

# **PREFACE**

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Thank you for purchasing 486EI EISA/VESA system board. This document helps configure and install the system board. The document is prepared with our best knowledge; however, we make no representation or warranty concerning the contents or use of this manual, and specifically disclaim any expressly implied warranties or merchant ability or fitness of any particular purpose. The information in this document is subject to change without notice.

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## **TECHNICAL REFERENCE**

- . I486 Microprocessor (Intel Order No: 240440-002)
- . I486 Microprocessor Programmer's Reference Manual (Intel Order No. 240486-001)
  
- . SIS 85C411 EISA System Chipset Data Book
  
- . The EISA Specification published by:  
BCPR Services, Incorporated
  
- . The VESA VL Bus Specification published by:  
Video Electronics Standard Association

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486EI EISA&VESA System Board User's Manual

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# CHAPTER 1: INTRODUCTION

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## PRODUCT OVERVIEW

The 486EI system board represents a powerful combination of performance, quality, and innovative system board design to address the needs of today's high performance systems. It incorporates the new emerging industrial standard VESA Local Bus, the 32-bit Extended Industry Standard Architecture (EISA) expansion bus, to deliver exceptional I/O throughput and expandability. The 486 Central Processing Unit (CPU) is coupled with a BURST 32-bit memory bus, an optional 128K/256K/512KB external fast write-back cache memory.

The 486EI system board supports 486SX, 487SX, 486DX, 486DX2, 486DX4, Overdrive CPUs with the external clock frequency up to 50MHz and internal clock frequency up to 100MHz. Onboard four banks of 72-pin Single In-line Memory Modules (SIMMs), support up to 256MB of Dynamic Memory.

The 486EI system board is designed to be mounted in a standard PC/AT or PC/XT type enclosure and uses industry-standard power supply inputs, connectors, expansion board sockets, and so forth; in other words, you can upgrade your existing PC system or build a new PC system with no modifications to existing components and adapters.

The 486EI system board is well suited for these typical applications:

- Large spreadsheet and database management
- High-performance network file servers in a multi-user/multi-tasking environment
- Artificial intelligence and scientific applications
- CAD/CAM/CAE workstations

- High speed automatic controllers

## **FEATURES**

### **CPU Support**

- . 486DX/4 microprocessor 75/90/100 MHz.
- . 486DX/2 microprocessor 50/66/80 MHz.
- . 486DX microprocessor 20/25/33/40/50 MHz.
- . 486SX, 487SX microprocessor 20/25/33 MHz.
- . Overdrive processors.

### **Cache Memory**

Support 2 banks of fast SRAM that support three different sizes: 128KB, 256KB, or 512Kbytes.

### **System Memory DRAM**

Four banks of By-36 DRAM SIMM sockets on board that support different types of SIMM such as 256Kx36, 1Mx36, 2Mx36, 4Mx36 and 16Mx36 for the total up to 256MB of memory.

### **System BIOS**

64KB of AMI BIOS with built-in CMOS Setup and Configuration Utilities.

### **Shadow RAM**

System BIOS ROM, VIDEO ROM, and I/O ROM are relocatable to 32-bit high speed DRAM for efficient execution.

### **System Chipset**

SIS 85C411V VL/EISA Chipset. Provides perfect ISA/EISA/VESA compatibility

## **VESA/EISA Bus**

The 486EI comes with three 32-bit VESA local bus slots and eight 32-bit EISA slots. All three VESA local bus slots support VESA Bus Mastering devices. Slots 1 to 6 of the EISA bus support EISA Bus Mastering devices.

## **System, EISA CMOS and Real-time Clock**

The 486EI system board uses the Dallas DS1387 with the following features:

- . MC146818 compatible real-time clock.
- . 128 Bytes of CMOS SRAM for ISA-compatible configuration data.
- . 4KB CMOS SRAM for EISA configuration data.
- . A Built-in battery with life cycle of more than 5 years to provide back up power to the CMOS SRAM and the Real-time clock during system power off.

## **Board Form Factor**

Standard XT form factor and mounting holes

# SPECIFICATIONS

## Electrical

Power (System board only): +5V DC + - 5%  
5.0 Amps, max.

## Environmental

Operating temperature (ambient): 0°C/32°F to 55°C/131°F  
Storage temperature -20°C/-4°F to 70°C/158°F  
Operating Humidity: 10% to 90%  
(non-condensing)  
Storage humidity: 5% to 95%  
(non-condensing)

## Dimensions

Width: 8.7 inches (221.0 mm)  
Length: 13.07 inches (332.0 mm)



## CHAPTER 2: JUMPERS & CONNECTORS

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**When working with the 486EI, it is extremely important that you avoid Electrical Static Discharge (ESD). Always ground yourself by wearing a grounded wristband or ankle strap.**

Figure 1 on the next page shows the component layout of the 486EI system board with locations of the system board jumpers and connectors. Note that most jumpers and connectors on the system board are labeled with proper names with pin 1 marked as '1'. To avoid damaging the board and to have proper operation, caution should be taken when connecting these jumpers and connectors.

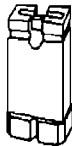
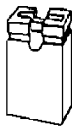
### JUMPER DESCRIPTIONS

Jumpers are used to select between various operating modes. A jumper switch consists of two, three, or four gold pins projecting from the system board. Placing the plastic jumper cap over two pins connects those pins and makes a particular selection. Using the jumper cap to cover two pins in this way is referred to as shorting those pins. If the cap is not placed on any pins at all or placed on only one pin, this is referred to as leaving the pins open.

**Note:** When you open a jumper, leave the plastic jumper cap attached to one of the pins so you don't lose it.

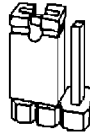
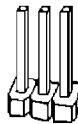


**OPEN**



**SHORTED**

**2-pin jumper**



**PINS 1-2  
SHORTED**

**3-pin jumper**



## CPU Jumpers

### CPU Type Jumpers

The 486EI system board supports three types of processors:

Type A: 486SX

Type B: 486DX, 486DX2, 486DX4

Type C: 487SX, P23T, OverDrive Processors

The jumper settings for each type of CPU are as follows:

CPU	J1 (2-pin)	J2 (3-pin)	J3 (3-pin)
Type A	OPEN	OPEN	2-3
<i>Type B</i>	<i>SHORT</i>	<i>1-2</i>	<i>1-2</i>
Type C	SHORT	2-3	1-2

### CPU Clock Frequency Jumpers

The 486EI system board provides following jumpers for different external clock frequencies to CPU ranging from 20MHz up to 50MHz to match to the external clock frequency required by the CPU installed.

CPU	JO1	JO2	JL2
SX-25 DX-25 DX/2-50	SHORT	SHORT	OPEN
<i>SX-33</i> <i>DX-33</i> <i>DX/2-66</i> <i>DX/4-100</i>	<i>OPEN</i>	<i>SHORT</i>	<i>OPEN</i>
SX-40 DX-40 DX/2-80	SHORT	OPEN	SHORT
DX-50	OPEN	OPEN	SHORT

## Supply Voltage to CPU Jumper

CPU Type <i>All DX, SX CPUs (5.0V)</i>	JP12 <i>1-3, 2-4</i>
For DX/4 CPU (3.3V)	3-5, 4-6

### *Attention:*

*JP12 is set to supply 5.0V to CPU by default. Make sure to change it to supply 3.3V for DX4 before turning power on. Supplying 5.0v to DX4 CPUs may damage the CPU permanently; warranty is void in that case.*

## Cache Memory Jumpers

The 486EI system board has following jumpers to select external cache sizes from 128KB, 256KB, or 512KB.

### Cache Memory Size Jumpers

	JC4	JC5	JP9
128KB	2-3	1-2	1-2
<b>256KB</b>	<b>1-2</b>	<b>1-2</b>	<b>4-5</b>
512KB	2-3	2-3	1-2

### Cache SRAM Type and Speed

Cache Size	Bank # Installed	SRAM Srn Type
128K	BANK 0 only	32Kx8
<b>256K</b>	<b>Two Banks</b>	<b>32Kx8</b>
512K	BANK 0 Only	128Kx8

(BANK 0 includes SRAM1, SRAM2, SRAM3, SRAM4)  
(BANK 1 includes SRAM5, SRAM6, SRAM7, SRAM8)

## CONNECTOR DESCRIPTIONS

Following is the list of 486EI system board connectors required to be installed for proper system operation. For detailed descriptions of these components, please refer to the next section. To avoid damaging the board and to have proper operation, caution should be taken when connecting these components.

- Power supply connectors (JS1 and JS2)
- Keyboard connector (J10)
- Power LED and keyboard lock connector (J9)
- Speaker connector (J8)
- Reset connector (J6)
- Turbo Switch connector (J22)
- Turbo Indicator LED (J24)

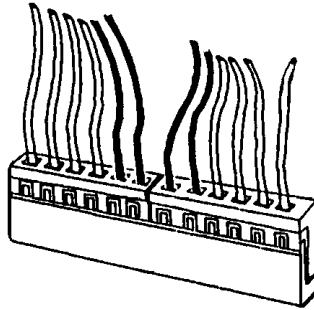
Please note that there is no Battery Connector on the 486EI because the DS1387 Real Time Clock with internal battery is provided. The battery life inside this IC lasts at least 5 years.

### Power Supply Connectors (JS1 and JS2)

The two Power Supply connectors, JS1 and JS2, are 6-pin AT standard power connectors. They are used to connect power lines and power good signal from the power supply. Most power supplies have two six-wire connectors, two of the wires on each connector are black. Align the two six-wire connectors so that the two black wires on each connector are in the middle as shown below. The pin assignments for JS1 and JS2 are indicated below:

Pin	Connector JS1	Connector JS2
1	Power Good	Ground
2	+5 VDC	Ground
3	+12 VDC	-5 VDC
4	-12 VDC	+5 VDC
5	Ground	+5 VDC

6	Ground	+5 VDC
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### Keyboard Connector (J10)

The keyboard connector is a 5-pin, circular-type DIN socket. It is used to connect the system board keyboard interface to any standard AT-compatible keyboard (84 or 101 -key type keyboards). The pin assignments are listed below:

Pin	Description
1	Keyboard Clock Signal
2	Keyboard Data Signal
3	Not Used
4	Ground
5	+5V Fused VDC



## Power LED and Keyboard Lock Connector (J9)

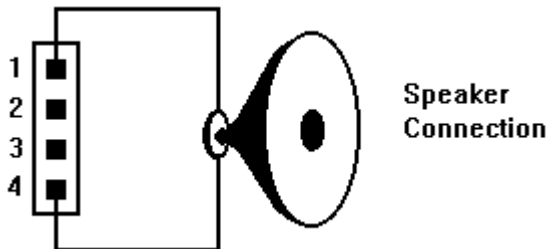
The Power LED and Keyboard Lock connector (J9) is 5-pin keyed BERG strip. It is used to connect +5 VDC power to the power indicator LED at the front panel and connect security keyboard lock to the keyboard controller. So provides limited security against casual intruders. The pin assignments are indicated below:

Pin	Description
1	LED Power
2	Key (No Connection)
3	Ground
4	Keyboard Lock
5	Ground

## Speaker Connector (J8)

The Speaker connector (J8) is a 4-pin keyed BERG strip. It is used to connect an external 2-inch, 8-ohm speaker to the system board to provide sound capability. The pin assignments are defined below:

Pin	Description
1	Speaker Data Out
2	Key (No Connection)
3	Ground
4	+5 VDC



## Reset Connector (J6)

The system RESET connector (J6) is a 2-pin BERG strip. It is used to connect the push button reset switch located on the front panel to the system board. System reset can be done by shorting pin 1 to pin 2 with the same effect as turning the power off and then on again.

Pin	Description
1	Reset Input
2	Ground

## Turbo Switch Connector (J22)

The Turbo switch (TURBO) is a 2-pin BERG strip. It is used to connect the front panel 2-position push switch to the system board speed switching circuitry. In Turbo speed, the cache memory is enabled and full speed of 32-bit memory transfer is utilized. In non-turbo speed, the cache memory is disabled. In both speeds, the ISA expansion bus timing compatibility is still preserved.

Pin	Description
1	Turbo Speed
2	Ground

### *Notes:*

- System runs at Turbo speed when pins 1 and 2 are shorted.
- System runs at Slow speed when pins 1 and 2 are open.

## **Turbo LED Connector (J24)**

The Turbo LED connector, marked as 'TB/LED', is a 2-pin BERG strip. It is used to connect a CPU operating frequency indicator LED from the front panel to the system board. The pin assignments are indicated below:

<b>Pin</b>	<b>Description</b>
1	LED Cathode
2	LED Anode

## **CHAPTER 3: HARDWARE INSTALLATION**

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### **BUILDING A HIGH PERFORMANCE SYSTEM**

The dimension of the 486EI system board is designed to fit perfectly in an PC/XT or an PC/AT standard case. To build a complete high performance system based on the 486EI system board, the following equipment are needed:

1. A chassis with dimension similar to PC/XT or PC/AT standard chassis.
2. A standard AT 220W power supply which is capable to provide a continuous power within a +4.75 VDC to +5.25 VDC range. A power line filter may be needed for areas with noisy transmission.
3. A 2-inch, 8-Ohm speaker to provide sound capability.
4. A push button switch with 2-pin connector for reset function.
5. At least one floppy drive (360K, or 1.2M, or 1.44M, or 2.88MB).
6. A combination hard disk and floppy disk controller card.
7. VLB SCSI/IDE controller For the best disk performance.
8. Hard disk drive corresponding to disk controller used.
9. A video card (Monochrome, CGA, EGA, VGA). VLB VGA is recommended for best performance.
10. A set of flat cables between floppy drive and hard disk drive to the combination controller card.
11. An AT-compatible keyboard (84 or 101 Keyboard) with cable.
12. A video display monitor.

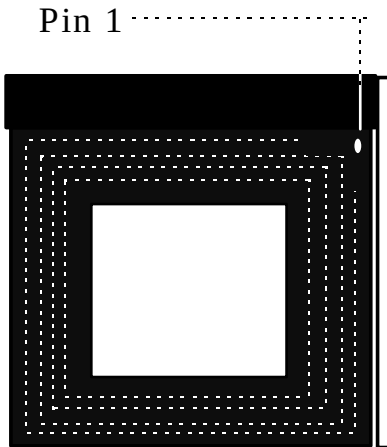
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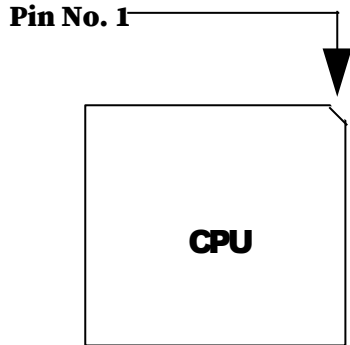
14. Following additional equipment will be useful to enhance the system:

- A bus or serial mouse.
- A tape back up drive.
- A CD-ROM drive.

## CPU INSTALLATION

Care should be taken when installing the CPU into the Zero Insertion Force (ZIF) socket on the system board. Lift the handle of ZIF socket up. Insert the CPU into ZIF socket without much force. On 486 processors pin 1 is with the square base and there is also a notch in one corner on the surface of the CPU. Pin no. 1 of CPU should go to hole for pin no. 1 on the socket. Match the hole and pin one and then easily insert the processor into socket. Press the handle gently down. A typical ZIF socket is shown below with pin no. 1 indicated.





## **!! Warning!!**

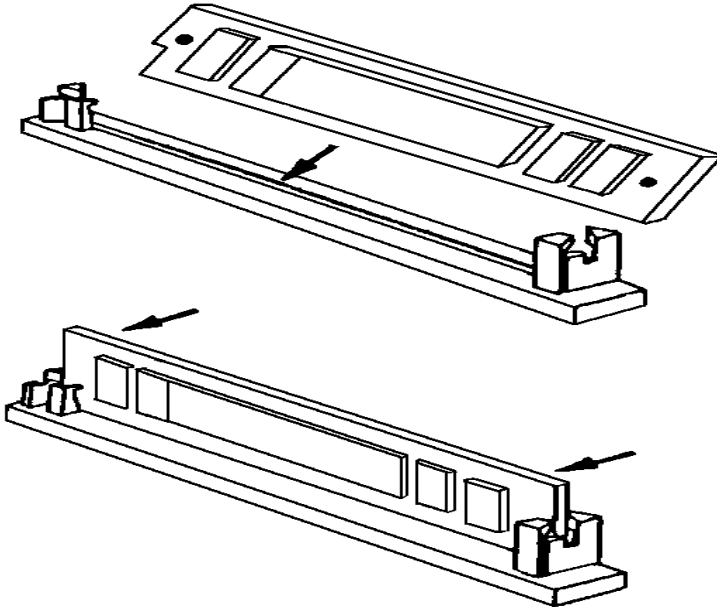
*Manufacturer of the board or CPU is not responsible for damage to CPU because of improper handling during installation or wrong installation.*

## INSTALLING DRAM SIMMS



*When working with DRAM SIMMs, it is extremely important that you avoid Electrical Static Discharge (ESD). Always ground yourself by wearing a grounded wristband or ankle strap.*

1. Power must be off while installing SIMMs.
2. The SIMM module should face to the right with pin 72 next to the power supply connectors.
3. Insert the SIMM at a 45 degree angle, tilted towards ISA slots.
4. Gently push the SIMM to an upright position until it "snaps" into place.
5. Repeat above steps until the entire bank is filled.





The 486EI system board provides four sockets for standard 72-pin SIMMs. Each socket makes one bank. These banks are labeled SIM1, SIM2, SIM3, and SIM4. The board supports the 256Kx36, 1Mx36, 2Mx36, 4Mx36, 8Mx36 and 16Mx36 SIMMs. DRAM speed must be 60ns, 70ns or 80ns. The board will work at full 32-bit data path with at least one SIMM installed. You can mix and match the SIMMs for maximum flexibility. For example, socket 1 & 2 can have 1Mx36 SIMMs and socket 3 & 4 can have 4Mx36 SIMMs, that combines to 40MBytes of memory total.

<b>BANK 1</b>	<b>BANK 2</b>	<b>BANK 3</b>	<b>BANK 4</b>	<b>TOTAL</b>
1Mx 36	None	None	None	4 Mbyte
1Mx 36	1Mx 36	None	None	8 Mbyte
1Mx 36	1Mx 36	1Mx 36	None	12 Mbyte
1Mx 36	1Mx 36	1Mx 36	1Mx 36	16 Mbyte
1Mx 36	4Mx 36	None	None	20 Mbyte
1Mx 36	1Mx 36	4Mx 36	None	24 Mbyte
1Mx 36	4Mx 36	4Mx 36	None	36 Mbyte
1Mx 36	1Mx 36	4Mx 36	4Mx 36	40 Mbyte
2Mx 36	None	None	None	8 Mbyte
2Mx 36	None	2Mx 36	None	16 Mbyte
2Mx 36	None	8Mx 36	None	40 Mbyte
8Mx 36	None	None	None	32 Mbyte
8Mx36	None	8Mx 36	None	64 Mbyte
4Mx 36	None	None	None	16 Mbyte
4Mx 36	4Mx 36	None	None	32 Mbyte
4Mx 36	4Mx 36	4Mx 36	None	48 Mbyte
4Mx 36	4Mx 36	4Mx 36	4Mx 36	64 Mbyte
16Mx 36	None	None	None	64 Mbyte
16Mx 36	16Mx 36	None	None	128 Mbyte
16Mx 36	16Mx 36	16Mx 36	None	172 Mbyte
16Mx 36	16Mx 36	16Mx 36	16Mx 36	256 Mbyte

# CHAPTER 4: SYSTEM SETUP

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## SYSTEM CMOS

You need to setup a system CMOS once every time:

- You start a new and unconfigured system.
- You receive a start-up error message indicating the configuration information stored in the non-volatile CMOS RAM has somehow become corrupted.
- You add, remove or change peripherals from your system.
- You add, remove or change DRAM from your system.

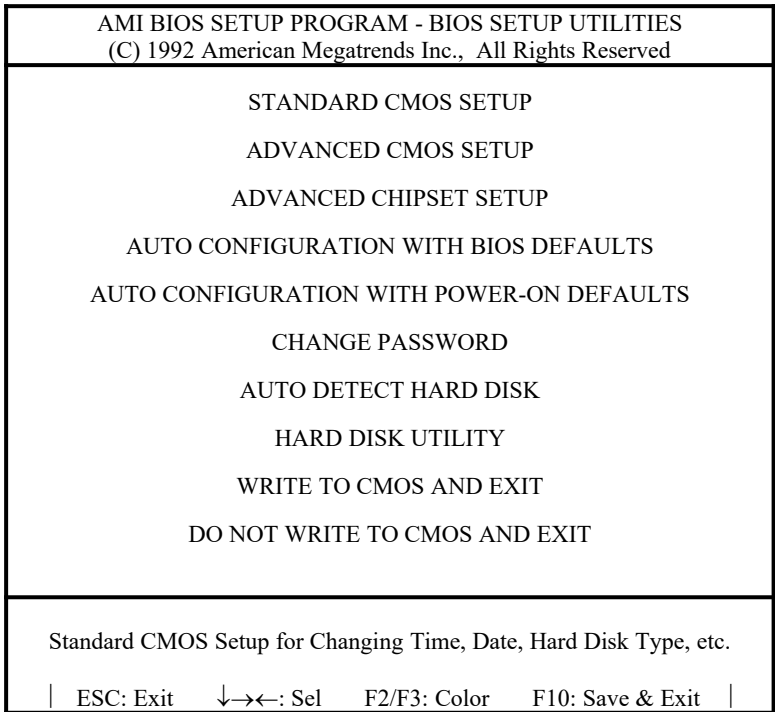
The first time you power up the system, the configuration information stored in the battery-backed CMOS RAM may not be correct. The BIOS detects this condition and prompts user to go through the SETUP section. This chapter explains how to use the BIOS SETUP program and make the appropriate entries.



*Some of the parameters are already factory preset and do not need to be changed. Please read the instructions carefully and only change the settings if necessary.*

### Entering CMOS Setup

1. Reset the system by turning it OFF then ON or pushing the "RESET" button on the system front panel.
2. Hit the <DEL> key momentarily as soon as the following message appears:  
**"Hit <DEL>, if you want to run SETUP"**
3. After you press the <DEL> key, the following BIOS Setup screen appears:



4. To select an option, use arrow key to high light the option then press **<ENTER>**. The option menu will appear for your selection.
5. Press **<ESC>** at anytime to return to the Main Menu.
6. Select **"WRITE TO CMOS AND EXIT"** option to save the changes, exit from the BIOS SETUP menu, and reboot the system. Select **"DO NOT WRITE TO CMOS AND EXIT"** to ignore the changes, exit from the BIOS SETUP menu, and reboot the system.

In each setup screen, the following common keyboard controls may be used:

<F1>:	Help
<F2>,<F3>:	Color (to change screen color)
<F5>:	Old Setup Values
<F6>:	BIOS Setup Default Values
<F7>:	Power On Default Values
<ESC>:	Exit Setup Section
<b>Arrow Keys:</b>	Select Setup Item
<PG UP/ PG DN>:	Modify the Setup Item

## **Standard CMOS Setup**

Use the standard CMOS Setup screen to check or modify general configuration information such as the date, time, floppy type, hard disk type, video type, etc.

### **Date (Month/Date/Year):**

On the bottom right corner of the screen, a calendar has been provided for user. You manually set the electronic calendar only if the values are incorrect.

### **Time (Hour/Minute/Second):**

The time here is 24-hour time. You would enter 5:30 P.M. as 17:30:00.

### **Hard Disk C:/D: Type:**

The BIOS provides 46 pre-defined types of popular hard disk drives. Relevant specifications include the number of cylinders and heads, write pre-compensation time, read/write head landing zone, number of sectors per track. A hard disk will not work properly if your enter incorrect drive parameters.

If your particular drive is not one of the 46 pre-defined types, simply scroll down to select type 47 and enter the appropriate values for *cylinders*, *heads*, *WPcom*, *LZone*, and *sectors*. *Size* is automatically determined by the other entries. If your hard drive is IDE type, you can also let the BIOS to determine the drive type by selecting "*AUTO DETECT HARD DISK*" from the Main Menu.

**Floppy Drive A: Type:**

Specify the type of the first floppy drive installed on the system. The 360KB, 720KB, 1.2MB, 1.44MB, 2.88MB are supported. 'Not Installed' could be used as an option for diskless workstations.

**Floppy Drive B: Type:**

Specify the type of the second floppy drive installed on the system. The 360KB, 720KB, 1.2MB, 1.44MB, 2.88MB are supported. 'Not Installed' could be used as an option for diskless workstations.

**Primary Display Monitor:**

Select the type of display monitor. The Color 40x25, Color 80x25, VGA/PGA/EGA, Monochrome are supported. 'Not Installed' option could be used for network file servers.

**Keyboard:**

Normally, keyboard is always installed. However, network system may not have keyboard. Select "Not installed" to inform BIOS boot up keyboard detect routine that keyboard is intentionally not installed.

After all selections have been done, press <ESC> key to exit this section.

## **Advanced CMOS Setup**

"ADVANCED CMOS SETUP" lists some system features that allows you to fine tune your system setup.

### **Above 1MB Memory Test:**

During system boot up, the system BIOS can either perform or not perform thoroughly test system memory above standard 1MB area. Since thorough test takes a long time, disable this option can speed up power-on initialization process and the BIOS will only scan the extended memory of every 32K locations to determine the on-board memory size. The default setting is "Disabled"

### **System Boot Up NumLock:**

When the computer boots up, BIOS can either select Numeric value or Cursor control functions for the numeric keypad of IBM compatible keyboards. Most extended compatible keyboards have separate cursor control keys. Therefore, the default setting should be "On" to select Numeric value function for the numeric keypad.

### **System Boot-Up Sequence:**

System can either boot up from floppy drive or from hard disk drive. Selecting option A:, C: will force the BIOS to look for bootable operating system files from floppy drive A: first before look for files from drive C:. Reverse this sequence by selecting "C:, A:". The default setting is " C:, A:"

### **External Cache Memory:**

To enable or disable on-board External Cache Memory. The default setting is "Enabled".

### **Internal Cache Memory:**

To enable or disable Internal Cache Memory of the CPU. The default setting is "Enabled".

### **Password Checking Option:**

The password feature is used to prevent unauthorized system boot-up or unauthorized use of system CMOS SETUP. Choose either "Setup" or "Always" as follow:

"Always" Each time the system is turned on, the pass word prompt appears.

"Setup" If there is a password set, the Password prompt only appears if you attempt to enter the BIOS Setup program. If there is no set password, the Password Checking Option is disabled. You create a password by using "CHANGE PASSWORD" in the Main Menu.

The default setting is "Setup".

### **Video ROM Shadow C000, 32K:**

Shadowing helps to speed up execution time of BIOS ROM code by copying the code to fast 32-bit RAM area and executes it from there. This option is for ROM code of the graphic card. The default setting is "Enabled".

### **Adapter ROM Shadow C800, 32K:**

### **Adapter ROM Shadow D000, 32K:**

### **Adapter ROM Shadow D800, 32K:**

This option is similar to the Video ROM Shadow option. However, the ROM code in this case is on the adapter card

that mapped to the corresponding memory area. If you have expansion cards with ROMs on them such as SCSI controller, you need to know which address spaces the ROMs are mapped into and select the corresponding address spaces for shadowing. However, care should be taken because some add-on cards may not work properly if their ROM code are shadowed. The default setting is "Disabled".

### **Boot Sector Virus Protection:**

This built-in utility will auto detect Software Viruses that may present in the Boot sector of the boot hard disk or boot floppy diskette during system boot up. The default setting is "Disabled"

## **Advanced Chipset Setup**

### **System DRAM Speed**

### **Cache Memory Read Cycle**

### **Cache Memory Write Cycle**

Since the 486EI system board can support different CPU types at different speeds, this option is provided so that users can set for the optimal performance of the board. The rule of thumb is the faster CPU speed, the slower should be set for the system DRAM speed.

	DX-25 DX2-50	DX-33 DX/2-66 DX/4-100	DX-40	DX-50
System DRAM Speed	<b>Fastest</b>	<b>Slower</b>	<b>Slower</b>	<b>Slowest</b>
Cache Write Cycle	<b>2T</b>	<b>2T</b>	<b>3T</b>	<b>3T</b>
Cache Read Cycle	<b>1T</b>	<b>1T</b>	<b>2T</b>	<b>2T</b>
System Bus Speed	<b>CLK/3</b>	<b>CLK/4</b>	<b>CLK/5</b>	<b>CLK/6</b>

### **Non-Cacheable Area Size:**



This option is valid only when the next option is selected. It determines the size of the non-cacheable memory block.

**Non-Cacheable Area Start:**

Determines the starting address of the selected non-cacheable memory block. Select Disabled if no block is selected.

**Video ROM (C0000) Cacheable:**

The Video ROM can be cached into CPU Internal Cache or system board External Cache memory to enhance the display performance. However, some display cards may not work properly when their ROM are cached. The default setting is “Disabled”.

**System BIOS ROM Cacheable:**

The System BIOS ROM can be cached to enhance the performance of the system. However, some software application may not operate properly when system BIOS ROM is cached. The default setting is “Disabled”.

**I/O Recovery Select:**

Some I/O devices on system boards or on add-on cards cannot respond properly if I/O cycles to the cards happen too quickly consecutively. This feature allows users to select number of wait states that system board will insert between the consecutive I/O cycles so that slow I/O devices can response. Typically, 5 should be selected if CPU speed is 33 MHz or less and 11 should be selected for CPU speed faster than 33 MHz. The default setting is 11.

After all selections have been done, press ESC to exit this section.

**Change Password**

Use this option to change system password. Go to Advanced CMOS Setup, select Change Password option and then select Setup. The initial password for AMI BIOS is "AMI". After typing this password, press ENTER and system will prompt you for a new password. Enter your own password for maximum of 6 characters.

If the "Always" option is chosen at Setup, each time the system is turned on, the prompt request for user password will appear.

If the "Setup" option is chosen at Setup, the password prompt will not appear when the system is turned on, but will appear if the user attempts to enter the Setup program.

## **Auto Detect Hard Disk**

Normally users have to select the correct types of hard drives used in the system. However, for some IDE hard drives, the types are not very well defined. This option, once selected, will automatically test and detect the type of hard drives installed.

## **Harddisk Utility**

Use this option to perform low-level hard disk format.

Low-level hard disk format should be done for new hard disks and should be done yearly for used hard disks. This format function allows you to format the entire disk or a part of the disk.

### **Warning !!!**

**All data on the hard disk may be lost  
after a low-level format.**

With Auto-Interleave you need not speculate about the value of the interleave factor while entering the parameters for format. This function determines the optimum interleave factor for the best disk performance.

Media Analysis does a comprehensive analysis of the hard disk surface to find out bad patches on your hard disk. This leaves the surface of the hard disk formatted with bad tracks marked bad.

### **Write to CMOS and EXIT**

After you have made any changes during setup, use this option to store those new information into Non-volatile CMOS memory. The system should reboot with the correct system board configuration.

### **Do Not Write to CMOS and EXIT**

After you have/have not made any changes during setup and decided not to store those information into non-volatile CMOS memory, use this option to exit Setup. The system should reboot with the current configuration stored in CMOS memory.

# BIOS BUILT-IN SPECIAL FEATURES

## Keyboard Speed Switch

System speed can also be switched by using keyboard. There are three available speeds as shown below:

### Fast speed:

Both internal and external cache memory of the system board are enabled.

### Medium speed:

External Cache memory is disabled

### Slow speed:

Both external and internal cache memory of the system board are disabled.

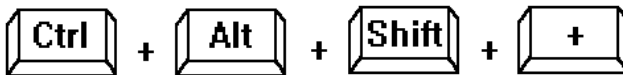
Set faster speed by pressing '+' key once while holding 'CTRL', 'SHIFT', and 'ALT' keys.



Set slower speed by pressing '-' key once while holding 'CTRL', 'SHIFT', and 'ALT' keys.



To go back to faster speed, pressing '+' once while holding 'CTRL', 'SHIFT', and 'ALT' keys.





## VESA/EISA/ISA ADAPTER SETUP

Turn off system power.

For VESA local bus adapter boards configured in ISA mode, you should refer to the adapter user's manual for properly setting switches and jumpers on the add-on cards.

For VESA adapters configured in EISA mode, refer to the user's manual of the adapters for instruction how to run the EISA Configuration setup.

Gently insert your new VESA adapters into any of the VESA expansion slots and your new EISA adapters into any of EISA slots. Note that only slot 1 to slot 6 support EISA bus mastering so that if an EISA adapter card is Bus mastering type then it has to be inserted into one of these slots. All of VESA slots support VESA Bus mastering.

### **Warning !!!**

**Care should be taken when inserting the VESA  
And EISA adapters into the board slots  
to avoid bending pins of the slots.**

Shipped with the board is a floppy diskette containing EISA CONFIGURATION UTILITY files (ECU) and configuration files for the board which extension name ".CFG". The configuration file for the 486EI is !AEI0401.CFG. You should copy all the files with extension name ".CFG" from the diskettes provided with the EISA adapter boards, into this diskette.

Turn on system power and boot up into DOS from floppy drive A. Remove the boot diskette and insert the system board EISA Setup diskette into drive A. Invoke the EISA Configuration Utility file by typing:

**CFG** <Enter>

The CFG.EXE program displays the current configuration information on the slot screen. Check to be sure all the EISA adapters are represented in the display. If not, ensure that all necessary configuration (\*.CFG) files are present on the current diskette.

From the setup screen, follow the interactive instructions to set up the system EISA configuration. All of the features of the system board are set to default mode so that you do not have to change them. Please read the AMI EISA Configuration Utility manual for more details.

# CHAPTER 5: HARDWARE OVERVIEW

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## MICROPROCESSOR

The 486EI supports 486DX, 486SX, 487SX, , 486DX/2, 486DX/4 OverDriver Processors. The 486SX is the same as the 486DX except that its internal Floating-Point Unit is removed and its operating speed is lower. The 487SX is exactly the same as the 486DX running at lower speed. The 486DX/2 is an upgrade version of the 486DX with the internal operating speed doubling the external clock speed. The 486DX/4 is an upgrade version of the 486DX/2 with the internal operating speed tripling the external clock speed. They are high performance 32-bit microprocessor with integrated memory management. These microprocessors support:

- 8KB internal cache memory in a 4-way set associative organization
- 32-bit address and 32-bit data interfaces
- 4 Gigabytes (Giga = 1,073,741,824) of physical address space
- 64 Terabytes (Tera = 2 to the power of 40) of virtual address space
- Object code compatible with all 8086 family microprocessors
- Three operational modes :
- Real Address Mode
- Protected Virtual Address Mode
- Virtual 8086 Mode
- Power-up internal Self-Test

## INTERNAL MATH COPROCESSOR

The 486DX, 486DX/2, 486DX/4, and 487SX all have a built-in floating-point instruction execution unit. This unit is compatible to the floating-point instruction execution unit of the 80387. However, the execution speeds for the arithmetic instructions running on the these CPUs are two to three times faster than when they run in a system with an 80386 and an 80387 coprocessor.



## **CACHE MEMORY**

The increase in speeds of DRAM over the last few years have not kept pace with the increase in microprocessor speeds. This requires very fast and unavailable DRAMs or a lot of wait states have to be inserted to the CPU memory cycles. System performance decreases as the number of wait states increases.

Cache memory is a small (so as not to greatly affect system cost) but can be accessed very fast. The code and data frequently accessed by the CPU normally is stored here. The 486 has a built-in 8KB unified code and data cache in a 4-way set associative organization. When the 486 accesses memory, it checks if data is in the cache memory and, if the data is there, it will get from here instead of go to slower main system memory. This is a cache hit situation. It is possible that 95 to 99 memory accesses out of 100 memory accesses are cache hits depending on the application software.

An optional 128Kbyte, 256KByte, or 512KByte external write-back cache memory is provided on the 486EI system board to achieve an even higher performance. This external cache requires from four to eight pieces of 32Kx8 or 128Kx8 fast static RAM chips. With external cache memory, the memory hit rate of the system will be future improved so that the overall performance is higher.

Table 3 in the next page shows system memory mapping with cached and non-cached locations.

**TABLE 3 : SYSTEM MEMORY MAPPING**

<b>Address (hex)</b>	<b>Function</b>	<b>Comments</b>
00000000-0009FFFF	640K System RAM	Cacheable
000A0000-000BFFFF	128K Video RAM	Non-cacheable
000C0000-000C7FFF	32K Video BIOS	Cacheable/Non-cacheable
000C8000-000CFFFF	32K I/O ROM	Non-cacheable
000D0000-000DFFFF	64K I/O ROM	Non-cacheable
000E0000-000EFFFF	64K Extended BIOS	Non-cacheable
000F0000-000FFFFF	64K On-Board BIOS ROM	Cacheable
00100000-00BFFFFFFF	System Memory (RAM)	Cacheable
00C00000-00FFFFFFF	System Memory (RAM)	Cacheable
01000000-BFFFFFFF	System Memory (RAM)	Cacheable
C0000000-C1FFFFFF	WEITEK Coprocessor	Non-cacheable
C2000000-FFFDFFFF	System Memory	Non-cacheable
FFFE0000-FFFFFFF	128K On-Board BIOS ROM	Non-cacheable

## **MAIN SYSTEM MEMORY**

The main memory subsystem of the 486EI consists of 640K of main memory below 1 Mega Bytes, 320K of I/O ROM BIOS, 64KB of system BIOS ROM, and 255MB of extended system memory.

### **System ROM**

The BIOS ROM from AMI is provided in a single 8-bit EPROM, which can hold up to 64KB of code and data. It is accessible at the top of the system's 4 GB memory address space and at the top of the first Megabyte of memory. The BIOS ROM support all ISA/EISA compatible features. In addition, Shadow RAM feature is provided to allow the BIOS code and VIDEO BIOS to be executed from 32-bit system DRAM resident at the same physical address. This feature significantly improves the performance in BIOS-call intensive applications.

The processor is reset when power is turned on or when the RESET switch is used. After RESET, the 486 CPU is initialized to a known internal state and begins fetching instructions, out of the BIOS ROM, from the reset address FFFFFFF0. This address leads to the entry point of the power-on system initialization procedure stored in BIOS ROM. The BIOS system initialization procedure consists of the following functions:

- Power-on self-tests such as BIOS Check Sum Test, system DRAM Test, Battery- Backed CMOS RAM Test.
- Initializing all the standard compatible I/O components such as Interrupt Controllers (Intel 8259A), DMA Controllers (Intel 8237A), Keyboard Controller (Intel 8742), Video Controller (CGA, EGA, VGA, etc.), System Timers (Intel 8254).

- Initializing all the ISA/EISA add-on cards based on the information stored in the EISA CMOS, if the system is already set up previously.
- Built-in SETUP program, if allowed, is used for system configuration such as:
  - Day/Time setting
  - Selection for floppy disk and hard disk types
  - Shadow RAM ON/OFF selection
  - Turbo ON/OFF selection
  - Cache ON/OFF selection

Beside initializing the system, BIOS ROM also provides BIOS interrupt calls for such functions as video access, floppy disk access, printer access, etc...

## **DRAM control Logic**

The DRAM control logic on the 486EI system board is designed and optimized for the 486 CPU. Unlike most other systems with a separate cache controller, the DRAM control logic is tightly coupled with the on-chip cache controller. When CPU address becomes available for a new memory cycle, both controllers operate in parallel. If the cycle is a read hit or a write hit, the cache controller will take control of the cycle while the DRAM controller stays in idle. If the cycle is a read miss, the DRAM controller will cooperate with the cache controller to generate appropriate cycles to write the data from the cache memory back to the system memory, if the cache data line is dirty, then read data from the system memory to the CPU and to update the cache memory. If the cycle is a write miss, the DRAM controller simply takes control to write the data to the system memory while the cache controller stays in idle. The DRAM controller and the system memory support the i486 burst memories read cycles and fast-page mode cache write back cycles for the highest performance.

The 486EI on-board DRAM is configured in a 36-bit-wide arrangement consisting of 32 bits of data and 4 bits of parity. Each parity bit is directly associated with one of the 4 bytes in the 32-bit double word.

The 486EI system board supports 4 banks of by-36 SIMM DRAM memory on the system board. Only one SIMM is required to have a system running at full 32-bit data path. Table 1 shows all the combination of SIMMs and memory configurations supported by the board.

## **Shadow DRAM Feature**

The 486EI supports the Shadow DRAM feature which allows the BIOS ROM, VIDEO ROM, and I/O ROM codes to be executed from the system DRAM resident at the same physical address space. Shadow DRAM feature significantly improves the system performance in BIOS-call intensive applications because executing code out of DRAM is very much faster than out of development effort by leading computer manufacturers to add 32-bit data transfer capabilities and intelligent bus masters to the original I/O Channel Bus called Industry Standard Architecture (ISA) bus which exists in IBM PC AT computers. Full compatibility to ISA is protected so users just have to replace old ISA system board with our high performance EISA system board and still can use existing ISA boards on EISA slots.

The 32-bit data transfer capability of EISA bus together with high performance 32-bit 486 microprocessors and peripherals greatly enhance system throughput. 32-bit data transfer from 486 to a 32-bit adapter is much faster than to a 16-bit adapter on the slot

## **ISA/EISA-COMPATIBLE EXPANSION BUS**

The 486EI system board has eight 32-bit ISA/EISA Expansion Bus connectors for interfacing with all ISA/EISA compatible I/O, memory, and master adapters. It is recommended that the on-board 32-bit DRAM memory should be used first before using 8-bit/16-bit/32-bit memory adapter on the ISA/EISA Expansion Bus because memory operations through this bus take significantly longer time.

### **EISA Bus Introduction**

The Extended Industry Standard Architecture (EISA) is a joint development effort by leading computer manufacturers to add 32-bit data transfer capabilities and intelligent bus masters to the Original I/O Channel Bus called Industry Standard Architecture (ISA) bus which exists in IBM PC/AT computers. Full compatibility to ISA is protected so users just have to replace old ISA board with higher performance EISA system board and still can use existing ISA boards on EISA slots.

EISA provides several advantages over the ISA bus:

- 32-bit addressing and data transfers
- Data transfer rates up to 33Mbytes/second
- Intelligent bus master support with multiple bus master arbitration.
- Interrupt sharing
- System automatic configuration (no jumpers setting for EISA adapters)

The EISA connector has been specially designed to accommodate both ISA and EISA cards. The connector has 192 pins in a two-level arrangement. The upper level of contacts is ISA-compatible, and the EISA compatible signals are on the lower level. The connector is keyed so that only EISA cards can contact both levels.

For ease of use, EISA provides an automatic configuration facility with each EISA adapter having a manufacturer

designated ID code. The ID code identifies the card type, allowing the set-up program to access a corresponding configuration file. Setup information is then written to system board battery backed CMOS RAM and to special I/O ports that can be addressed by physical slot number.

## **ISA/EISA Compatible Peripherals**

The 486EI system board provides the following standard peripherals:

- Enhanced DMA functions with seven independently programmable channel
- 
- Supports up to six intelligent bus masters (slot 1 to slot 6)
- Two 82C59A compatible Interrupt Controllers
- Five 82C54 compatible programmable interval timers
- One keyboard controller (Intel 8742 micro-controller)

## **VESA LOCAL BUS INTRODUCTION**

The processor bus is the Local Bus. Although the speed of the CPUs has been rapidly increased from 8MHz, to 25MHz, 33MHz, and 50MHz in recent years, on a standard ISA or EISA bus, the bus clock speed is still limited to 8MHz. The maximum possible performance can be achieved through a 0-wait state access on the ISA bus is 250-nanoseconds with 16-bit data width; for a maximum data transfer rate of 8MB/s; and on the EISA bus is 125-nanoseconds with 32-bit data width, for a maximum data transfer rate of 33MB/s. These numbers do not include the overhead for translating processor bus cycle into ISA/EISA bus cycle.

VESA local bus is the emerging bus standard to solve this I/O bottle neck on high performance system boards. On the VESA local bus, the bus speed can go up to 50MHz CPU speed. The minimum time to run a 0-wait state access on the VESA local bus is only 60-nanoseconds for a 33-MHz 486 processor, or 40ns for a 50MHz 486 processor with a very little overhead; thus the data transfer rate can be multiple times that on the EISA bus.

The VESA local bus slot is defined as a 112-pin Micro Channel connector in-line with the system EISA bus connector.

For more information, please refer to the VESA local bus specifications.



## APPENDIX A: AMI BIOS HARD DISK TYPE

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Type	Cylinder	Heads	Write Precomp	Landing Zone	Sectors	Size
1	306	4	128	305	17	10MB
2	615	4	300	615	17	20MB
3	615	6	300	615	17	31MB
4	940	8	512	940	17	62MB
5	940	6	512	940	17	47MB
6	615	4	65535	615	17	20MB
7	462	8	256	511	17	31MB
8	733	5	65535	733	17	30MB
9	900	15	65535	901	17	112MB
10	820	3	65535	820	17	20MB
11	855	5	65535	855	17	35MB
12	855	7	65535	855	17	50MB
13	306	8	128	319	17	20MB
14	733	7	65535	733	17	43MB
16	612	4	0	663	17	20MB
17	977	5	300	977	17	41MB
18	977	7	65535	977	17	57MB
19	1024	7	512	1023	17	60MB
20	733	5	300	732	17	30MB
21	733	7	300	732	17	43MB
22	733	5	300	733	17	30MB
23	306	4	0	336	17	10MB
24	925	7	0	925	17	54MB
25	925	9	65535	925	17	69MB
26	754	7	754	754	17	44MB
27	754	11	65535	754	17	69MB

Type	Cylinder	Heads	Write Precomp	Landing Zone	Sectors	Size
28	699	7	256	699	17	41MB
29	823	10	65535	823	17	68MB
30	918	7	918	918	17	53MB
31	1024	11	65535	1024	17	94MB
32	1024	15	65535	1024	17	128MB
33	1024	5	1024	1024	17	43MB
34	612	2	128	612	17	10MB
35	1024	9	65535	1024	17	77MB
36	1024	8	512	1024	17	68MB
37	615	8	128	615	17	41MB
38	987	3	987	987	17	25MB
39	987	7	987	987	17	57MB
40	820	6	820	820	17	41MB
41	977	5	977	977	17	41MB
42	981	5	981	981	17	41MB
43	830	7	512	830	17	48MB
44	830	10	65535	830	17	69MB
45	917	15	65535	918	17	114MB
46	1224	15	65535	1223	17	152MB
47	USER'S	TYPE				

## **APPENDIX B: ISA I/O ADDRESS MAP**

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<b>I/O ADDRESS (HEX)</b>	<b>I/O DEVICE</b>
000 - 01F	DMA Controller 1, 8237A-5
020 - 03F	Interrupt Controller 1, 8259A
040 - 05F	System Timer, 8254-2
060 - 06F	8742 Keyboard Controller
070 - 07F	Real-Time Clock/CMOS and NMI Mask
080 - 09F	DMA Page Register, 74LS612
0A0 - 0BF	Interrupt Controller 2, 8259A
0C0 - 0DF	DMA Controller 2, 8237A-5
0F0 - 0FF	i486 Math Coprocessor
1F0 - 1F8	Fixed Disk Drive Adapter
200 - 207	Game I/O
20C - 20D	Reserved
21F	Reserved
278 - 27F	Parallel Printer Port 2
2B0 - 2DF	Alternate Enhanced Graphic Adapter
2E1	GPIB Adapter 0
2E2 - 2E3	Data Acquisition Adapter 0
2F8 - 2FF	Serial Port 2 (RS-232-C)

<b>I/O ADDRESS (HEX)</b>	<b>I/O DEVICE</b>
300 - 31F	Prototype Card
360 - 363	PC Network (Low Address)
364 - 367	Reserved
368 - 36B	PC Network (High Address)
36C - 36F	Reserved
378 - 37F	Parallel Printer Port 1
380 - 38F	SDLC, Bisynchronous 2
390 - 393	Cluster
3A0 - 3AF	Bisynchronous 1
3B0 - 3BF	Monochrome Display and Printer Adapter
3C0 - 3CF	Enhanced Graphics Adapter
3D0 - 3DF	Color/Graphics Monitor Adapter
3F0 - 3F7	Diskette Drive Controller
3F8 - 3FF	Serial Port 1 (RS-232-C)
6E2 - 6E3	Data Acquisition Adapter 1
790 - 793	Cluster Adapter 1
AE2 - AE3	Data Acquisition Adapter 2
B90 - B93	Cluster Adapter 2
EE2 - EE3	Data Acquisition Adapter 3
1390 - 1393	Cluster Adapter 3
22E1	GPIB Adapter 1

<b>I/O ADDRESS (HEX)</b>	<b>I/O DEVICE</b>
2390 - 2393	Cluster Adapter 4
42E1	GPIB Adapter 2
62E1	GPIB Adapter 3
82E1	GPIB Adapter 4
A2E1	GPIB Adapter 5
C2E1	GPIB Adapter 6
E2E1	GPIB Adapter 7

## APPENDIX C: EISA I/O ADDRESS SPACE

ADDRESS (Hex)	DESCRIPTION	COMMENTS
0000 - 00FF	ISA System Board I/O	
0100 - 03FF	ISA Expansion Adapter	EISA System Board and
0400 - 04FF	EISA System Board Controller	ISA I/O Space
0500 - 07FF	Alias of 0100 - 03FF	(0 to 4KB Range)
0800 - 08FF	EISA System Board I/O	
0900 - 0BFF	Alias of 0100 - 03FF	
0C00- 0CFF	EISA System Board I/O	
0D00- 0FFF	Alias of 0100 - 03FF	
1000 - 10FF	Slot 1 I/O	
1100 - 13FF	Alias of 0100 - 03FF	
1400 - 14FF	Slot 1 I/O	
1500 - 17FF	Alias of 0100 - 03FF	EISA Slot 1 I/O Space
1800 - 18FF	Slot 1 I/O	
1900 -1BFF	Alias of 0100 - 03FF	
1C00 -1CFF	Slot 1 I/O	
1D00 -1FFF	Alias of 0100 - 03FF	
z100 - z3FF	Alias of 0100 - 03FF	

<b>ADDRESS</b> (Hex)	<b>DESCRIPTION</b>	<b>COMMENTS</b>
z400 - z4FF	Slot "z" I/O	
z500 - z7FF	Alias of 0100 - 03FF	EISA Slot "z" I/O Space
z800 - z8FF	Slot "z" I/O	z = 2, 3, 4, 5, 6, 7, 8, 9
z900 - zBFF	Alias of 0100 - 03FF	A, B, C, D, E, or F
zC00 - zCFF	Slot "z" I/O	
zD00 - zFFF	Alias of 0100 - 03FF	

# APPENDIX D:

## INTERRUPT LEVEL ASSIGNMENTS

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<b>LEVEL</b> on SYSTEM	<b>LEVEL</b> on IO BUS	<b>TYPICAL INTERRUPT SOURCE</b>
NMI	None	Parity, ISA/EISA Channel Check, Bus Time Out, Fail Safe Timer Timeout
IRQ0	None	Interval Timer 1, Counter 0 Out
IRQ1	None	Keyboard Controller
IRQ2	None	Cascade Interrupts from IRQ8 to IRQ15
IRQ3	IRQ3	Serial Port 2
IRQ4	IRQ4	Serial Port 1
IRQ5	IRQ5	Parallel Port 2
IRQ6	IRQ6	Diskette Controller
IRQ7	IRQ7	Parallel Port 1
IRQ8	None	Real Time Clock
IRQ9	IRQ2	Expansion Bus Pin
IRQ10	IRQ10	Expansion Bus Pin
IRQ11	IRQ11	Expansion Bus Pin
IRQ12	IRQ12	Expansion Bus Pin
IRQ13	None	Coprocessor Error, DMA Chaining
IRQ14	IRQ14	Fixed Disk Drive Controller Expansion Bus Pin
IRQ15	IRQ15	Expansion Bus Pin



# **Product Information Record**

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Date Purchased or Received: \_\_\_\_\_

Purchased From: \_\_\_\_\_

Product Name: \_\_\_\_\_

Product Revision: \_\_\_\_\_

CPU Processor Speed: \_\_\_\_\_

Memory Size: \_\_\_\_\_

Serial Number: \_\_\_\_\_

BIOS Version: \_\_\_\_\_

Software Driver Version: \_\_\_\_\_

Record all the above information as you received the product for future reference.