

American Megatrends, Inc.
Series 68 Enterprise-III
80486 EISA Motherboard
User's Guide

MAN-680
1/11/93

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Preface

To the OEM, VAR, or System Integrator

Thank you for purchasing the high performance Series 68 Enterprise-III AT-compatible motherboard from American Megatrends. It is assumed that you have also licensed the rights to use the technical documentation for the Enterprise-III. This manual was written for American Megatrends customers who are system integrators, VARs, or OEMs to assist in the proper installation and operation of the Enterprise-III motherboard. This manual is not meant to be read by the computer owner who purchases a computer with the Enterprise-III motherboard. It is assumed that you, the computer manufacturer, will use this manual as a sourcebook of information, and that parts of this manual will be included in the computer owner's manual.

Technical Support

If an Enterprise-III motherboard fails to operate as described or you are in doubt about a configuration option, please call technical support at 404-246-8600.

Acknowledgments

This manual was written by Vivek Saxena, Paul Narushoff, and Robert Cheng.

American Megatrends BBS

The American Megatrends BBS permits OEMs, VARs, and system integrators to access technical information about American Megatrends motherboard, peripheral card, and BIOS products. Product Engineering Change Notices, Tech Tips, Technical Notes, and complete technical manuals are available on the BBS.

Data Transmission Rates

The BBS automatically handles modems with data transmission rates from 1,200 to 14,400 bps. If using an HST modem, call 404-246-8780. If using a non-HST modem, call 404-246-8782.

BBS Phone Numbers

The following table lists the characteristics of the BBS phone numbers. The BBS requires no parity, 8 data bits, and 1 stop bit.

Phone Number	Characteristics
404-246-8780	Supports HST and v.42bis.
404-246-8781	Supports HST and v.42bis.
404-246-8782	Dual standard. Can handle 2400 or 9600 bps. Supports v.32bis and v.42bis. Can handle up to 14,400 baud.
404-246-8783	Supports v.32bis and v.42bis.

Packing Slip

You should have received:

- an Enterprise-III EISA VLB motherboard,
- the *Enterprise-III Motherboard User's Guide*,
- a diskette containing the American Megatrends ECU and EISA configuration files.
- the *American Megatrends ECU User's Guide*, and
- the AMIFlash Utility program.

Chapter 1

Introduction to VL-Bus

The Series 68 Enterprise-III EISA Local Bus Motherboard conforms to the VESA® (Video Electronics Standards Association) VL-Bus® specifications as well as the EISA (Extended Industry Standard Architecture) specification.

VL-Bus Slots are Buffered

The American Megatrends Enterprise-III VL-Bus implementation is unique. The American Megatrends VL-Bus design fully buffers both VL-Bus expansion slots. This buffering is totally transparent to the end user and preserves complete VL-Bus compatibility.

Advantages of Buffered VL-Bus

Because VL-Bus Adapter Cards sit directly on the CPU bus, the additional loading on the CPU signals can cause unreliable CPU operation. At 33 MHz, most CPU signals have Setup/Hold times in the order of 10^{-9} seconds. It is easy to see how timing can be thrown off by the additional load from devices on the VL-Bus.

The American Megatrends VL-Bus design includes full buffering for all VL-Bus expansion slots. Each VL-Bus expansion slot always appears as a fixed non-capacitive load on the CPU bus. Therefore, the end user can install any type of VL-Bus-compatible Adapter Card on the system and still be certain of totally reliable operation.

American Megatrends VL-Bus Implementation

The VL-Bus

The VL-Bus is designed to standardize the hardware interface of peripherals connected to a microprocessor-level local bus. The VL-Bus Specification is a standard set of interface, architecture, timings, electrical, and physical specifications that permits all VL-Bus products to be totally interchangeable.

VL-Bus is Based on 80486 Local Bus Design

The general architecture of the VL-Bus is designed to Intel® 80486 CPU local bus standards with additional hardware functions that accommodate VL-Bus master devices and facilitate the system I/O bus interface. The timing specifications allow VL-Bus devices to operate at the full 32-bit 80486 CPU bandwidth. Both VL-Bus slots on the Enterprise-III motherboard have bus mastering capability.

EISA and Local Bus Expansion

The American Megatrends Enterprise-III EISA Local Bus motherboard has six bus master EISA expansion slots and two VL-Bus expansion slots. The VL-Bus slots include a standard EISA 32-bit slot (with no EISA bus mastering capability but *full VL-Bus bus mastering*) and an inline VL-Bus connector.

American Megatrends VL-Bus Implementation, Continued

The following graphic shows the EISA and VL-Bus expansion slots. You can install 8-bit or 16-bit ISA or 32-bit EISA adapter cards in any expansion slot, including the VL-Bus slots. The VL-Bus expansion slots are EISA non-bus mastering slots *but have full VL-Bus bus mastering capabilities*.

EISA or ISA adapter card will have no VL-Bus functionality when installed in a VL-Bus expansion slot.

The current VL-Bus expansion socket specification includes a 16-bit MCA® (Micro Channel Architecture) expansion socket inline with a standard 32-bit EISA expansion socket connector.

A future VL-bus specification will use a 32-bit MCA connector (a total of 64 bits). The VL-Bus specification supports 32-bit EISA adapter cards.

VL-Bus Adapter Cards

The VL-Bus Adapter Cards have a different set of connectors on the bottom of the card, as shown below. These types of adapter cards will only fit in the VL-Bus expansion slots.

Chapter 2

Enterprise-III Description

Dimensions

The American Megatrends 80486 Enterprise-III EISA Local Bus motherboard is approximately 12" by 13", similar in size to a standard AT motherboard. The mounting hole locations permit the motherboard to be used with any AT chassis. The height of the components is no more than 1½ inches, but allow 2 inches of clearance for the power supply connectors, as shown below.

Specifications

Microprocessor

Microprocessors can be installed in two sockets: the CPU socket and the Upgrade Socket. The motherboard supports the following processors:

In CPU Socket	In Upgrade Socket	Frequencies
80486DX		33 or 50 MHz
80486DX2		25 MHz (50 MHz internally), or 33 MHz (66 MHz internally)
80486SX		25 or 33 MHz
	P24T	25 MHz (50 MHz internally), or 33 MHz (66 MHz internally)
	80487SX	25 or 33 MHz
	P23T	25 MHz (50 MHz internally), or 33 MHz (66 MHz internally)

CPU Socket

The Enterprise-III has a 168-pin PGA socket for an Intel 80486DX, 80486SX, or 80486DX2 CPU.

Overdrive Support

The Enterprise-III has a 240-pin LIF Upgrade Socket for an 80487SX (if an 80486SX is in the CPU Socket) or a future Intel processor, such as the Intel P23T or P24T.

Heat Sink for 50 and 66 MHz CPUs

The Enterprise-III EISA Local Bus motherboard has a heat sink for all motherboards equipped with a 50 MHz 80486DX or 25 MHz (operates at 50 MHz internally) or 33 MHz (operates at 66 MHz internally) 80486DX2 to help dissipate heat. See page for additional information about heat dissipation.

Specifications, Continued

Processor Speeds

The Enterprise-III operates at either of two speeds: high or low. High speed is set at time of manufacture to the processor speed (25, 33, 50, or 66 MHz). Low speed (8 MHz) is simulated by adding extra cycles. The clock speeds can be changed via the <Ctrl> <Alt> <+> and <Ctrl> <Alt> <-> keychords. These keychords can be changed by the OEM via AMIBCP.

System Memory

The Enterprise-III EISA motherboard supports up to 256 MB of onboard memory via four banks of 16 MB x 9 SIMMs. 256 KB x 9, 1 MB x 9, and 4 MB x 9 SIMMs can also be used. Each SIMM bank consists of four SIMM slots, a total of 16 SIMM sockets. The 70 ns SIMMs must support fast page mode.

Cache Memory

The 256 KB secondary (external) cache memory uses a write-through or write-back caching algorithm. Up to 64 MB of system memory is cached. There are zero wait states for cache memory read and write for motherboards operating at speeds up to 33 MHz. Burst mode is supported.

In addition, 80486 processors have an 8 KB internal cache memory. All of system memory is cached in the 80486 internal cache memory.

Both internal and external cache memory is enabled by pressing <Ctrl> <Alt> <Shift> <+> and disabled by pressing <Ctrl> <Alt> <Shift> <->

Specifications, Continued

SRAM Type

The Enterprise-III EISA Local Bus motherboard uses 15 ns 32 KB x 8 SRAM DIPs for cache memory.

ROM

The Enterprise-III EISA motherboard has 128 KB of Read Only Memory in a Flash EPROM used for the system BIOS at E0000h - FFFFFh. The AMIFlash Utility programs the Flash EPROM. AMIFlash is provided with the Enterprise-III motherboard.

Shadow RAM

AMIBIOS Setup allows you to selectively shadow the 128 KB system BIOS, video BIOS (in 32 KB increments), or Adaptor ROM BIOS (in 32 KB increments) in ADVANCED CMOS SETUP in AMIBIOS Setup.

System BIOS

The Enterprise-III EISA motherboard uses a customized AMIBIOS system BIOS with a built-in Setup configuration utility and hard disk drive utilities. Via AMIBIOS Setup, you can configure up to two user-definable hard disk drive types. You can easily configure systems with no video monitor, keyboard, or floppy disk drives in STANDARD CMOS SETUP.

CMOS RAM

The Enterprise-III has 128 bytes of standard ISA CMOS RAM to store system configuration data. ISA CMOS RAM, the real time clock, and the battery are on the Dallas DS1488 CMOS RAM/RTC chip. The Enterprise-III EISA motherboard also includes an additional 4 KB of EISA Extended CMOS RAM.

Specifications, Continued

Built-in Battery

The Enterprise-III EISA motherboard uses a Dallas DS1488 CMOS RAM chip with a built-in battery.

Math Coprocessor

Enterprise-III motherboards equipped with an 80486SX support an optional Intel 80487SX math coprocessor.

Expansion Slots

The Enterprise-III has eight 32-bit EISA expansion slots. Six of these slots are EISA bus mastering slots. The other two slots are VL-Bus mastering slots. The VL-Bus and EISA slots also can be used for 8- or 16-bit ISA adapter cards.

Seven DMA Channels

The Enterprise-III has seven DMA channels. In accordance with the EISA specifications, any DMA channel may be programmed for 8, 16, or 32-bit DMA device size and ISA compatible, type A, type B, or burst type C modes.

Specifications, Continued

Fifteen Interrupt Levels

The Enterprise-III has 15 hardware interrupt levels. Of course, NMIs take precedence over the following hardware interrupts.

Priority	Label	Typical Interrupt Source
1	IRQ 0	Interval Timer 1, Counter 0 OUT
2	IRQ 1	Keyboard
3-10	IRQ 2	Used internally for IRQ 8 through IRQ 15
3	IRQ 8	Real-Time-Clock
4	IRQ 9	EISA bus
5	IRQ 10	EISA bus
6	IRQ 11	EISA bus
7	IRQ 12	PS/2 Mouse
8	IRQ 13	Coprocessor Error
9	IRQ 14	EISA bus (Hard disk drive controller)
10	IRQ 15	EISA bus
11	IRQ 3	EISA bus (Serial Port 2)
12	IRQ 4	EISA bus (Serial Port 1)
13	IRQ 5	EISA bus (Parallel Port 2)
14	IRQ 6	EISA bus and floppy disk controller
15	IRQ 7	EISA bus (Parallel Port 1)

Specifications, Continued

Timer Features

The Enterprise-III has five programmable 16-bit counter/timers.

System Arbiter

The Enterprise-III has standard EISA arbitration features.

Refresh Generation

The Enterprise-III has a refresh generation feature.

I/O Capability

The Enterprise-III accesses 32-, 16-, or 8-bit memory devices and 32-, 16-, or 8-bit I/O devices on both the VL-Bus and the EISA bus.

I/O Address Space

The Enterprise-III uses I/O addresses x100h through x3FFh for ISA compatible I/O (x = a "don't care" character which does not affect mapping location. For example, I/O port addresses 0100h, 1100h, 2100h, and 3100h map to the same location).

The Enterprise-III also uses the following EISA I/O port addresses:

- s000h through s0FFh for EISA expansion slot
- s400h through s4FFh for EISA expansion slot
- s800h through s8FFh for EISA expansion slot
- sC00h through sCFFh for EISA expansion slot

(s = EISA bus slot number, the motherboard is always 0)

Specifications, Continued

Memory Range

The Enterprise-III uses 32-bit memory addresses to access 4 gigabytes of memory address space on the EISA expansion slots.

I/O Channel Check

The Enterprise-III supports the use of the I/O channel check to generate NMIs.

I/O Wait State Generation

The Enterprise-III has an open bus structure (allowing multiple microprocessors to share system resources, including memory). The Enterprise-III supports refresh of system memory from channel microprocessors.

Keyboard and Keyboard Lock

The Enterprise-III has a five-pin IBM AT-compatible DIN connector and has a keyboard lock to prevent unauthorized access.

PS/2 Mouse

A PS/2 mouse can be directly attached to a mouse connector mounted next to the keyboard connector.

Speaker

The Enterprise-III has a standard speaker attachment.

Real Time Clock

The Enterprise-III has a standard crystal-controlled AT-type real time clock. The real time clock is included with ISA CMOS RAM on the Dallas DS1488 chip.

Chapter 3

Installation

Step	Action	Turn to
1	Unpack the motherboard	Page
2	Set switch and jumper options.	Page
3	Install memory.	Page
4	Install upgradable processor or math coprocessor.	Page
5	Install motherboard.	Page
6	Connect the power supply.	Page
7	Connect the keyboard.	Page
8	Connect the mouse.	Page
9	Connect cables.	Page
10	Install adapter cards	Page
11	Perform initial test and configuration.	Page

Step 1 Unpack the Motherboard

Step	Action
1	If the box is damaged, call Technical Support at 404-246-8600.
2	Perform all unpacking and installation procedures on a grounded anti-static mat. Wear an anti-static wristband, grounded at the same point as the anti-static mat or use a sheet of conductive aluminum foil grounded through a 1 megohm resistor.
3	The motherboard is packed in an anti-static bag, and sandwiched

	between sheets of sponge. Remove the sponge and the anti-static bag. Save the original packing material.
4	Place the motherboard on a grounded anti-static surface component-side up.
5	Inspect the motherboard for damage. Do not apply power if damaged.
6	Press down on all socketed ICs to verify proper seating.
7	If the motherboard is undamaged, it is ready to be installed.

Enterprise-III Motherboard Layout

CPU and Upgrade Socket

Intel 80486SX, 80486DX, or 8048DX2 CPUs can be inserted in the CPU socket. An Intel 80487SX math coprocessor or an Upgrade Processor (P23T or P24T) can be inserted in the Upgrade Socket.

Step 2 Set Switch and Jumper Options

SW1

SW1 has two switches. See the graphic on the previous page for the SW1 location. Set SW1 before installation.

Switch	Description
DIAG	Turns on manufacturing diagnostics. This switch is factory-set to OFF and should remain OFF.
COL/MONO	Sets the video type. It has no effect if an EGA or VGA adapter is used. It is factory-set to OFF (for a monochrome display adapter). Set ON to use a CGA video adapter card.

J2 Force Boot to Flash

J2 is a two-pin header next to the power supply connectors which should be OPEN (the default setting). Place a two-pin shorting bridge on J2 only when the Flash EPROM BIOS is to be updated. See the following illustration for the J2 location.

Step 2 Set Switch and Jumper Options, Continued

J7 Select Processor Type

J7 is a four-pin single-inline berg that selects the processor type. Pins 1-2 and 3-4 are shorted if the Enterprise-III EISA motherboard has an 80486DX or 80486DX2 microprocessor. Pins 2-3 are shorted if the motherboard has an 80486SX processor. Set J7 before installing the motherboard. See the graphic on the following page for the location of J7. J7 look like this.

J30 Local Bus ID

J30 is a three-pin single-inline berg. In normal operation, pins 1-2 are shorted when running Local Bus Adapter Cards at 33 MHz or less (the default setting). Short pins 2-3 if running Local Bus Adapter Cards at speeds higher than 33 MHz. J30 is shown below. Set J30 before installing the motherboard. See the graphic on the next page for the location of J30.

Step 2 Set Switch and Jumper Options, Continued

J19 CPU Priority

J19 is a three-pin header that selects the CPU priority. Short pins 1-2 to set Low priority (the default setting). Short pins 2-3 to set High priority.

J20, J21, J24 Select Processor Speed

Set the following two-pin berg headers as described in the table below for 20 MHz operation.

Jumper	Setting
J20	CLOSED
J21	OPEN
J24	OPEN

Step 3 Install Memory

The main memory on the Enterprise-III EISA motherboard consists of four 32-bit memory banks of four SIMM sockets each. The SIMM sockets accept 256 KB x 9, 1 MB x 9, 4 MB x 9, or 16 MB x 9 SIMMs in the combinations shown below.

If used, SIMM banks must be completely filled, no matter which type of SIMMs are used. All SIMMs in a bank must be the same type.

For system memory, fast page mode access and hidden refresh is supported. Burst support is provided.

Possible Memory Configurations

Bank0	Bank1	Bank2	Bank3	Total RAM
256 KB x 9	None	None	None	1 MB
256 KB x 9	256 KB x 9	None	None	2 MB
1 MB x 9	None	None	None	4 MB
256 KB x 9	256 KB x 9	1 MB x 9	None	6 MB
1 MB x 9	1 MB x 9	None	None	8 MB
256 KB x 9	256 KB x 9	1 MB x 9	1 MB x 9	10 MB
1 MB x 9	1 MB x 9	1 MB x 9	None	12 MB
1 MB x 9	1 MB x 9	1 MB x 9	1 MB x 9	16 MB
4 MB x 9	None	None	None	16 MB
256 KB x 9	256 KB x 9	4 MB x 9	None	18 MB
1 MB x 9	4 MB x 9	None	None	20 MB
1 MB x 9	1 MB x 9	4 MB x 9	None	24 MB
4 MB x 9	4 MB x 9	None	None	32 MB
1 MB x 9	4 MB x 9	4 MB x 9	None	36 MB
1 MB x 9	1 MB x 9	4 MB x 9	4 MB x 9	40 MB
4 MB x 9	4 MB x 9	4 MB x 9	None	48 MB
4 MB x 9	4 MB x 9	4 MB x 9	4 MB x 9	64 MB
16 MB x 9	None	None	None	64 MB
16 MB x 9	16 MB x 9	None	None	128 MB

16 MB x 9	16 MB x 9	16 MB x 9	None	192 MB
16 MB x 9	16 MB x 9	16 MB x 9	16 MB x 9	256 MB

Step 3 Install Memory, Continued

SIMM Part Numbers

Memory Type	Manufacturer	Part Number
1 MB x 9	Fujitsu®	MB85235-70
	Toshiba®	THM91070AS-70 THM91000AS-70
	Motorola®	MCM91000S-70 MCM91430S-70
	Oki®	MSC2312A-704S9
	NEC®	MC-42100A9-70
	Samsung®	KMM591000AN-7
	Siemens	HYM910005-70
4 MB x 9	Motorola	MCM94000A-70
	Samsung	KMM594000A-70
	Oki	MSC2340-70459
16 MB x 9	Mitsubishi	MH16M09J-7
	Mitsubishi	MH16M09TJ-7
	Samsung	KMM5916000-7

Installing SIMMs

The SIMM banks have four SIMM sockets each, a total of 16 SIMM sockets. The sockets take 256 KB x 9, 1 MB x 9, 4 MB x 9, or 16 MB x 9 SIMMs. Use only one SIMM type to fill each bank. The following shows the SIMM location.

Step 3 Install Memory, Continued

Place the motherboard on an anti-static mat. With the component side of the SIMM facing you, firmly push the SIMM into the socket. When properly inserted, the SIMM clicks in place as the latching pins engage, as shown below.

Selecting SIMMs

The SIMMs must meet the following specifications:

Parameter	Specification
Page Mode	Fast
Refresh	CAS before RAS
t_{CAC}	≤ 20 ns
t_{RAC}	≤ 70 ns
t_{AA}	≤ 45 ns
t_{RP}	70 ns
t_{CPA}	≤ 45 ns