: -12 volts to pin 15	

\*JRAM-AT serial-serial module only  
Piggyback Modules

**23.6: INTRODUCTION TO WIRING YOUR OWN SERIAL CABLES**

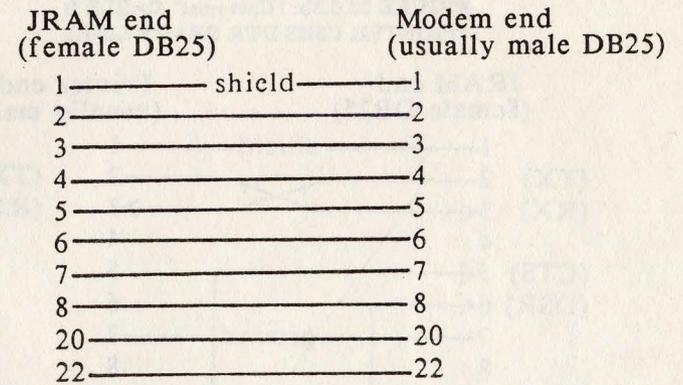
By wiring special cables for your serial devices, you can leave all the JRAM serial port shunts in their delivered positions and plug different serial devices into the same port at different times. Wiring your own cables for your serial devices is not as complicated as you might imagine. Virtually all modems use the same simple cable, and we have found that one of our two "universal" cable wirings will work with every printer that our users have tried. If you are ever in doubt about cable wiring, see your printer manual and IBM's Technical Reference Manual, or call the printer manufacturer.

All the cables described have DB25 (25-pin) connectors at each end. The JRAM end of the cable always has a female connector. The serial device end usually has a male connector, but not always. Check your printer or manual before buying any connectors. Since you are already wiring a custom cable, you may want to make the JRAM end a DB9 (9-pin) connector to plug directly into the JRAM serial port. By doing this, you can dispense with the adapter cable that came with the serial port, but you will not be able to use the special cable with any other serial port.

**23.6.1: MODEM CABLES**

Modem cables are simple. Every pin on the JRAM end is wired straight to the same number pin on the modem end. Not all these lines are actually used in most applications, but the unused lines do not hurt anything, and complete straight-through cables are easy to find or make. (See Figure 23.6.1)

FIGURE 23.6.1: MODEM CABLE



**23.6.2: SERIAL PRINTER CABLES**

All the serial printers we know of will work with one of the two "universal" serial printer cables described here. To determine which cable you need, check your printer manual. If your printer uses the RTS (Request To Send) ready line, use "universal" cable A. If your printer uses the DTR (Data Carrier Detect) ready line, use "universal" cable B. If your printer uses both, either cable will work. Many printers allow you to set which ready line is used. There is no reason to prefer one setting over the other.

FIGURE 23.6.2a: "Universal" CABLE A (PRINTER USES RTS READY LINE)

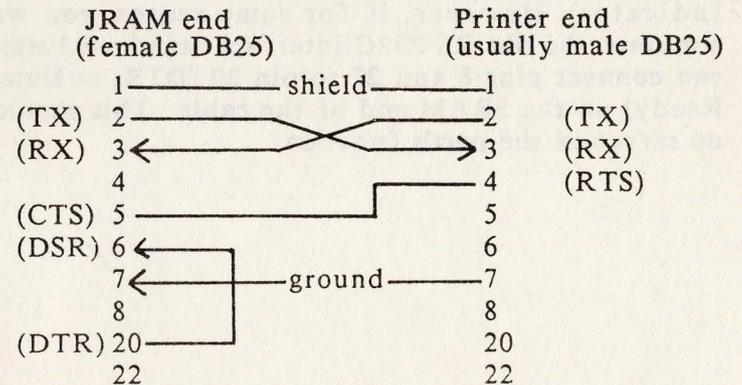
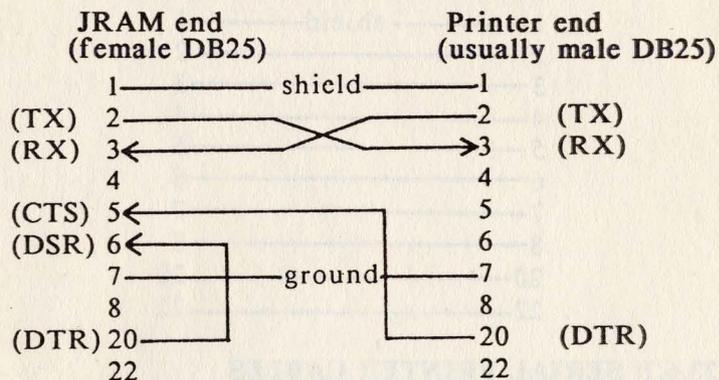


FIGURE 23.6.3b: "Universal" CABLE B  
(PRINTER USES DTR READY LINE)



These "universal" cables ignore some ready lines used by some printers to signal specific problems such as "out of paper" or "buffer full". These signals are different for every printer that uses them. However, no software that we know of ever checks for these signals, so there is no point in designing printer-specific cables to transmit them.

Under normal circumstances, the PC never checks pin 8 (DCD, or Data Carrier Detect) or pin 22 (RI, or Ring Indicator). However, if for some reason you want to simulate the old RS-232C interface standard better, you can connect pins 8 and 22 to pin 20 (DTR, or Data Term Ready) on the JRAM end of the cable. This should have no effect on the port's function.

## SECTION TWENTY-FOUR USING MORE THAN 2 SERIAL PORTS

### 24.1: INTRODUCTION TO USING MORE THAN TWO SERIAL PORTS

If you need multiple serial ports, you can install additional JRAM boards with the serial-serial modules. You can use up to eight serial ports in a single PC. Two may be ordinary serial ports; the remainder must be JRAM serial-serial module ports.

NOTE: DOS allows only two serial ports, COM1 and COM2, which use the two interrupts, IRQ4 and IRQ3. (There are additional interrupts on the AT, but DOS still allows only two serial ports.) To make use of the serial-serial modules' multiple-porting capabilities, you must use special software that sets up the additional serial ports, and you may need other software to control them, depending on your application. JBOOT.BIN (in the JETDRIVE package) sets up ports COM3 and COM4 in the table area reserved for them by DOS, and creates a similar table within itself for COM5 through COM8. JSPOOL can send data to printers, plotters, modems, and so on attached to COM1 through COM4. To receive data from these ports or to use COM5 through COM8, you need additional special-purpose software.

### 24.2: ASSIGNING COM NAMES ABOVE COM2

The port names (COM1, COM2...) are assigned to the two output connectors according to the settings of shunts P14 through P17 (the ones on the left edge of the module) and the setting of shunt P4. A single shunt connector serves for both P14 and P15; another single shunt connector serves for P16 and P17. That is, if P14 is set to position 1, then there is no shunt connector at all on P15. If P17 is set to position 0, then there is no shunt connector on P16. Shunt P4 must always be set to either position 1 or position 0. Do not remove shunt P4.

Table 24.2 shows how to assign the port names to the two serial port connectors. Notice that the two connectors on a single module cannot both have even names (COM2 and COM4) or both have odd names (COM1 and COM3).

Naturally, they also cannot both have the same name.

Assign the port names without skipping any COM numbers. If you have four serial ports, assign COM1 through COM4. If you do not, most multiport programs will rename the ports so that the names are sequential and start with COM1. If you already have one ordinary serial port, start your JRAM serial port names with COM2; if you already have two ordinary serial ports, start your JRAM serial port names with COM3.

TABLE 24.2  
SHUNT POSITIONS for  
USING MORE THAN 2 SERIAL PORTS

Output 1 (25-pin connector)

	COM1	COM2	COM3	COM4	COM5	COM6	COM7	COM8
COM1	X	P14-0 P16-0 P4-1	X	P14-0 P16-1 P4-1	X	P14-0 P17-0 P4-1	X	P14-0 P17-1 P4-1
COM2	P14-0 P16-0 P4-0	X	P14-0 P16-1 P4-0	X	P14-0 P17-0 P4-0	X	P14-0 P17-1 P4-0	X
COM3	X	P14-1 P16-0 P4-1	X	P14-1 P16-1 P4-1	X	P14-1 P17-0 P4-1	X	P14-1 P17-1 P4-1
COM4	P14-1 P16-0 P4-0	X	P14-1 P16-1 P4-0	X	P14-1 P17-1 P4-0	X	P14-1 P17-1 P4-0	X
COM5	X	P15-0 P16-0 P4-1	X	P15-0 P16-1 P4-1	X	P15-0 P17-0 P4-1	X	P15-0 P17-1 P4-1
COM6	P15-0 P16-0 P4-0	X	P15-0 P16-1 P4-0	X	P15-0 P17-0 P4-0	X	P15-0 P17-1 P4-0	X
COM7	X	P15-1 P16-0 P4-1	X	P15-1 P16-1 P4-1	X	P15-1 P17-0 P4-1	X	P15-1 P17-1 P4-1
COM8	P15-1 P16-0 P4-0	X	P15-1 P16-1 P4-0	X	P15-1 P17-0 P4-0	X	P15-1 P17-1 P4-0	X

TECHNICAL NOTE: Strictly speaking, these shunts do not control the names COM1 through COM8. What they control is the addresses at which the ports receive and deposit data. When the computer boots up, it checks the possible

addresses (without a special program, DOS checks only two) to see if ports are present. The first port found gets named COM1, the second COM2, and so on. If there is only one port, it will be named COM1, regardless of which of the checked addresses it has. In order to have the settings in the table above correspond to the COM names shown, you have to use the settings in COM name order. That is, if you have no other serial ports and you set the JRAM ports to be COM1 and COM2 as shown in the table, they will be COM1 and COM2 after the computer has booted up. If you set them to be COM2 and COM3, then even though JBOOT.BIN sets up the ports, they will still be named COM1 and COM2 after booting up.

Finally, if you already have a serial port that by some strange chance is set to the second address checked by DOS, and you have followed the instructions and set your JRAM ports to COM2 and COM3, you will end up with two ports assigned to COM1, and one port assigned to COM2. If this happens, reset your old serial port to COM1.

SERIAL PORT ADDRESSES

Port	Addresses
COM1	3F8-3FF (hex)
COM2	2F8-2FF
COM3	3E8-3EF
COM4	2E8-2EF
COM5	368-36F
COM6	268-26F
COM7	348-34F
COM8	248-24F

**24.3: ASSIGNING INTERRUPTS TO MORE THAN TWO SERIAL PORTS**

The JRAM serial-serial modules allow multiple serial ports to share one or both of the two interrupts provided by DOS. They also allow serial ports to use or share interrupt IRQ2 in PCs, XTs, and compatibles, and interrupts IRQ2, IRQ10, IRQ11, IRQ12, and IRQ15 in ATs and compatibles. The port controlling software has to take care of determining which port issued a shared interrupt. Alternatively, if your software does not make use of the serial port interrupts, they can be disabled.

The interrupts are assigned to Output 1 and Output 2 by shunts P5, P6, and P10. The optional shunts P18 and P19 allow the four additional interrupts supported by the AT and must be specifically requested when ordering. Note

that not all possible combinations of interrupts are allowed on a single module.

To disable any interrupt for Output 1, remove shunt P6 and P18, if present. To disable any interrupt for Output 2, remove shunt P10 and P19, if present.

Table 24.3.1: Serial Port Interrupt Assignments  
STANDARD SET

OUT 1	OUT 2	P5	P6	P10
IRQ 4	IRQ 3	1	1	0
IRQ 4	IRQ 4	1	1	1
IRQ 3	IRQ 3	1	0	0
IRQ 3	IRQ 4	1	0	1
IRQ 2	IRQ 3	0	1	0
IRQ 2	IRQ 2	0	1	1
IRQ 3	IRQ 3	0	0	0
IRQ 3	IRQ 2	0	0	1

SPECIAL SET

(Request additional shunts from factory)

OUT 1	OUT 2	P5	P6	P10	P18	P19
IRQ 3	IRQ 10	0	0	-	-	0
IRQ 2	IRQ 10	0	1	-	-	0
IRQ 3	IRQ 10	1	0	-	-	0
IRQ 4	IRQ 10	1	1	-	-	0
IRQ 3	IRQ 11	0	0	-	-	1
IRQ 2	IRQ 11	0	1	-	-	1
IRQ 3	IRQ 11	1	0	-	-	1
IRQ 4	IRQ 11	1	1	-	-	1
IRQ 12	IRQ 3	0	-	0	0	-
IRQ 12	IRQ 2	0	-	1	0	-
IRQ 12	IRQ 3	1	-	0	0	-
IRQ 12	IRQ 4	1	-	1	0	-
IRQ 15	IRQ 3	0	-	0	1	-
IRQ 15	IRQ 2	0	-	1	1	-
IRQ 15	IRQ 3	1	-	0	1	-
IRQ 15	IRQ 4	1	-	1	1	-
IRQ 12	IRQ 10	1 or 0	-	-	0	0
IRQ 12	IRQ 11	1 or 0	-	-	0	1
IRQ 15	IRQ 10	1 or 0	-	-	1	0
IRQ 15	IRQ 11	1 or 0	-	-	1	1

"-" indicates shunt removed

## SECTION TWENTY-FIVE THE CLOCK/CALENDAR MODULE

### 25.1: CLOCK/CALENDAR SPECIFICATIONS

The JRAM clock/calendar is a twenty-four hour clock and four year calendar, backed up by a lithium battery. Used with the TREETIME program supplied on your distribution diskette and a simple AUTOEXEC.BAT file, the clock automatically sets the time and date whenever you turn on your PC.

### 25.2: DISABLING THE CLOCK/CALENDAR

The JRAM clock comes enabled. If you already have a clock that you prefer, or if you do not want the clock, just do not use TREETIME. If for some reason you want to electrically disable the clock, note the appropriate directions for your particular module:

- 1) If you have the serial-parallel clock/calendar, move shunt P7 from position 1 (enabled) to position 0 (disabled).
- 2) If you have the serial-serial clock/calendar, move shunt P3 from position 1 (enabled) to position 0 (disabled).
- 3) If you have the clock/calendar module, remove the entire module from the JRAM board. See Section 21 for details.

### 25.3: THE CLOCK/CALENDAR BATTERY

When the computer is turned off, the JRAM clock runs on its lithium battery. This battery should last at least a year, perhaps two years if your computer is on a lot of the time. When TREETIME displays the wrong time after you boot up, suspect that the battery has died. To replace the battery, remove the JRAM board from the computer. Lift

the top clip of the battery holder very slightly with your fingernail or a small screwdriver. Press down on the rim of the battery near the base of the metal clip. The opposite edge of the battery will rise, and you will be able to slide it over the rim of the holder and out from under the clip. Replace the battery with a BR2325 lithium battery, available at computer dealerships and well-stocked drug stores. Make sure that the "plus" side of the battery is up, and that the battery and contacts are clean. Naturally, you will have to reset the clock after replacing the board and booting up.

#### 25.4: SETTING THE TIME AND DATE

To set the time on the JRAM clock/calendar, first set the time and date as you would normally (by typing in "DATE" and "TIME", followed by the appropriate numbers. See the DOS manual for details). Then put a copy of your Tall Tree Systems distribution diskette in drive A: and type

```
A>TREETIME X
```

The computer will report the appropriate time and date information. Note that **anything** after the command TREETIME, including a comment in an AUTOEXEC.BAT file, will cause the clock/calendar to be reset. Do not follow the TREETIME command with anything except <enter> unless you want to reset the JRAM clock. The last thing to do is to copy the TREETIME.COM file onto your boot disk and include the TREETIME command in your AUTOEXEC.BAT file. If you do not already have an AUTOEXEC.BAT file, create one by typing

```
A>COPY CON AUTOEXEC.BAT  
TREETIME
```

Each time you boot up, the clock will automatically set the time and date for you. See the DOS manual for more about AUTOEXEC.BAT files.