

FOX - III
286

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REVISION 1.0

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RADIO FREQUENCY INTERFERENCE STATEMENT

This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference with radio and television reception.

If this equipment does cause interference to radio or TV reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- * Reorient the receiving antenna.
- * Relocate the computer away from the receiver.
- * Move the computer away from the receiver.
- * Plug the power cord of computer into a different outlet so that computer and receiver are on different branch circuits.
- * Ensure that card slot covers are in place when no card is installed.
- * Ensure that card mounting screws, attachment connector screws, and ground wires are tightly secured.
- * If peripherals are used with this system, it is suggested to use shielded, grounded cables, with in-line filters if necessary.

If necessary, the user should consult the dealer service representative for additional suggestions.

The manufacturer is not responsible for any radio or TV interferences caused by unauthorized modifications to this equipment. It is the responsibility of the user to correct such interferences.

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Preface

This manual covers the necessary information to operate the FOX-III system board. In-depth explanations of the functions of the motherboard are provided. The table of contents gives detailed information about the arrangement of this manual. The system BIOS setup is further discussed in the appendix.

The content in this manual is only for reference and is intended to provide basic information for the general users. There are also technical information provided for hardware and software engineers.

The manual compose of 4 chapters, chapter 1 contains a brief introduction of FOX-III motherboard. In the chapter 2, specifications and functions of FOX-III are discussed. It also outlines many advanced features of the CPU and the system architecture. Chapter 3 deals with the installation of coprocessor, DRAM modules, jumpers and the memory configurations. Technical information is provided in the chapter 4.

System BIOS and the system setup are further described in the appendix A. All setup procedures are explained.

Note : FOX-III is available in three versions, 12MHz, 16MHz and 20MHz; which are further classified into 2 categories - with or without memory modules. Features and functions described in the manual is identical for each version except for their operating frequencies and memory configurations.

KEEPING THE SYSTEM COOL

Airflow is critical for proper operation. The motherboard contains many high-speed components and they will generate heat during operation. Other add-on cards and hard disk drive can also produce a lot of heat. As a result, the temperature inside the computer system may be very high. These boards require cool air to prevent a deadly heat build-up. Be sure that all cooling vents in the front or sides of the computer are open and that air circulation is good. Check the clearance at the back of the computer; the power supply contains a fan to blow air out of the case, make sure the fan is not blocked by cables or papers. Don't push your computer flush against the wall; leave it some breathing space. Heat can destroy computer chips.

CLEANING THE "GOLDEN FINGER"

Whenever inserting an add-on card to the motherboard, make sure that there is no dirt on the "golden finger" of the add-on card. If not, the contact between the "golden finger" and the slot may be poor and thus causing the add-on cards to work improperly. Use a pencil eraser to clean the "golden finger" if dirt is found.

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Diagnostics Option Menu

You may note the following in the Diagnostics main menu:

- The top line with title of the program, copyright message and the date and time in military format.
- ROMDIAG Options Line with the devices/adapters supported by the program. They are: Hard Disk, Floppy disk, Keyboard, Video and Misc. Each device option in the diagnostics option line has its own test option window which is displayed when the particular device is highlighted.
- Diagnostics Option Window. Below the diagnostics option line, the diagnostics option menu for that option is displayed.
- The Help Window in Reverse Video specifying usage of keys.
- The bottom line with a short Message describing the test under the Block Cursor.

CHAPTER 1 INTRODUCTION

The FOX-III system board is a cost-effective, mid-range performance system board that is designed for PC/AT compatible application. It offers an increased power and flexibility architecture by supporting 80286 processor speeds up to 20 MHz. (*See NOTE on PREFACE*)

For the memory system, it is configurable from 512K to 4 MByte of DRAMs on the system board with true "0" wait state DRAM accesses. Hardware EMS is implemented with 4 registers. In addition to it, System and Video shadowing features are also supported in 16K blocks. It is also optimized to allow mixing of DRAM types to give end user the maximum flexibility in choosing the correct DRAM capacity for their applications. This flexibility in configuration allows you to select an ideal cost/performance combination.

FOX-III is a fully PC/AT compatible system board implemented with a highly integrated chip sets to provide high performance, reliability and compatibility. This means that virtually all the hardware and software that is available for the PC/AT can also be run on a system you build around the FOX-III system. It supports MS-DOS, Xenix, Unix and all PC/AT application programs. Users can run applications designed for the PC/AT on FOX-III without any modification. Multi-tasking and multi-user capabilities are fully functional on this system board.

EXITING CMOS SETUP

After you have entered the correct values to all of the SETUP options, you may now exit the SETUP program. To do so, press <ESC> key to exit. The following message will then appear :

Write data into CMOS and exit (Y/N)?

Press Y to update the data and exit the SETUP program.

The computer now performs a cold boot (equivalent to turning the power off and back on again), performs the memory test, and then tries to boot from the disk drive. If your hard disk has not yet been initialized, be sure that you have a bootable DOS diskette in the A drive.

SPECIFICATION

Processor Subsystem :

80286 CPU
Optional 80287 co-processor

Speed :

Turbo/normal speed
Software/hardware selectable

Memory Subsystem :

4MB using 1M SIMMs
1MB using 256Kbx4 DRAM chips or 256K SIMMs
Support memory mixing of 256K and 1M
System BIOS shadow
Video BIOS shadow
Hardware EMS implementation
128K or 256K Eprom BIOS
0 or 1 wait state selectable

the base memory. Generally, the former option is appropriate. If the hard disk type 47 is defined or if you run program like OS/2, select the option 2.

OPTION 8 MAIN BIOS SHADOW

Main BIOS Shadow can be selected in this menu. If you have system memory of 1MB or more, enable Main BIOS shadow for a more efficient system. The Main BIOS will be shadow at F0000h. You cannot enable this option if your system memory is less than 1MB.

- a) Disabled *
- b) Enabled

OPTION 9 Fast I/O BUS speed

This option provides a way to speed up the I/O operation, however care should be exercised in setting this option. Make sure that the peripheral cards are capable of operating at high speed before making changes, otherwise problems could arise. It is therefore strongly recommended that this option be disabled.

- a) Disabled *
- b) Enabled

PROCESSOR

The 80286 is an advanced, high-performance microprocessor with specially optimized capabilities for multiple user and multi-tasking systems. The 80286 has built-in memory protection that supports operating system and task isolation as well as program and data privacy within tasks. The 80286 includes memory management capabilities that map 2^{30} (one gigabyte) of virtual address space per task into 2^{24} bytes (16 megabytes) of physical memory.

The 80286 is upward compatible with 8086 and 8088 software. Using 8086 real address mode, the 80286 is object code compatible with existing 8086,88 software. In protected virtual address mode, the 80286 is source code compatible with 8086, 88 software and may require upgrading to use virtual addresses supported by the 80286's integrated memory management and protection mechanism. Both modes operate at full 80286 performance and execute a superset of the 8086 and 88 instructions.

The 80286 provides special operations to support the efficient implementation and execution of operating systems. For example, one instruction can end execution of one task, save its state, switch to a new task, load segment-not-present exception and restartable instructions.

The 80286 operates in two modes: protected virtual address and real address.

When you install a new hard disk, make sure whether it is already formatted. If not, the BIOS has to check for a while before reporting the hard disk error. In fact, the error arises only because the hard disk is not formatted. If the hard disk is formatted, you can run DOS FDISK and DOS FORMAT.

Some fixed disks are specially handled and must be set to 'Not Installed'. Consult the fixed disk manual for details.

OPTION 4 DISPLAY

Four types of display are supported:

1. CGA 80 column mode
2. CGA 40 column mode
3. EGA and VGA
4. Monochrome

If the type of display is incorrect, the BIOS will prompt you and ask you to set up again. But the BIOS is still able to display messages on the display attached to the system. Thus you can enter the setup program.

The jumper JP2 must be set according to this setting. Otherwise, the BIOS will report error after self-test.

Real Address Mode

In this mode, physical memory is a contiguous array of up to 1 megabyte. The selector portion of the pointer is interpreted as the upper 16 bits of a 20-bit address, and the remaining 4 bits are set to zero. This mode of operation is compatible with the 8088 and 8086.

Segments in this mode are 64KB in size and may be read, written or executed. An interrupt may occur if data operands or instructions attempt to wrap around the end of a segment. In this mode, the information contained in the segment does not use the full 64KB, and the unused end of the segment may be overlay by another segment to reduce physical memory requirements.

CMOS SETUP OPTIONS

Following is a detail explanation of each CMOS Setup option.

OPTION 1 TIME AND DATE

Use PgUp and PgDn keys to change the value. The date and time cannot be entered directly. A calendar is displayed on the lower right corner of the screen for your reference.

OPTION 2 FLOPPY DISK DRIVE

Four types of floppy disk drives are supported:

1. 5- $\frac{1}{4}$ inch standard drive (360K)
2. 5- $\frac{1}{4}$ inch high-density drive (1.2M)
3. 3- $\frac{1}{2}$ inch standard drive (720K)
4. 3- $\frac{1}{2}$ inch high-density drive (1.44M)

The system BIOS supports two floppy disk drives and they are recognized as drive A and B. Select the correct types. Otherwise the drives cannot work properly. If one of them is not installed, select 'Not Installed' for that drive.

OP codes and operands through these I/O ports. The microprocessor also receives and stores results through the same I/O ports. The "BUSY" signal generated by the coprocessor signifies to the microprocessor to wait until the coprocessor has finished executing.

The following describe the mathematics coprocessor control ports:

0F0 The latched Mathematics Coprocessor busy signal can be cleared with an 8-bit, Out command, to port F0. The coprocessor will latch "BUSY", if it asserts its error signal. Data output should be zero.

0F1 The Mathematics Coprocessor will reset to real address mode which is in the 8087 compatible if an 8-bit Out command is sent to port F1. Again, the data output should be zero.

Once you have entered the SETUP menu, enter the date, time, the primary display type, the floppy drive installed and the hard disk drive type (if installed). The SETUP program will automatically determine your computer's memory configuration and display it on the SETUP menu.

memory is installed, it also support relocation of memory from address A0000 to address FFFFF that are not used in shadowing to above 1M. The following table shows the various shadowing and relocation combinations.

| Shadow Range Relocated | Relocation Range | Memory |
|-----------------------------|-----------------------------|--------|
| No shadowing | A0000-FFFFF | 384K |
| C0000- | A0000-BFFFF | 128K |
| D0000- | A0000-CFFFF | 192K |
| E0000- | A0000-DFFFF | 256K |
| F0000- | A0000-EFFFF | 320K |
| C0000-CFFFF, F0000-FFFFF | A0000-EFFFF, D0000-EFFFF | 256K |

CMOS SETUP

Note : The BIOS may be updated from time to time, the one you got may not be exactly as discussed; this section will also be updated as necessary.

Follow the instructions as they come up on the screen to complete the initial procedure. The initial prompt on the screen tells you to press the key if you want to use the setup program. It is displayed briefly just after the RAM test is run when you first turn on the system. If it disappears before you have a chance to respond turn the system off and on again or reset the system and the message will reappear. The initial screen prompt will be similar to:

Press key if you want to run SETUP or DIAGS

Hit key to get into the Setup Mode. (Note that key will get you into the setup mode, only when the above message is displayed on the screen.)

Upon your pressing of the key, the following message will appear on the screen :

**EXIT FOR BOOT
RUN CMOS SETUP
RUN DIAGNOSTICS**

CHAPTER 3 INSTALLING COMPONENTS

Warning : Be sure to turn off the computer's power switch before installing or replacing any component.

If installation sounds risky, let your dealer install the 80287. If you make a mistake, you could damage the 80287 or your computer.

INSTALLING 80287 MATH COPROCESSOR

The speed rating of 80287 Math coprocessor should match that of the system speed for an optimum and reliable operation. Refer to the table below to determine the correct speed rating of the 80287.

| FOX-III | Math Coprocessor |
|--------------|------------------|
| 20MHz System | 80287-10 |
| 16MHz System | 80287-10 |
| 12MHz System | 80287-8 |

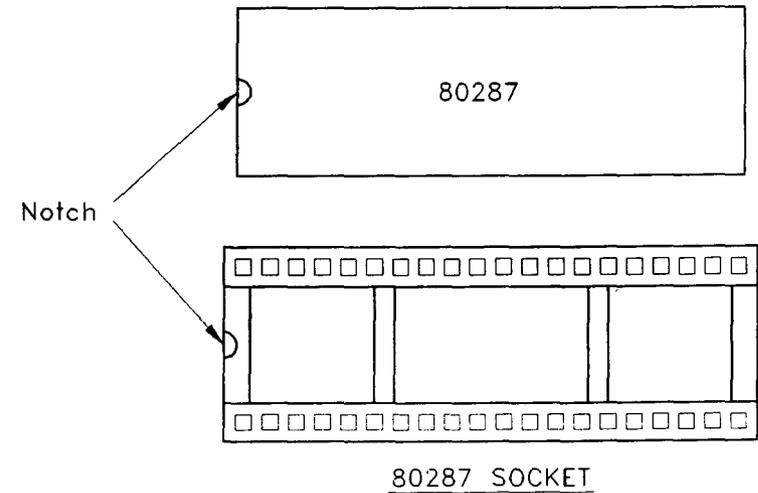
The other type of errors are serious failure and are conveyed as a number of beep and repeated infinitely.

| Beep Count | Meaning |
|------------|--|
| 1 | DRAM Refresh Failure |
| 3 | Base 64K Byte Memory Failure |
| 4 | System Timer Failure |
| 5 | Processor Failure |
| 6 | Keyboard Controller - Gate A20 Failure |
| 7 | Virtual Mode Exception Error |
| 9 | ROM-BIOS Checksum Failure |

If no error is found during self-test, the system BIOS will proceed to boot from floppy disk or hard disk. The system BIOS will list the system configuration on the screen similar to below.

| System Configuration (C) Copyright 1985-1990, American Megatrends Inc., | | | |
|---|---------------|-------------------|----------|
| Main Processor | : 80286 | Base Memory Size | : 640 KB |
| Numeric Processor | : None | Ext. Memory Size | : 0 KB |
| Floppy Drive A: | : 1.2 MB, 5¼" | Hard Disk C: Type | : 2 |
| Floppy Drive B: | : 1.44MB, 3½" | Hard Disk D: Type | : None |
| Display Type | : VGA or EGA | Serial Port(s) | : None |
| ROM-BIOS Date | : 6/13/90 | Parallel Port(s) | : 3BC |

Illustration are given below.



Check whether the system BIOS can detect the coprocessor upon power up. The system BIOS will display a list of devices on the motherboard after self-test. If the coprocessor is installed, it should show the type of coprocessor.

If it is the first time that the computer is started up, you will need to configure the system by telling the SETUP program what hardware configuration your system contains.

The SETUP is a program that resides in the BIOS and is called up everytime the system boots up. It lets you specify your system's configuration of diskette drives, hard disk drives, video display, memory, date and time. The AMI BIOS SETUP provides a one-screen interactive equipment and machine configuration setup. It can be run after the system has been turned on and the memory test is finished or has been escaped. The SETUP program is built-in, you do not need a diskette to use it.

If your FOX-III is already installed in a working system, you will not need to use the SETUP program unless the configuration already recorded in the on-board CMOS RAM is lost or a change is made in your system hardware configuration. If the information is lost due to loss of battery power, you will need to reenter the configuration.

SYSTEM MEMORY CONFIGURATION

FOX-III offers a flexible memory configuration. There are 2 memory banks available, these memory banks are referenced as BANK 0 and BANK 1 in the motherboard. (See *Appendix C for the motherboard layout*) User has the option of either using DIP type DRAM or SIMM type memory modules. Still if the user prefers, he could use both types together. That means you could use DIP and SIMM type memory at the same time. Please note that however, you cannot install both memory types marked with the same bank reference. For example if you had already installed DIP memory into 'BANK 0', you can no longer install SIMM into the SIMM socket referenced as 'BANK 0'.

One bank of memory refers to as 2 SIMMs modules or 6 DIP memory chips (4x44256 + 2x41256). For the SIMM memory, user can install 256K and/or 1M SIMM; therefore it has a maximum memory capacity of 4 Megabytes. On the other hand; if purely DIP DRAM are used, it will allow up to 1 Megabytes of memory. The DIP DRAM are organized in 2 banks as shown below:

I/O Channel (D-Side)

| I/O Pin | Signal Name | I/O |
|---------|-------------|--------|
| D1 | -MEM CS16 | I |
| D2 | -I/O CS16 | I |
| D3 | IRQ10 | I |
| D4 | IRQ11 | I |
| D5 | IRQ12 | I |
| D6 | IRQ15 | I |
| D7 | IRQ14 | I |
| D8 | -DACK0 | O |
| D9 | DRQ0 | I |
| D10 | -DACK5 | O |
| D11 | DRQ5 | I |
| D12 | -DACK6 | O |
| D13 | DRQ6 | I |
| D14 | -DACK7 | O |
| D15 | DRQ7 | I |
| D16 | +5 Vdc | Power |
| D17 | -MASTER | I |
| D18 | GND | Ground |

The different configurations of memory is illustrated on the following table. It shows the memory configuration available for each possible memory map.

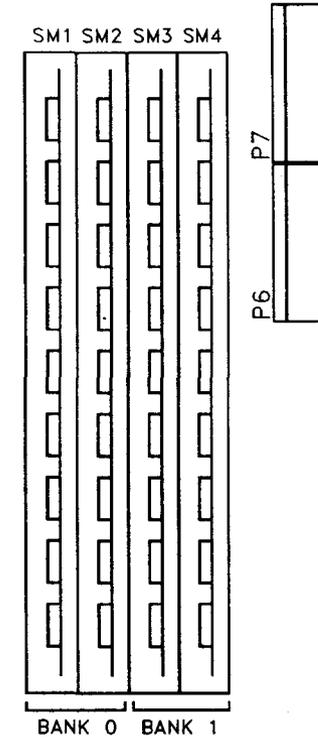
Memory Configuration

| Bank 0 | Bank 1 | Total Memory |
|--------|--------|--------------|
| 256K | --- | 512K |
| 256K | 256K | 1M * |
| 256K | 1M | 2.5M |
| 1M | --- | 2M |
| 1M | 1M | 4M |

* This is a special case where memory relocation is available, the 384K of memory between 640K and 1M can be remapped between 1M and 1.384M as extended memory or can be used for EMS and Shadow RAM simultaneously.

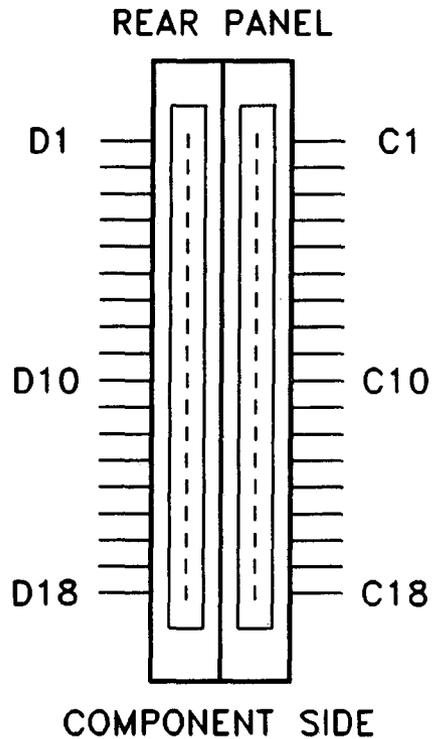
I/O Channel (B-Side)

| I/O Pin | Signal Name | I/O |
|---------|-------------|--------|
| B1 | GND | Ground |
| B2 | RESET DRV | I |
| B3 | +5 Vdc | Power |
| B4 | IRQ9 | I |
| B5 | -5 Vdc | Power |
| B6 | DRQ2 | I |
| B7 | -12 Vdc | Power |
| B8 | OWS | I |
| B9 | +12 Vdc | Power |
| B10 | GND | Ground |
| B11 | -SMEMW | O |
| B12 | -SMEMR | O |
| B13 | -IOW | I/O |
| B14 | -IOR | I/O |
| B15 | -DACK3 | I |
| B16 | DRQ3 | O |
| B17 | -DACK1 | I |
| B18 | DRQ1 | O |
| B19 | -Refresh | I/O |
| B20 | CLK | O |
| B21 | IRQ7 | I |
| B22 | IRQ6 | I |
| B23 | IRQ5 | I |
| B24 | IRQ4 | I |
| B25 | IRQ3 | I |
| B26 | -DACK2 | O |
| B27 | T/C | O |
| B28 | BALE | O |
| B29 | +5 Vdc | Power |
| B30 | OSC | O |
| B31 | GND | Ground |



RAM Module Orientation

The following figure shows the pin numbering for I/O channel connectors JB2, JB3, JB4 & JB5.



SYSTEM BOARD JUMPER SETTING

There are several jumpers in the motherboard that allow the user to select the desired system configuration. The following tables show the function and default settings of these jumpers.

ROM Size

| JP1 | ROM Size |
|-----|----------|
| 1-2 | 27256 * |
| 2-3 | 27128 |

Display Selection

| JP2 | |
|-----|----------------------|
| 1-2 | Monochrome display * |
| 2-3 | CGA, EGA or VGA |

Note : * factory setting

SYSTEM EXPANSION BUS

FOX-III provides six expansion slots, four of which are 16-bit and two are 8-bit expansion slot.

The I/O channel supports:

- * I/O address space from hex 100 to hex 3FF
- * Selection of data access (either 8 or 16 bit)
- * 24 bit memory addresses (16MB)
- * Interrupts
- * DMA channels
- * Memory refresh signal

P 2 - Speaker Connector

| Pin | Assignment |
|-----|------------|
| 1 | Data out |
| 2 | +5 Vdc |
| 3 | Ground |
| 4 | +5 Vdc |

P 3 - Power LED & Ext-Lock Connector

| Pin | Assignment |
|-----|------------------|
| 1 | +5 Vdc |
| 2 | Key |
| 3 | Ground |
| 4 | Keyboard inhibit |
| 5 | Ground |

P 4 - Turbo Switch Connector

| Pin | Assignment |
|-----|---------------|
| 1 | Selection Pin |
| 2 | Ground |

CMOS RAM ADDRESS MAP

| Addresses | Description |
|-----------|--|
| 00-0D | * Real-time clock information |
| 0E | * Diagnostic status byte |
| 0F | * Shutdown status byte |
| 10 | Diskette drive type byte - drives A and B |
| 11 | Reserved |
| 12 | Fixed disk type byte - drives C and D |
| 13 | Reserved |
| 14 | Equipment byte |
| 15 | Low base memory byte |
| 16 | High base memory byte |
| 17 | Low expansion memory byte |
| 18 | High expansion memory byte |
| 19-2D | Reserved |
| 2E-2F | 2-byte CMOS checksum |
| 30 | * Low expansion memory byte |
| 31 | * High expansion memory byte |
| 32 | * Date century byte |
| 33 | * Information flags (set during power on) |
| 34-3F | Reserved |

* These bytes are not included in the checksum calculation and are not part of the configuration record.

P 8 - External Battery Connector

| Pin | Assignment |
|-----|------------|
| 1 | + Vdc |
| 2 | not used |
| 3 | Ground |
| 4 | Ground |

KB 1 - Keyboard Connector

| Pin | Assignment |
|-----|----------------|
| 1 | Keyboard clock |
| 2 | Keyboard data |
| 3 | Spare |
| 4 | Ground |
| 5 | +5 Vdc |

The following shows the addresses for the page register.

| Page Register | I/O Address (HEX) |
|---------------|-------------------|
| DMA Channel 0 | 0087 |
| DMA Channel 1 | 0083 |
| DMA Channel 2 | 0081 |
| DMA Channel 3 | 0082 |
| DMA Channel 5 | 008B |
| DMA Channel 6 | 0089 |
| DMA Channel 7 | 008A |
| Refresh | 008F |

This section provides technical information about FOX-III and is intended for advanced users interested in the basic design and operation of FOX-III.

MEMORY MAPPING

| Address | Range | Function |
|-----------------|--------------|------------------------------------|
| 000000-7FFFFFFF | 000K-512K | System Board Memory (512K) |
| 080000-09FFFF | 512K-640K | System Board Memory (128K) |
| 0A0000-0BFFFF | 640K-768K | Display Buffer (128K) |
| 0C0000-0DFFFF | 768K-896K | Adaptor ROM / Shadow RAM (128K) |
| 0E0000-0EFFFF | 896K-960K | System ROM / Shadow RAM (64K) |
| 0F0000-0FFFFFFF | 960K-1024K | System BIOS ROM / Shadow RAM (64K) |
| 100000-3FFFFFFF | 1024K-4096K | System Memory |
| 400000-FFFFFFF | 4096K-16318K | I/O Channel Memory |

SYSTEM TIMERS

FOX-III has three programmable timer/counters which are build-in in the chipset and they are defined as channels 0 through 2:

| | |
|-----------|---------------|
| Channel 0 | System Timer |
| Gate 0 | Tied on |
| Clk in 0 | 1.190 Mhz OSC |
| Clk out 0 | 8259 IRQ 0 |

| | |
|-----------|---------------------------|
| Channel 1 | Refresh Request Generator |
| Gate 1 | Tied on |
| Clk in 1 | 1.190 Mhz OSC |
| Clk out 1 | Request Refresh Cycle |

| | |
|-----------|--|
| Channel 2 | Tone Generation of Speaker |
| Gate 2 | Controlled by bit 0 of port hex 61 PPI bit |
| Clk in 2 | 1.190 Mhz OSC |
| Clk out 2 | Used to drive the speaker |

Note : Channel 1 is programmed to generate a 15-micro-second period signal.

The 8254 Timer/Counters are treated by system programs as an arrangement of four programmable external I/O ports. Three are treated as counters and the fourth is a control register for mode programming.

I/O ADDRESS MAP

I/O Address Map on System Board

I/O address hex 000 to 0FF are reserved for the system board I/O.

| ADDRESS (HEX) | DEVICE |
|---------------|--|
| 000-01F | DMA Controller 1, 8237 |
| 020-03F | Interrupt Controller 1, 8259, Master |
| 040-05F | Timer, 8254 |
| 060-06F | Keyboard Controller |
| 070-07F | Real Time Clock, NMI (non-maskable interrupt) mask |
| 080-09F | DMA Page Register, 74LS612 |
| 0A0-0BF | Interrupt Controller 2, 8259 |
| 0C0-0DF | DMA Controller 2, 8237 |
| 0F0 | Clear Math Coprocessor Busy |
| 0F1 | Reset Math Coprocessor |
| 0F8-0FF | Math Coprocessor Port |

DIRECT MEMORY ACCESS (DMA)

FOX-III supports seven DMA channels.

| Channel | Function |
|---------|------------------------------|
| 0 | Spare (8 bit transfer) |
| 1 | SDLC (8 bit transfer) |
| 2 | Floppy Disk (8 bit transfer) |
| 3 | Spare (8 bit transfer) |
| 4 | Cascade for DMA Controller 1 |
| 5 | Spare (16 bit transfer) |
| 6 | Spare (16 bit transfer) |
| 7 | Spare (16 bit transfer) |

REAL TIME CLOCK AND CMOS RAM

The CMOS RAM Chip (146818) contains the real-time clock and 64 bytes of CMOS RAM, it keeps configuration information when power is off. Upon you turn the system power on, CMOS will load the recorded configuration into the system so that the system can function in the right track with the equipped devices. However, if you haven't configured the CMOS, or the battery which supports the power to the CMOS is weaken, you need to redefine the necessary parameters whenever the system is boot up. The following page shows the CMOS RAM addresses.

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P 5 - Turbo LED Connector

| Pin | Assignment |
|-----|------------|
| 1 | +5 Vdc |
| 2 | LED signal |

P6,P7 - Power Supply Connector

| Pin | Assignment |
|-----|------------|
| 1 | POWERGOOD |
| 2 | +5 Vdc |
| 3 | +12 Vdc |
| 4 | -12 Vdc |
| 5 | Ground |
| 6 | Ground |

| Pin | Assignment |
|-----|------------|
| 1 | Ground |
| 2 | Ground |
| 3 | -5 Vdc |
| 4 | +5 Vdc |
| 5 | +5 Vdc |
| 6 | +5 Vdc |

REAL TIME CLOCK INFORMATION

The following table describes real-time clock bytes and specifies their addresses.

| Byte | Function | Address |
|------|-------------------|---------|
| 0 | Seconds | 00 |
| 1 | Second alarm | 01 |
| 2 | Minutes | 02 |
| 3 | Minute alarm | 03 |
| 4 | Hours | 04 |
| 5 | Hour alarm | 05 |
| 6 | Day of week | 06 |
| 7 | Date of month | 07 |
| 8 | Month | 08 |
| 9 | Year | 09 |
| 10 | Status Register A | 0A |
| 11 | Status Register B | 0B |
| 12 | Status Register C | 0C |
| 13 | Status Register D | 0D |

SYSTEM BOARD CONNECTORS

Under typical conditions, these connectors should be connected to the indicators and switches of the system unit.

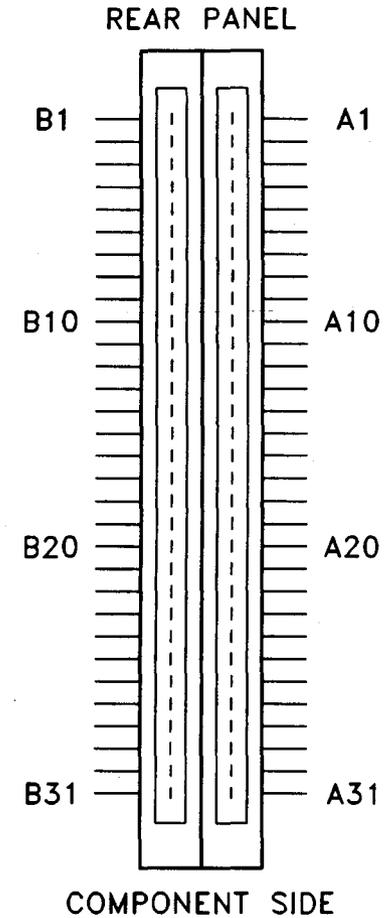
| Connector | Function |
|-----------|--------------------------------|
| P1 | Hardware reset connector |
| P2 | Speaker connector |
| P3 | Power LED & Ext-lock connector |
| P4 | Turbo switch connector |
| P5 | Turbo LED connector |
| P6, P7 | Power supply connector |
| P8 | External battery connector |
| KB1 | Keyboard connector |

Pin assignments of the connectors are illustrated as follows:

P 1 - Hardware Reset Connector

| Pin | Assignment |
|-----|---------------|
| 1 | Selection Pin |
| 2 | Ground |

The following figure shows the pin numbering for I/O channel connectors JA1-JA5.



CONTROL OF SYSTEM SPEED

System Speed can be selected by hardware switch and keyboard. Connector P4 should be connected to the turbo switch of the case panel. This controls the operation mode between turbo and normal mode, it will toggle between the 2 modes when pressed.

In addition to the front-panel switch, you can also change the system speed via keyboard. Press 'Ctrl', 'Alt' and '+' for turbo mode and 'Ctrl', 'Alt' and '-' for normal mode.

In either case, the turbo LED will light up to indicate whether the system is now running in turbo mode or normal mode. In turbo mode, the turbo LED will be turned on. In normal mode, the turbo LED is off.

It should be noted that turbo switch setting will override the keyboard switching mode, but not vice versa.

The following tables summarize pin assignments for the I/O channel connectors.

I/O Channel (A-Side)

| I/O Pin | Signal Name | I/O |
|---------|-------------|-----|
| A1 | -I/O CH CK | I |
| A2 | SD7 | I/O |
| A3 | SD6 | I/O |
| A4 | SD5 | I/O |
| A5 | SD4 | I/O |
| A6 | SD3 | I/O |
| A7 | SD2 | I/O |
| A8 | SD1 | I/O |
| A9 | SD0 | I/O |
| A10 | -I/O CH RDY | I |
| A11 | AEN | O |
| A12 | SA19 | I/O |
| A13 | SA18 | I/O |
| A14 | SA17 | I/O |
| A15 | SA16 | I/O |
| A16 | SA15 | I/O |
| A17 | SA14 | I/O |
| A18 | SA13 | I/O |
| A19 | SA12 | I/O |
| A20 | SA11 | I/O |
| A21 | SA10 | I/O |
| A22 | SA9 | I/O |
| A23 | SA8 | I/O |
| A24 | SA7 | I/O |
| A25 | SA6 | I/O |
| A26 | SA5 | I/O |
| A27 | SA4 | I/O |
| A28 | SA3 | I/O |
| A29 | SA2 | I/O |
| A30 | SA1 | I/O |
| A31 | SA0 | I/O |

Installing SIMM Modules

Whenever adding memory modules to the motherboard, install 2 modules at a time. Also make sure that the SIMM is installed in the correct orientation, the chips on the modules should be facing the I/O expansion slots. See the following page for the correct orientation of the memory modules.

To install a module, the module edge should be inserted with an angle into the socket's contact and then the module is pivoted into position, where the locking latches will secure it. If the module edge is not completely inserted into the socket, it cannot be pivoted to be in vertical position and should be dragged out and inserted again. Do not force the module into the SIMM socket. It will damage the locking latches.

The modules should be locked by the locking latches of the sockets firmly. Please check carefully before turning on the power. Otherwise, the system will not work properly.

I/O Channel (C-Side)

| I/O Pin | Signal Name | I/O |
|---------|-------------|-----|
| C1 | SBHE | I/O |
| C2 | LA23 | I/O |
| C3 | LA22 | I/O |
| C4 | LA21 | I/O |
| C5 | LA20 | I/O |
| C6 | LA19 | I/O |
| C7 | LA18 | I/O |
| C8 | LA17 | I/O |
| C9 | -MEMR. | I/O |
| C10 | -MEMW | I/O |
| C11 | SD8 | I/O |
| C12 | SD9 | I/O |
| C13 | SD10 | I/O |
| C14 | SD11 | I/O |
| C15 | SD12 | I/O |
| C16 | SD13 | I/O |
| C17 | SD14 | I/O |
| C18 | SD15 | I/O |

Dip Memory Configuration

| Memory Bank | Memory Location | DRAM Size |
|-------------|--------------------|-----------|
| BANK 0 | U14, U15, U19, U20 | 44256 |
| | U10, U11 (parity) | 41256 |
| BANK 1 | U16, U17, U21, U22 | 44256 |
| | U12, U13 (parity) | 41256 |

'U10, U11' & 'U12, U13' are the parity bits for BANK 0 and BANK 1 respectively. These sockets can be left blank if parity checking logic is not desirable.

There are several combinations of DRAM types you may consider. So, a basic system can be equipped with fewer memory and later more memory can be installed when upgrading the system. As a typical case, a basic system can be equipped with 512 Kbyte memory using 256K DIP DRAM and then memory size is later increased to 2.5 Megabytes by putting another 2 banks of 1M SIMM. The memory size is detected automatically by system BIOS and indicated during memory test after power up. No switches or jumpers are required to be set for the memory size and DRAM type.

All microcomputer systems use a Basic Input Output System. This is software that has been permanently recorded in a ROM (Read Only Memory) chip and functions as the basic point of communication between the system board and the rest of the computer.

The BIOS provides an operational interface to the system and relieve the programmer from worrying about the characteristics of hardware devices. Thus, hardware modifications and enhancements become transparent to user's programs, access to BIOS is through the program interrupts of the 80286 microprocessor. Each BIOS entry point is available through its own interrupt.

Upon you turn on the power of your FOX-III system, the system will go through a self-test routine which checks all of its internal devices. Complete testings will be carried out on the CPU, base 640K RAM, extended RAM, ROM, system board, CMOS memory, video controllers, parallel and serial subsystems, floppy and fixed disk subsystems and the keyboard.

When the self-test is completed, the system will search for the DOS (disk operating system) system file in drive A. If no system diskette is put in drive A, it will check the fixed disk (if installed).

INSTALLING SYSTEM MEMORY

The speed rating of the system DRAM should match that of the system speed for an optimum and reliable operation . Refer to the table below to determine the correct speed rating of the DRAM.

| FOX-III | System DRAM |
|---------------|-------------|
| 20 MHz System | 60 ns * |
| 16 MHz System | 80 ns |
| 12 MHz System | 100 ns |

* Only selected brand can be used. Please contact the dealer about the detailed information.

MEMORY TEST BYPASS

After the system is powered on or after a reset, the BIOS performs diagnostics of the system and displays the size of the memory being tested.

Note that you can bypass the memory test by pressing the <ESC> key. This option would be useful when the memory on the system is quite large. You may hit the <ESC> key when the message following message appears on the screen:

Press <ESC> Key to bypass MEMORY test

It is recommended to complete the memory test. The total memory size is displayed after the memory test.

In case of serious errors, the BIOS will suspend the test. If the display is not initialized, the BIOS will report the error through a sequence of beep sounds. Otherwise, error message will be shown on the screen.

There are two types of errors reported by beep sounds. One is conveyed as one long beep followed by a number of short beeps. The meanings of the errors are as below :-

| Short Beep Count | Meaning |
|------------------|-------------------------|
| 3 | Memory Failure |
| 8 | Display Adapter Failure |

Your computer can be damaged by static discharge. You're less likely to discharge static electricity if you ground yourself by touching the metal on your computer before you begin installation.

Find the 80287 socket on your computer's system board. The socket has 20 holes on each side, and is located at 'U9' on the motherboard.

Align the 80287 so that its notch matches up with the notch on the socket. Before you install the 80287, verify that its pins match up with the holes in the socket. If they don't, align the pins by laying the 80287 on its side on a table and gently pressing its top edge (not the pins). Repeat for the other row of pins.

When you are sure the pins are aligned correctly, press firmly and evenly on the 80287 to "seat" the pins in the socket. Carefully examine the 80287's pins. Look for any pins that are bent under or out. If you find bent pins, remove the 80287, gently straighten them, and insert the chip again.

Do check the list to make sure that the configuration is correct. Sometimes, problems arise because of the incorrect information of the configuration. For example, if you forget to modify the setup after changing the floppy disk drive from one type to another, it can not boot from floppy disk or may not work properly. If you check the list, you can figure out the cause of the problem at the early stage.

I/O SUBSYSTEM

It is very important that a high speed system should be compatible with existing peripherals without downgrading the performance. The FOX-III system is exactly designed with this capability in mind. It has the capability of communicating with I/O peripherals at 8MHz or slower while maintaining high speed for system operation.

SYSTEM FUNCTIONS

System functions include:

- Interrupt
- DMA
- Timer
- Real time clock
- Clock and ready generation
- I/O channel control

All system functions are 100% compatible to AT standard. I/O channel of FOX-III is designed to be compatible with standard AT bus. All the expansion cards conformed to the standard AT bus can be used in FOX-III without problem.

Use <Up> and <Down> keys to highlight the selected item. Highlight RUN CMOS SETUP for the SETUP program and press the <Return> key to enter this option.

Depending on the BIOS version, a SETUP menu similar to below will appear:

| CMOS SETUP (C) Copyright 1985-1990, American Megatrends Inc., | | | | | | | |
|---|-----|-----|-----|---------------------------|-----|-----|--|
| Date (mn/date/year) : Sun, Jul 1, 1990 | | | | Base memory size : 640 KB | | | |
| Time (hour/min/sec) : 12 : 05 : 30 | | | | Ext. memory size : 0 KB | | | |
| Floppy Drive A: : 1.2 MB, 5 1/4" | | | | Numeric Processor : None | | | |
| Floppy Drive B: : 1.44 MB, 3 1/2" | | | | | | | |
| Cyln Head WPcom LZone Sect Size | | | | | | | |
| Hard Disk C: type : Not Installed | | | | | | | |
| Hard Disk D: type : Not Installed | | | | | | | |
| Primary Display : VGA or EGA | | | | | | | |
| Keyboard : Installed | | | | | | | |
| Video BIOS shadow : Enabled | | | | | | | |
| Scratch RAM option : 1 | | | | | | | |
| Main BIOS shadow : Enabled | | | | | | | |
| Fast I/O BUS Speed : Disabled | | | | | | | |
| O Wait State Option: Enabled | | | | | | | |
| Memory Relocation : Enabled | | | | | | | |
| Month : Jan, Feb, Dec | | | | | | | |
| Date : 01, 02, 03, 31 | | | | | | | |
| Year : 1901, 1902, 2099 | | | | | | | |
| ESC=Exit, I+I+=Select, PgUp/PgDn=Modify | | | | | | | |
| Sun | Mon | Tue | Wed | Thu | Fri | Sat | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 | |
| 15 | 16 | 17 | 18 | 19 | 20 | 21 | |
| 22 | 23 | 24 | 25 | 26 | 27 | 28 | |
| 29 | 30 | 31 | 1 | 2 | 3 | 4 | |
| 5 | 6 | 7 | 8 | 9 | 10 | 11 | |

MEMORY SYSTEM

FOX-III features zero wait-state DRAM accesses in a design which supports up to 4 MByte of DRAM on the system board. This feature improve performance significantly relative to the conventional PC/AT design. User can configure the DRAM for the one-wait/zero-wait option. This flexibility in configuration allows you to select an ideal cost/performance combination.

Hardware LIM EMS is supported using 4 register sets for software applications which require expansion memory. Hardware EMS can also be disabled allowing the use of software "Limulators" for maximum flexibility. Expanded memory provides usable memory beyond DOS's 640K limit. DOS application programs that conform to the EMS (such as the latest versions of 1-2-3, Symphony, Framework II, SuperCalc3) can use expanded memory. If you use DOS application programs, it would be most desirable to use EMS.

To further enhance the system performance, shadow RAM is supported. Shadow RAM is a technology that loads system BIOS and/or video BIOS from the low speed EPROM/ROM directly into fast DRAM during boot-up of the computer. The execution of the BIOS then will have significant improvement because access to DRAM is much faster than ROM.

BIOS is shadowed in 16K blocks in the range of C0000 to FFFFF. In the case that 1M of

Key Conventions

The field shown in reverse video is the current field, which is the one the user may changes.

Use the arrow keys to move the options.

Use <PgUp> or <PgDn> to move bar inside settings menu.

Use <ENTER> to select the options.

Use <ESC> key to abort and return to previous menu.

Note that if user settings do not allow system to startup, which happens if incorrect settings were made; the following steps should be taken:

- a) Turn off the computer.
- b) Hold <INS> key down.
- c) Turn on the computer.
- d) When memory test begins, release <INS> key.

The above procedure will clear the CMOS register hence allowing the BIOS to bring up the system with BIOS default values.

MATH COPROCESSOR

The 80287 Math Coprocessor enables the FOX-III system to perform high-speed arithmetic, logarithmic functions, and trigonometric operations with extreme accuracy.

The coprocessor works in parallel with the microprocessor. The parallel operation decrease operating time by allowing the coprocessor to do mathematical calculations while the microprocessor continues to do other functions.

The 80287 Math Coprocessor is an extension to the 80286 microprocessor architecture. When combined with the 80286 microprocessor the 80287 dramatically increases the processing speed of computer application software which utilize mathematical operations. This makes an ideal computer workstation platform for applications such as financial modelling and spreadsheet, CAD/CAM, or graphics.

It adds over seventy mnemonics to the 80286 microprocessor instruction set. Specific 80287 math operations include logarithmic arithmetic, exponential, and trigonometric functions. The 80287 supports integer, extended integer, floating point and BCD data formats, and fully conforms to the ANSI/IEEE floating point standard.

The Mathematics Coprocessor, 80287 is treated as an I/O device through I/O port address hex 0F8, 0FA and 0FC. The microprocessor sends

The BIOS is able to detect the type of the drives automatically. But remember to check the settings before exit.

OPTION 3 FIXED DISK DRIVE

There are 47 types of fixed disks supported by the BIOS. Consult your fixed disk manual to determine its correct type. The parameters such as cylinder number, head number, sector number and pre-compensation must match your fixed disk's parameters.

Use PgUp and PgDn keys to change the fixed disk type. If the type of your fixed disk is not included in the hard disk list, define a new type as type 47. Use left and right arrow keys to move between the parameter fields and enter the parameters. The parameters will be stored in the CMOS RAM and your fixed disk can be used afterwards. Each hard disk can be assigned a different type 47 hard disk. So two hard disks which are not included in the list can be used together in your system.

If the type of fixed disk is wrong, it takes a while before the BIOS can identify the error. After setting the fixed disk type, if the system halts after reboot, please wait for a while. It is most likely that the setting of fixed disk type is incorrect.

Virtual Address Mode

The virtual address mode provides a 1-gigabyte virtual address space mapped onto a 16 megabyte physical address space. Virtual address space is larger than physical address space, and the use of a virtual address that does not map to a physical address location will cause a restartable interrupt.

This mode uses 32-bit pointers that consist of a 16-bit selector and offset components. The selector specifies an index into a memory-resident table, and the 24 bit base address of the desired segment is obtained from the memory table. A 16-bit offset is added to the segment base address to form the physical address. The microprocessor automatically references the tables whenever a segment register is loaded with a selector. Instructions that load a segment register will refer to the memory-based tables without additional program support. The memory-based tables contain 8-byte values called descriptors.

OPTION 5 KEYBOARD

If a keyboard is attached to the system, select 'Installed'. The BIOS will test the keyboard during self-test.

OPTION 6 VIDEO BIOS SHADOW

The Video BIOS Shadow can be enabled /disabled in this particular option. If the display card has no video ROM (as in the case of monochrome display card), there is no need to shadow the Video BIOS. However, if you are using VGA or EGA card where there's video ROM, video accesses will be improved if video BIOS shadow is enabled. You will not be able to enable this option if you have less than 1MB of system memory.

- a) Disabled *
- b) Enabled

OPTION 7 SCRATCH RAM

The BIOS may require memory storage for certain functions and the storage can be allocated in two ways. One way is to use the BIOS stack and another is to allocate a 1K bytes memory in

I/O Subsystem :

Compatible to standard AT bus
Four 16-bit expansion slots
Two 8-bit expansion slots

System Support Functions :

- 8-Channel DMA (Direct Memory Access)
- 16-level interrupt
- 3 programmable timers
- CMOS RAM for system configuration
- Real time clock with battery backup
- OS/2 Optimization (Fast A20 gate and fast reset)

Other Features :

- On board POWERGOOD test circuit
- External battery connector
- Hardware turbo switch

OPTION 10 0 WAIT STATE OPTION

With this feature, user can use a wide range of DRAM speed available. If the user is using slow DRAM, disable this option; this will provide better timing margins for the DRAM. If however high speed DRAM is available to the user, do enable this option; this will allow zero wait state memory access and improve the system performance significantly. In that way, it is up to the user to determine the desired cost/performance effective system.

- a) Enabled *
- b) Disabled

OPTION 11 MEMORY RELOCATION

If your system memory is 1 MByte, enable this feature. In that case you can remap the 384KB memory so that the memory which is neither used as EMS nor shadow RAM can be used as extended memory. Note that this option is applicable only for the 1 MByte memory configuration.

- a) Enabled *
- b) Disabled

* BIOS Default

To speed up the switching of CPU between protected and real mode, a special feature known as 'OS/2 Optimization' is also incorporated. Otherwise known as 'Hot Reset and Fast A20 Gate', this feature provides an unique method to handle the mode switching which will improve the performance for advanced operating system and expanded memory manager applications.

In addition, the FOX-III provides standard ISA expansion bus connectors so that add-on cards developed for the PC/AT will be fully functional. On-board power good generator is also implemented to ensure the reliability of the system and is capable of working with any power supplies.

FOX-III system is the perfect choice for general business applications involving spreadsheet, word processing, database, presentation graphics, telecommunications and network workstations.

RUNNING AMI BIOS DIAGNOSTICS

Follow initial procedures in the CMOS Setup until the following display is shown on the screen:

**EXIT FOR BOOT
RUN CMOS SETUP
RUN DIAGNOSTICS**

Use the <Up> & <Down> to move the highlight bar to select "RUN DIAGNOSTICS" and then press <Enter>. A diagnostic menu will soon appear on the screen.

The AMI Diagnostics provides an easy to operate screen-menu allowing inexperienced users to operate the program. Simply press <Left> or <Right> and <Up> or <Down> keys to move the highlight bar the option desired.

The diagnostics program performs specialized tests on each of the following when instructed.

- Hard disk drive(s)
- Floppy disk drive(s)
- Keyboard
- Video adapter board and monitor
- Printer and Communication ports

Chapter 4 TECHNICAL INFORMATION 4-1

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APPENDIX A SYSTEM BIOS A-1

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APPENDIX B
OPERATION AND MAINTENANCE

Preventing a problem is better than having to fix it after it has happened. This is where cleanliness and proper operating procedures come into play.

ANTI-STATIC PRECAUTION

Some components of the FOX-III or computer components are static-sensitive devices and can be damaged by static discharges. To prevent such damage, the device may be wrapped in a conductive, anti-static bag; certain precautions should be taken before removing the device from its bags. When installing or removing any add-on card, DRAM module or coprocessor, care should be taken when handling these devices. Touch an unpaint metal part of your system unit (for example, the screws on the rear of the system unit) with one hand, then hold the component you are installing on the other hand. This will place your body, the component, and the system unit at the same ground potential, preventing an accidental static discharge. Be sure to handle circuit boards by the edges only and do not touch the component pins or solder joints. Grasp diskette drives or fixed disk drives by their frames to avoid touching the circuit board. Memory chips or co-processor should be held by their bodies only, not by their pins.

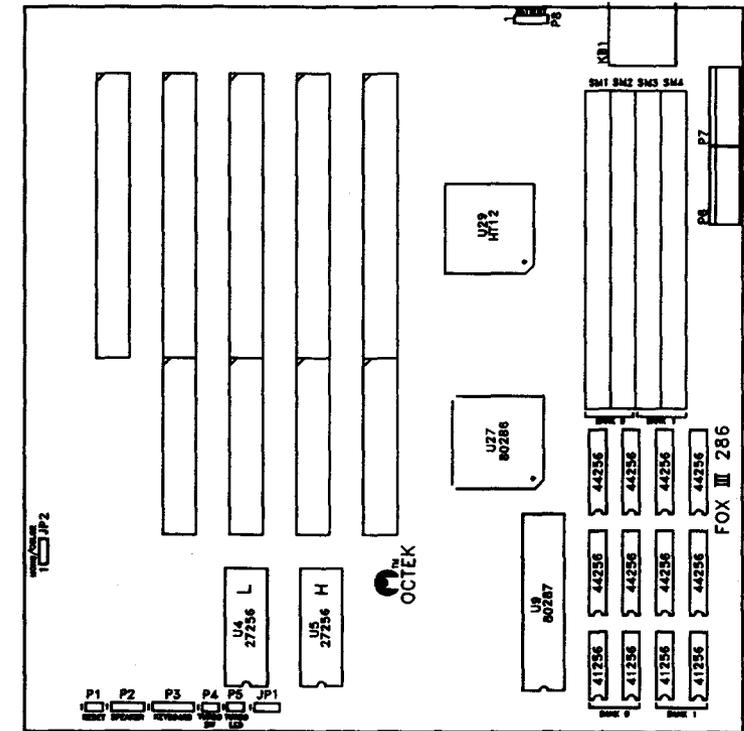
CLEANING THE MOTHERBOARD

Because the system is air-cooled, dust can enter your system through the ventilation slots. At least once a year, take the cover off your computer and vacuum the interior to remove accumulated dust. Use a brush attachment on the vacuum and carefully go over all exposed parts. To prevent dust from accumulating on the motherboard, installing all mounting plates on the rear of the case. Regularly examine your system, and if necessary, vacuum the interior of the system with a miniature vacuum.

Note

1. To achieve optimum performance, enable '0 Wait State option' and 'Main BIOS shadow' in the CMOS Setup.
2. For 1MB memory configuration, enable the 'Memory relocation' option in the CMOS Setup; this will allow the 384KB to be used as extended memory.
3. Do not try to enable 'Fast I/O BUS speed' in the CMOS Setup unless you are sure that the peripherals are capable of operating at high speed.
4. Electronic components are sensitive to dust and dirt. Do inspect and clean the computer system regularly.
5. Turn off the power whenever you install or remove any connector, memory module and add-on card. Before turning on the power, make sure that all the connectors, memory modules and add-on cards are well secured.
6. After power is on, please wait for a minute. The system BIOS are going through a self-test during this period and nothing is shown on the screen. After the self-test, the system BIOS will initialize the display adaptor and messages will be shown.
7. The SIMM sockets are fragile device. Do not force the SIMM modules into the sockets. It may break the locking latches.

APPENDIX C SYSTEM BOARD LAYOUT



FOX III 286 MOTHERBOARD

The material in this manual is for information only and is subject to change without notice.

REVISION: 1.0

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