WARNING !!!

The AMI 386SX motherboard contains static sensitive components. Follow instructions to prevent damage to these components by static electricity.

1.1 Unpacking the AMI 386SX Motherboard

Please read this section carefully to ensure that you do not damage the AMI 386 SX through a commonly ignored hazard: electro-static discharge (ESD). Use a pencil and check off each step as you go. AMI wishes you to have a trouble-free installation and be using your system to its full potential in the least amount of time.

CAUTION !!!

Do not remove the AMI 386SX motherboard from its protective anti-static bag until you are ready to install it in the system. Unpacking should be done on an anti-static mat grounded to a good earth ground point. You should also be wearing an anti-static wristband, grounded at the same point as the anti-static mat. (An alternative is to use a sheet of conductive aluminum foil grounded through a 1 Meg-ohm resistor to ground. Similarly, a strip of conductive aluminum foil wrapped around the wrist and grounded through a 1 Meg-ohm resister will serve the purpose of a wristband.)

1)   Inspect the shipping container for obvious damage. If there is any damage to the shipping container, keep it, do not throw it away. In the event of damage to the motherboard, caused by

handling, the shipping container is required to file a claim against the carrier. **NOTE**: Save the original AMI Motherboard box, two pieces of foam, and the anti-static bag. These will be needed if you return the motherboard to the distributor for any reason.

2)   The motherboard is packaged in an anti-static bag inserted between two sheets of foam. Remove the top layer of foam and carefully remove the anti-static bag. **DO NOT** remove the motherboard from the anti-static bag until it is placed on the grounded mat. Place the anti-static bag on the grounded mat with the component side up. With your wrist strap on, grasp the end of the motherboard and slowly withdraw the motherboard from the anti-static bag, being careful not to snag any components. Place the motherboard on the grounded mat with the component side up. Inspect the motherboard for visible damage.

NOTE

If there is any apparent damage at this time do not proceed any further. Place **all** pieces back in the box and immediately contact the distributor you purchased the motherboard from.

3)   It is possible that during shipment the socketed Integrated Circuits (IC's) may have vibrated loose in their sockets. Ensure that the motherboard is positioned component side up, flat with nothing under the motherboard, then firmly and gently press down on all socketed IC's to ensure they are properly seated.

4)   Inspect all the connectors for foreign material and ensure that all the pins on the berg-pins

are straight. Use a pressurized spray to remove the foreign material, do not use any metal tools in the connectors. If the material cannot be removed using pressurized spray, contact your distributor. Straighten berg-pins using a small pair of straight long-tipped needle nose pliers. Slowly reshape the pin, do not bend back and forth.

1.2 Video Display Select Switch Setting

In the vicinity of PS8 and PS9 you will see a 2 position DIP switch marked SW1. Inspect the switch and pay note to the numbering of the two slide switchs. Also note the direction to slide the switch to turn it OFF or ON. Switch 1 will always be in the OFF position, it is used for factory testing only. Switch 2 is used to set the type of video display adapter card installed in the system. The shipped position of this switch in normally OFF position for a MONOCHROME DISPLAY (MDA, HERC, etc). Set this switch to ON position if you want to use a COLOR DISPLAY (CGA). The setting of this switch has no effect if the display adapter is an EGA or a VGA.

1.3 Installing the AMI 386SX Motherboard

Before proceeding, familiarize yourself with the layout of the AMI 386SX motherboard using Figure 1.1.

1)   When you purchased your AMI 386SX motherboard, it was configured as you requested. If the SIMM (Single In line Memory Module) modules are not installed or you are adding SIMM

modules to increase memory size proceed to section 5 at this time.

2)   If you purchased a Intel 80387SX and it is not installed, proceed to section 6 at this time.

CAUTION

Before proceeding, attach a ground wire from any bare metal area on the main chassis to the same grounding point as you wrist strap. This will protect the motherboard from electro-static discharge.

NOTE

If you are replacing an existing motherboard with the AMI 386SX motherboard remove the I/O cards, power connectors, and berg connectors. Then placing the old board next to the AMI 386SX, transfer the standoffs. Then proceed to step 4.

3)   The AMI 386SX will fit into any standard XT/AT board chassis. All required mounting hardware should have been supplied with your chassis. No hardware is supplied with the motherboard. Remove the chassis cover and position the chassis beside the board. Carefully position the board inside the case where it is to be mounted. Determine the position of the holes to insert the plastic standoffs. Placing the motherboard on a piece of the shipping foam, firmly press the standoffs into the required holes until the locking pins snap. On the chassis, install the plastic edge supports in the required holes. Now install the metal standoffs in the drilled screw holes on the

chassis, be careful not to strip the threads.

4)   Carefully slide the motherboard into the chassis, making sure that the stand-offs go into the slots provided for them. Ensure that the motherboard is level with the chassis. The edge of the motherboard should fit into the slots of the chassis mounted plastic clips. In case the motherboard is not sitting properly, remove it carefully and try again. Put the two motherboard mounting screws in the holes provided for them and tighten them, do not over-torque or you may possibly damage the board. (Note: You may have to shift the motherboard slightly to align the screw mounting holes on the motherboard with those on the chassis.)

1.4 Connecting the AMI 386SX Motherboard.

The connectors supplied with the chassis must be connected properly before the system is powered on. Refer to Figure 1-1 for location of the connectors PS8 and PS9 on the motherboard before continuing.

CAUTION

When hooking up chassis connectors to the motherboard, ensure you are hooking up the right connector end. Most connector wires are color-coded, you may look at the color of the wires leaving the switch or LED and match the connector end. It is possible to have more than one connector with the same color-coded wires, so it is good to check by following the wire to the switch or LED.

J1: Keyboard Connector - 5 pin DIN socket. Connect an IBM AT compatible keyboard.

Pin	Assignments
1	Keyboard clock
2	Keyboard data
3	Not used
4	Ground
5	VCC

J2: Keyboard Reset Disable Jumper - 2 pin single-in-line BERG. When jumpered normal operation of soft reset is enabled, if opened the keyboard reset is disabled.

J5: Battery Connector - 4 pin single-in-line BERG. This is an optional connector You may connect a 6 Volt Battery pack to this connector. This allows the Real Time Clock (RTC) and CMOS memory to retain its contents during power off.

CAUTION

Ensure that the positive (+) terminal, normally indicated by a red wire, is connected to the pin marked "+" on J5.

Pin	Assignments
1	6V dc
2	Not used
3	Not used
4	Ground

NOTE

There is a factory installed Lithium battery holder on your motherboard, part number is Duracell DL2016. It is highly recommended you use only one battery configuration.

J8 and J9: Memory Speed Selection Jumpers - 2, 3 pin single-in-line BERG connectors. Use to select operating speed of DRAM as follows:

J8	J9	Speed of DRAM
1-2	1-2	100 ns Fast Page Mode DRAM
2-3	1-2	Other 100 ns DRAM
2-3	2-3	120 ns DRAM

J10: Audio Connector - 4 pin single-in-line BERG. This is an optional connector, there is a factory installed piezo speaker on the motherboard.

Pin	Assignments
1	Data out
2	Key
3	Ground
4	VCC

J11: Keyboard Lock Connector - 5 pin single-in-line BERG. This allows the user to lock-out the keyboard, protecting the system from unauthorized use. This connector is keyed with a blank hole.

Pin	Assignments
1	LED power
2	Key

3	Ground
4	Keyboard Inhibit
5	Ground

J14: TURBO LED Connector - 2 pin single-in-line BERG. The LED will be lit when board is running at "hi" speed.

Pin	Assignment
1	Clock speed
2	LED power

J17: Factory Testing Jumper - 2 pin single-in-line BERG. **Do not use**, for factory testing of certain board functions.

J18: Turbo Switch Connector - 2 pin single-in-line BERG. When the button is pressed, the system will switch to hi or lo CPU speed.

Pin	Assignments
1	Ground
2	Mode switch

J19: Reset Button Connector - 2 pin single-in-line BERG. When the button is pressed, the system will perform a hard reset.

Pin	Assignments
1	Hard reset
2	Ground

J26:EPROM Type Selection Jumper - 3 pin single-in-line BERG. Use to select type of EPROM as follows:

Pin	Type EPROM
1-2	64 or 128 (8Kx8. ie;2764)
2-3	256 (32Kx8. ie;27256)

PS8 and PS9: Power Supply Connectors - 6 pin Power Supply Connectors. The connectors are keyed.

	Pin	Assignments
PS8	1	Power Good
	2	VCC
	3	+12 V
	4	-12 V
	5	Ground
	6	Ground
PS9	1	Ground
	2	Ground
	3	-5 V
	4	VCC
	5	VCC
	6	VCC

1.5 Installing Input/Output Cards.

The AMI 386SX uses standard add-on cards to interface to the real world. The cards may be any IBM compatible 8-bit or 16-bit Input/Output (I/O) card. These cards plug into the I/O slots provided on the AMI 386SX.

Information about I/O slot usage follows.

J6/7,J12/13,J15/16,J20/21,J22/23,J24/25: 16-bit

Input/Output Card Slots - 62+36 pin I/O slot connectors. Used for either 16-bit or 8-bit I/O cards.

J27 and J28: 8-bit Input/Output Card Slots - 62 pin I/O slot connectors. Used for 8-bit I/O cards.

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2.1 Before Power-Up Checklist

1) [   ] Visually ensure all connectors are seated.

2) [   ] Visually ensure all cards are seated.

3) [   ] Visually ensure no screws or foreign material are on motherboard.

2.2 Initial Power-Up

After you have completed the "Before power-up checklist", you are ready to power-up.

NOTE

We recommend you to plug your system into a surge protected power strip. This will help protect your system in the event of a power surge. During a lightning storm it is advisable to either unplug your system or use a UPS (un-interruptable power supply).

Plug in the power cord, switch on the monitor and set the brightness and contrast to full. Allow the monitor to warm up for a few minutes, then turn on the system power. The message you will

get on the screen should be:

 386SX BIOS (C)1990 American Megatrends Inc

 ▓▓▓▓▓▓▓ KB OK

 Press <ESC> to bypass MEMORY test

 (C) American Megatrends Inc.,
DISX- ▓▓▓▓▓▓- ▓▓▓▓▓▓▓▓-K ▓

The following conditions may exist at power up and the first display screen may not be same:

1. The Video Display Adapter used in the system is other than the standard Monochrome or Color Graphics board. In this case, with some display adapter cards, the Video Display ROM will place a message on the screen.

2. The Video Display Monitor is not correct for the video adapter. (e.g, connecting Color Graphics Monitor with Monochrome Display Adapter card).

3. There is some problem with the motherboard or the display adapter card. In this case the BIOS will inform the USER of the fault either

through error beeps emitted by the speaker or displaying the error message on the display screen if the video adapter card is OK. These errors are considered to be fatal errors and the system ROM BIOS does not proceed further if this kind of error occurs. Following are the fatal errors that the BIOS displays on the display screen:

    a. KB CONTROLLER ERROR
    b. CMOS INOPERATIONAL
    c. 8042 GATE-A20 ERROR
    d. INVALID SWITCH/ MEMORY
FAILURE
    e. DMA #1 ERROR
    f. DMA #2 ERROR
    g. DMA ERROR
    h. INTR #1 ERROR
    i. NO ROM BASIC

For any of the above mentioned errors the BIOS will not allow the system proceed booting. It displays the error message and SYSTEM HALTED.

2.3 Memory Test

The BIOS performs a memory diagnostics and displays the size of the memory being tested on the second line of the screen display. Note that you can bypass

the memory test by pressing the <ESC> key. This option would be quite useful when the memory on the system is quite large. The memory test is not performed when a soft reboot is executed through the keyboard or a software program.

After testing the memory, the BIOS continues to initialize the peripherals using the SETUP information stored in the SYSTEM CMOS RAM. The following errors do not cause a RUN SETUP UTILITY request:

       a. CH-2 timer error
       b. Keyboard error
       c. KB/Interface error
       d. INTR #2 error
       e. Display switch not proper
       f. Keyboard is locked ... Unlock it
       g. FDD controller failure
       h. HDD controller failure
       i. C: drive error
       j. D: drive error
       k. D: drive failure

You will be requested to "Press <F1> to RESUME" to allow you to read the messages. After pressing F1 the BIOS will proceed by booting from bootable device. If you wish to modify or check the setup you must reboot and press the <DEL> key when requested.

2.4 Run System Setup (SETUP) Utility

The BIOS will ask you to RUN SETUP UTILITY when any number of the following conditions exist:

    a. CMOS battery state low
    b. CMOS system options not set
    c. CMOS checksum failure
    d. CMOS memory size mismatch
    e. CMOS time & date not set
    f. CMOS display type mismatch
    g. C:drive failure

If any of these errors are found by the BIOS, a message will appear on the display:

RUN SETUP UTILITY

Press <F1> to RESUME

in which case pressing **F1** key will allow you to select any of the following options:

EXIT FOR BOOT

RUN CMOS SETUP

RUN DIAGNOSTICS

FOR ANY OF THE ERRORS MENTIONED, IT IS RECOMMENDED THAT YOU ALWAYS CHOOSE THE

OPTION TO "RUN CMOS SETUP" BEFORE ANY OTHER OPTION OTHERWISE THE SYSTEM MAY BEHAVE UNPREDICTABLY.

If you choose the option **EXIT FOR BOOT** the system will attempt boot from any bootable (e.g, FLOPPY, HARD DISK) device if the **CMOS SETUP** will recognize the device.

Choosing **RUN CMOS SETUP** will take you through the "SETUP" procedure discussed in the next section. Choosing **RUN DIAGNOSTICS** will take you through "DIAGS" option which is discussed in Section 4 of this manual.

2.5 SETUP Screen Display

The following section will assist you in answering the questions asked by BIOS in set up. The SETUP screen is shown in figure 2-1. The SETUP is user friendly and has a HELP window at the bottom left corner of the screen. The HELP window is displayed in reverse video (black characters in white background). At the very bottom left of the screen, is displayed the key conventions used to modify the information displayed. The

PgUp and **PgDn** keys are used to change or modify an option. **Left, Right, Up** and **Down** arrow keys are used to go through the system options. **ESC** key is used to quit the system SETUP. The system option which you will be changing at any given time will also be in reverse video to help you know what information you are modifying. As an example, when the SETUP screen initially comes up, the **MONTH** in the **DATE** line will be in reverse video. This means that you may now modify the MONTH.

Date Setup

The screen displays:

> **Date (mn/date/year): Tue, Jan 01, 1990**

The help window displays:

> **Month : Jan, Feb,.....Dec**
> **Date : 01, 02, 02,...31**
> **Year : 1901, 1902,...2099**

To change each reverse video portion of the date, use the **PgUp** and **PgDn** keys. to move on to the next area of the date use the **Left and Right** arrow keys.

Time Setup

The screen displays:

Time (hour/min/sec): 00: 00: 00

The help window displays:

Time is 24 hour format:-
Hour:(00-23), Minute:(00-59),
Second:(00-59)
(1:30 AM = 01:30:00),   (1:30 PM
= 13:30:00)
To change each reverse video portion of
the time, use the **PgUp** and **PgDn** keys.
to move on to the next area of the time
use the **Left and Right** arrow keys.

Floppy drive A: Setup

The screen displays:

Floppy drive A: : Not Installed

The help window displays:

Options:-
360 KB 5¼", 1.2 MB 5¼",
720 KB 3½", 1.44 MB 3½", Not
Installed

To change drive A:, use the **PgUp** and

PgDn keys.

Floppy drive B: Setup

The screen displays:

> **Floppy drive B: : Not Installed**

The help window displays:

> **Options:-**
> **360 KB 5¼", 1.2 MB 5¼",**
> **720 KB 3½", 1.44 MB 3½", Not**
> **Installed**

To change drive B:, use the **PgUp** and
PgDn keys.

Hard disk C: Setup

The screen displays:

> **Hard disk C: type : Not Installed**

The help window displays:

> **FIXED type = 01...46, USER**
> **defined type = 47,**
> **For type 47 Enter:**
> **Cyln,Head,WPcom, LZone,Sec,**
> **(WPcom is 0 for ALL, 65535 for**
> **NONE)**

To change disk C: type, use the **PgUp** and **PgDn** keys. You will notice the information Cyln, Head, WPcom, LZone, Sec, and Size will be displayed for each type disk. A complete table is given in Appendix A of this manual.

Hard disk D: Setup

The screen displays:

Hard disk D: type : Not Installed

The help window displays:

**FIXED type = 01...46, USER
defined type = 47,
For type 47 Enter:
Cyln,Head,WPcom, LZone,Sec,
(WPcom is 0 for ALL, 65535 for
NONE)**

To change disk D: use the same procedure as disk C: again all disk information will be displayed for each type disk.

Primary display Setup

The screen displays:

Primary display   : Not Installed

The help window displays:

> **Options:-**
> **Monochrome, Color 40x25,**
> **VGA or EGA, Color 80x25, Not**
> **Installed**

To change the Primary display, use the **PgUp** and **PgDn** keys.

Keyboard Setup

The screen displays:

> **Keyboard   : Not Installed**

The help window displays:

> **Options:-**
> **Installed   : Test Keyboard**
> **Not Installed : Do not test**
> **keyboard**

To change the keyboard option, use the **PgUp** and **PgDn** keys.

Video BIOS shadow Setup

The screen displays:

Video BIOS shadow   : Enabled

The help window displays:

Options:-
Enabled : Shadow RAM ON
Disabled : Shadow RAM OFF

The BIOS enables the Shadow RAM feature initially. It enables the RAM to shadow the ROM of video display adapters which have their video driver routines kept inside the adapter ROM. Since the AT slots run at speeds very much slower than the CPU, the performance of the system gets affected if the video drivers are executed from the ROM. To beef up the performance, the video drivers in ROM are copied to faster motherboard memory and executed from there. This concept is called Shadow RAM.

To change the Video BIOS shadow option, use the **PgUp** and **PgDn** keys.

Scratch RAM option

The screen displays:

Scratch RAM option : 1

The help window displays:

**if required, BIOS will use 256
bytes of RAM
(1) : Using BIOS stack area at
0030:0000
(2) : Reducing base memory size
by 1KB**

To change the scratch RAM option, use
the **PgUp** and **PgDn** keys.

MAIN BIOS shadow Setup

The screen displays:

MAIN BIOS shadow   : Disabled

The help window displays:

**Options:-
Enabled : Shadow RAM ON
Disabled : Shadow RAM OFF**

To change the Main BIOS shadow option,
use the **PgUp** and **PgDn** keys.

512KB-640KB memory Setup

The screen displays:

512KB-640KB memory : Enabled

The help window displays:

Options:-
Enabled : 512KB-640KB at
system board
Disabled : 512KB-640KB at AT
BUS

This option allows you to place the 512KB-640KB DOS area in system board memory or AT BUS memory.

To change the 512KB-640KB option, use the **PgUp** and **PgDn** keys.

Total RAM relocated Setup

The screen displays:

Total RAM relocated: 384 KB

The help window displays:

Options:-
0KB, 128KB, 256KB, 384KB

To change the total RAM relocated option, use the **PgUp** and **PgDn** keys.

Exiting Setup

After you review all information on the Setup display and are sure it is correct, press the **<ESC>** key. The help window will display the following message:

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

You must press **<ENTER>** after you select Y or N. If you enter **<N>** or **<n>** the cursor will jump back to the Emulated CPU speed option at which time you can modify any option. If you enter **<Y>** or **<y>** the screen will clear and a **HARD BOOT** will take place.

2.6 Summary of SETUP Screen

The Setup screen allows you to set:

a) **Date**
Keyboard

b) **Time**
BIOS shadow

c) **Floppy drive A:**
RAM

d) **Floppy drive B:**
BIOS shadow

e) **Hard Disk C: type**
640KB memory

f) **Hard Disk D: type**
RAM relocated

h)

i) **Video**

j) **Scratch**

k) **MAIN**

l) **512KB-**

m) **Total**

g) **Primary display**

The Setup procedure automatically detects the following:

a) **Base memory size**
b) **Extended memory size**
c) **Presence of Weitek Coprocessor**.

Note : The Setup option is available even after a soft reset.

2.7 Errors Reported by BIOS

BIOS performs various diagnostic tests at the time the system is powered up. Whenever an error is encountered during these tests, either you hear a few short beeps or see an error display on your display monitor. If the error occurs before the display device is initialized the system reports the error by giving a number of short beeps.

Some errors are considered to be fatal in which case the system halts after reporting the error either through audio speaker or video display screen. Some errors are considered to be non-fatal in which case the BIOS reports the error and the process continues.

Errors heard through AUDIO speaker

Beep Count	Meaning
1	DRAM refresh failure .
2	Parity Circuit failure.
3	Base 64KB RAM failure.
4	System Timer failure.
5	Processor Failure.
6	Keyboard Controller - Gate A20 error.
7	Virtual Mode Exception Error.
8	Display Memory R/W Test Failure.
9	ROM-BIOS CheckSum Failure.

NOTE : All errors are fatal except error 8.

Fatal Errors through VIDEO display device

1. KB CONTROLLER ERROR
2. CMOS INOPERATIONAL
3. 8042 GATE-A20 ERROR
4. INVALID SWITCH/MEMORY ERROR
5. DMA #1 ERROR
6. DMA #2 ERROR
7. DMA ERROR
8. INTR #1 ERROR
9. NO ROM BASIC

Non-Fatal Errors through video display device

1. CH-2 timer error
2. Keyboard error
3. KB/Interface error
4. INTR #1 error
5. INTR #2 error
6. Display switch not proper
7. Keyboard is locked … Unlock it
8. FDD controller failure
9. HDD controller failure
10. C:drive error
11. D:drive error
12. D:drive failure
13. CMOS battery state low
14. CMOS system options not set
15. CMOS checksum failure
16. CMOS memory size mismatch
17. CMOS time & date not set
18. CMOS display type mismatch
19. C:drive failure

2.8 User Selectable Options Through Keyboard Key

This section describes USER options available in the SYSTEM BIOS through keyboard key.

Key Sequence	BIOS Function
<ESC>	Press this key to bypass system memory test.

<DEL>   Press this key to run System SETUP program.

<INS>   With some EGA/VGA card with video RAM shadow feature enabled, there may be a problem. There may be no display on the screen after the system is powered on. Switch off the System and switch it on again with <INS> key pressed in the keyboard. This will cause the BIOS to let the USER run the SET UP program again so that video RAM shadow feature can be disabled and let the user run the SET UP program again so that video RAM shadow feature can be disabled.

The following User Selectable options require you to PRESS AND HOLD the <CTRL><ALT> keys and at the same time press:

<DEL>   This key sequence is called SOFT RESET. When this key sequence is pressed the system reboots.

<+> This key sequence allows the system to jump to high speed of operation (25MHz) with cache memory enabled for maximum system throughput. The cursor changes to a block to indicate the change.

<-> This key sequence allows the system to jump to low speed of operation (8MHz). Double line cursor indicates the switching.

<SHIFT><+> This key sequence enables the external cache memory to maximize system throughput at high speed of operation.

<SHIFT><-> This key sequence disables the external cache memory to reduce system throughput.

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The system board is approximately 8.5 by 13 inches and uses very large scale integration (VLSI) technology. It has the following features:

* 80386SX Microprocessor

* 8/16 MHz System Clock

* Optional EGA/VGA RAM Shadow

* Optional 80387SX Numeric Coprocessor (16 MHz)

* Upto 8 MB of on board page interleaved memory

* System support function:

    -7 Channel Direct Memory Access (DMA)
    -16 level interrupt
    -Three programmable timers
    -System clock

* User selectable 64KB/128KB ROM subsystem

* User selectable synchronized system board clock switching option for reducing the processor clock frequency to 8MHz

* 8MHz I/O bus timing compatibility

* Speaker attachment

* CMOS (Complementary Metal Oxide Semiconductor) RAM to maintain

system configuration

*   Real-Time clock

*   Optional battery backup for CMOS
configuration table and Real-Time Clock

*   Keyboard attachment

*   8.5 by 13 inch board: Extended XT
form-factor

*   8 input/output (I/O) slots:

        - 6   62/36 pin   16-bit card-edge
        sockets
        - 2   62 pin   8-bit card-edge
        sockets

3.1 The Microprocessor

The 80386SX is a medium performance 32-bit
microprocessor designed for Multitasking operating
systems. The processor can address up to 16-
Megabytes of physical memory and 64-Terabytes
(1-Terabyte = 1-K Gigabyte) of virtual memory. It
has integrated memory management and protection
architecture which includes address translation
registers, advanced multitasking hardware and
protection mechanism to support operating systems.
In addition, it is object code compatible with 8086
family of microprocessor. The 80386SX has built-
in features to support coprocessors, DMA and
interrupts (both maskable and non-maskable). It
has two modes of operation: Real address mode and
Protected virtual address mode.

In real address mode it operates as a fast 8086 with 32-bit extension if desired. In Protected mode, software can perform a task switch into tasks designated as virtual 8086 mode tasks. The virtual 8086 tasks can be isolated and protected from one another by the use of paging and I/O permission bit map.

3.2 System Performance

Clock Speed

The AMI-386SX operates at 16 MHz, which results in a clock cycle time of 62.5 ns. It can run at two different speeds.

The lower speed is equivalent to a clock speed of 8MHz. For convenience, we shall assume this speed to be 8 MHz throughout the rest of this manual.

The panel-mounted turbo switch determines the initial speed after power-on. The speed can be switched at any time while the machine is operating.

If installed the 80387SX Numeric processor runs at the processor clock frequency.

Data Access: Bus Width

The 80386SX microprocessor supports two types of accesses: Memory, and Input/Output. Each type of access can be 16- or 8-bit wide. The memory and I/O devices are 16 or 8 bit wide. The AMI-386SX

allows any type of access to a device of any width. If necessary, the hardware will split a 80386SX bus cycle into a number of (upto 16 / 8 = 2) cycles to allow access to a 16- or 8-bit device. All the on-board devices in the memory space is organized 16-bit wide. These include the on-board DRAM and the EPROM containing the BIOS. All the on-board I/O devices are 8-bit wide, with the exception of the 80387SX math coprocessor which is a 16-bit device.

The AMI-386SX can support 16- and 8-bit memory and I/O devices on the I/O slots.

EGA/VGA RAM Shadow

The memory space from address 0C0000 thru 0DFFFF is reserved for I/O slot ROM. Most often, only the EGA BIOS (0C0000-0C3FFF), which is accessed through a 8-bit bus, is located in this area. The slow execution of this device driver makes the video I/O sluggish. The AMI-386SX provides the option of mapping this space into the 16 bit system board RAM. The EGA/VGA bios can be copied in the 16-bit RAM and executed from there. This improves the video I/O speed, since the EGA BIOS can now be accessed through a 16-bit bus. When this is done then memory address 0C0000 through 0DFFFF cannot be accessed on the 16-bit I/O slot. Also, any I/O slot 8-bit memory in that space will be automatically disabled.

DRAM access

In 80386SX, a zero wait-state bus cycle requires two clock cycles. The required number of clock cycles increases by one with every wait-state introduced in the access. Most processor accesses are memory read operations. To speed up the memory reads, the AMI-386SX incorporates a page interleave scheme. This improves system speed, since a page hits requires no wait states, whereas a normal memory access would require wait states to be inserted.

Data Access: Cycle times

Table 3.1 gives the wait states and total bus cycle times for different cases of on-board DRAM access:-

J8 Jumper Setting :	1-2	2-3	1-2	2-3
J9 Jumper Setting :	1-2	1-2	2-3	2-3
Mode :	F4	F1	W01	W02
Max Pages Active :	4	1	4	4

Wait States

Page Hit

Bank Hit :	0	0	1	2
Bank Miss:	0	NA	0	0

Page Miss

Bank Hit :	2	2	2	3
Bank Miss:	2	1	2	3
New RAS :	1	1	1	2

DRAM Speed (ns) :	100	100	100	120

Type	: Page DRAM Mode	Page DRAM Mode

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The AMI 386SX System BIOS has a built in Advanced Diagnostics program which has several diagnostics features for the various hardware components of the system. The BIOS diagnostics program will perform diagnostics on the following hardware:

* Hard disk
    - Physical drives C: and D:

* Floppy drives
    - Physical Drives A: and B:

* Keyboard

* Video
    - Mono and Color

* Printer and Communication ports
    - All that are available.

4.1 Selecting the various Advanced Diagnostics Options

Getting to the Advanced Diagnostics

Press the <DEL> key on the keyboard when you see the following message at system startup:

Press <DEL> if you want to run SETUP or DIAGS

The display gives the following message after the BIOS initializes:

EXIT FOR BOOT

RUN CMOS SETUP
RUN DIAGNOSTICS

Move the bar with the up or down cursor keys to highlight RUN DIAGNOSTICS, then press <ENTER>.

4.2 Diagnostics Menu

Note the following in the Diagnostics Opening Menu :

*   The **Guide Line** in Reverse Video specifying the usage of the Cursor Keys, <ENTER> & <ESC> key.

*   The Configuration of the system in the **Devices Present** box.

*   The **Real Time Clock** ticking away at the right hand top corner of the screen.

*   **Diagnostics Options Line** - Hard Disk, Floppy, Keyboard, Video & Miscellaneous Diagnostics.

*   **Hard Disk Diagnostics Options Window** - detailing the various hard disk diagnostics that are available.

*   Note that the **Block Cursor** is on the Hard Disk & the first option under hard disk diagnostics - Hard Disk Format.

Key Conventions

*   Use the Left & Right arrow keys to move in

the Diagnostics Options Line.

*   Use the Up & Down arrow keys to move within a Diagnostics Options Window.

*   Use the <ENTER> key to select the option in the Diagnostics Options Window.

*   Use <ESC> key to abort & return to previous menu.

Diagnostics Options Window

The individual diagnostics option window is as follows:

> * Hard Disk
> * Floppy Disk Drive
> * Keyboard
> * Video
> * Miscellaneous

4.3 Hard Disk Diagnostics

Using Hard Disk Diagnostics Options

The Hard Disk options discussed below fall in two categories:

> * **Destructive Operation**   - The data on the Hard Disk is lost.

> * **Non-destructive Operation** -   The data on the Hard Disk is undisturbed.

The following list gives the various Hard Disk

Options & the category they fall into.

   * Hard Disk Format - Destructive
Operation.
   * Auto Interleave -   Destructive
Operation.
   * Media Analysis -   Destructive
Operation.
   * Performance Test - Non-destructive
Operation.
   * Seek Test -   Non-destructive
Operation.
   * Read/Verify Test -   Non-destructive
Operation.
   * Check Test Cylinder -   Data on the
Test Cylinder alone is lost.

All the options under Hard Disk Diagnostics require
more or less the following inputs:

   * Disk Drive
   * Drive Type
   * Interleave Factor
   * Bad Track List
   * Start Cylinder
   * End Cylinder
   * Start Head
   * End Head

All the above input fields have a default value. Thus
a user need not necessarily key-in all the inputs. The
nature of the various input parameters are discussed
as follows.

Drive Name

Enter the Hard disk drive on which you want the

diagnostics function to be performed. The default value for this parameter is normally the drive name you entered the last time . However, in case of a single drive System, the disk drive for the operation is assumed to be the physical drive actually present in your system.

For example if the drive is connected as physical drive "D", this parameter will be assumed as "D".

Drive Type Definition

The default value for the drive type is the SETUP value set during the CMOS setup. However, if the drive was not set during CMOS Setup, this value is defaulted to 1 and the user has an option of setting the drive to be one among the 46 standard Disk drive types. Note that all the information about the drive unfolds when the disk drive type is being chosen. (Appendix A also has a listing)

If the disk drive type does not fall within the 46 standard disk types, use the **USER** option to define your own parameters for the drive. In this case you need to provide the following parameters about the drive:

> Number of Cylinders
> Number of Heads
> Number of Sectors per track
> Write precom Cylinder number
> Landing zone

NOTE: The **USER** definition is valid only as long as the Diagnostics is in effect. This feature is provided for you to test a disk drive, the definition for which is not available in the ROM.

Interleave Factor

Choose an optimum interleave factor. Use the
Auto-Interleave option if you are in doubt.

The default value for the interleave factor is 3.

Mark Bad Tracks

With every Hard disk drive you get a list of bad
tracks , if there is any, from the manufacturer. If you
have such a list answer **'Y'** to this question.

You will then get a menu which will then allow you
to edit the complete bad track list. You can exit Bad
track entry by hitting **<ESC>** key or selecting the
Save and Exit option.

The default answer for this question is <N>.

Start and End Cylinder Number

Enter the Start & End Cylinder Number here. The
default value of the start and end cylinder number
will be 0 and the maximum number of cylinders
respectively.

Start and End Head number

Enter the Start and End head numbers here. The
default value for the start Head is 0 and that of the
End head is the value of the maximum head
number.

Proceed

If all the entries are correct, press <Y>, or press <N> to go over all the entries again. The default answer is <N>.

Warning

For each destructive operation, you get a WARNING message . You could proceed with the operation if you are absolutely sure about the information you have entered up to this point and you really want to proceed with the operation.

Activity Screen

While performing any operation, BIOS displays a small window at the right hand top corner of the screen called the activity window. Depending upon the type of operation, the activity window will have different information displayed in it.

Hard disk Format Option

WARNING: The **hard disk format** option is a destructive operation. You will loose all the data that you may have on it. If you want to retain your data on an used hard disk, Please make sure you have taken a backup before you start using this option.

This option allows you to preformat the Hard disk for use by DOS or any other operating system. This option can be used in one of the following circumstances:

To integrate a new hard disk to the system

To reformat an used hard disk which has developed some bad patches due to aging or bad handling.

Auto Interleave Option

WARNING: The **Auto interleave** option is a destructive operation. You will loose all the data you may have on the hard disk. If you want to retain the data on an used hard disk, Please make sure you have taken a backup of your hard disk before you start using this operation.

This is a very powerful feature, it enables you to get the peak performance out of your Hard Disk.

With this feature you need not speculate about the value of the Interleave Factor. The BIOS is entrusted with the job of finding the optimum Interleave value by a trial & error method. The BIOS will then start formatting the hard disk with this interleave factor. However, if you need to enter the bad track list, you have to stop the formatting after if finds out the optimum interleave factor by pressing the **<ESC>** key. You can then go into the Format option and used the above found interleave factor, format the Hard disk.

Media Analysis Option

WARNING: The **Media Analysis** option is a destructive operation. You will loose all the data stored on your hard disk. If you want to retain the data on a used hard disk after this operation is performed, please make sure that you have taken a

complete backup of your hard disk.

This is the most important operation for your hard disk drives. This diagnostics function does a series of tests on your hard disks to find out the bad patches on the hard disk. Even though manufacturers give a list of bad tracks with each hard disk, most of the time lot of new bad patches are introduced due to aging, bad handling of the disks. This function finds out all possible bad tracks on your hard disk and marks them as bad too. This operation takes quite some time & for best results this test should run uninterrupted.

Performance Test

This test enables the user to check his disk performance. The critical factor in deciding the disk performance is the Interleave Factor. Changing the Interleave factor can bring about drastic changes in Disk Performance.

The test determines the Data Transfer Rate & the Track to Track Seek time. Data Transfer Rate is measured in the units Kilobytes/Second & the Track to Track seek time in milliseconds. Higher value for Data transfer rate implies a better disk performance & lower value of track to track seek time indicates a better disk.

Seek Test

This test checks the seek capability of the Hard Disk on the specified Cylinder & Head range. First a sequential seek is performed & then a random

seek is performed. Any errors during the test are reported.

Read/Verify Test

This test performs sequential & random read & verify operation on the specified Cylinder, Head range.

Force Bad Tracks

This operation enables a User to define a list and mark tracks as bad. Certain specific applications require this option. (ie;Networking software)

4.4 Floppy Diagnostics

All the options under floppy diagnostics require more or less the following inputs :

       * Drive No.
       * Start Track No.
       * End Track No.

As in the case of hard disk the list below gives the effect of each of the diskette tests :

       Diskette Format   - Destructive
       Speed Test   - Non Destructive
       Random R/W Test   - Destructive
       Sequential R/W Test - Destructive
       Disk Change Line Test   - Non

Destructive

Diskette Format

WARNING: This test will erase all data on the disk under test. Be sure you have saved the data or are using a blank disk.

This test allows an user to check out the Floppy controller's abilities to format a diskette. Note that this is only a test to check out the format function of the controller. The diskettes formatted with this option does not have the file structure to hold files for any operating system like DOS. You have to format these diskettes again under the operating system you intend to use these diskettes with.

Drive Speed Test

This test determines the speed of rotation of the drive. Please note that the following are the allowable speeds for the various drives:

        * 1.2 MB drive - 360 rpm with a 1.2 Mb diskette.
                        300 rpm with a 360 Kb diskette.
        * 360 KB drive - 300 rpm.
        * 720 KB drive - 300 rpm.

Allow for a tolerance of 1% on all the speeds. Please ensure that the diskette is formatted before performing this test.

Random Read/Write Test

WARNING: This test will erase all data on the disk under test. Be sure you have saved the data or are using a blank disk.

This test performs a random read/write operation on the diskette and in turn checks the random seek, read/write capability of the drive. Ensure that the diskette is formatted before performing this test.

Sequential Read/Write Test

WARNING: This test will erase all data on the disk under test. Be sure you have saved the data or are using a blank disk.

This test performs a Sequential read/write operation and checks the sequential seek, read/write capability of the drive. Ensure that the diskette is formatted before performing this test.

Disk Change Line Test

This test checks out the functioning of disk change line capabilities of the diskette drives. This test is valid only for drives with the disk change line feature (ie; 1.2 Mb-5 1/4" HD and 720 Kb-3 1/2" drive.) NOTE: Test requires a formatted diskette.

4.5 Keyboard Diagnostics

There is only one diagnostics test available for the keyboard.

Scan / ASCII Code Test

Upon invoking this test a keyboard layout is shown on the screen. This keyboard layout might not necessarily correspond with your keyboard but will have the keys you have on your keyboard.

The objective of this test is to determine whether the keys depressed match with their Scan and ASCII codes. Every time a key is depressed the scan code & the ASCII code of the key is shown.

Use <CTRL><BREAK> key to abort this test.

4.6 Video Diagnostics

The Video diagnostics include the following for both Monochrome and Color display adapter cards:

        * Sync Test   - Checks the Sync capability.
        * Adapter Test - Performs test on the Display
                                Memory.
        * Attribute Test   - Checks the attributes of the
                                Display

        * 80 x 25 Display Test- Checks the 80 x 25
                                character set of the display
                                adapter.

If you have a color display card installed, you will have the following additional diagnostics functions.

        * 40 x 25 Display test
        * 320 x 200 Graphics test

* 640 x 200 Graphics test
* Page selection test
* Color test

The Video diagnostics functions do not require any inputs from the user. However, the test results are displayed on the screen.

4.7 Miscellaneous Diagnostics

These include the following tests :

* Serial Communication Port Test.
* Printer Port Test.

Serial Communication Port Test

This test requires a special RS-232C connector to be plugged on to the port.

The details of this connector are as below :

* RD & TD Shorted.
* DSR & DTR Shorted.
* CTS & RTS Shorted.

This test exercises the port for different :

* Baud Rates
* 7 Bit / 8 Bit &
* Odd / Even Parity

The results of the test are displayed on the screen.

Printer Port Test

This test writes a pattern on the Printer & the results
are observed on the Printer.

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Your AMI 386SX motherboard memory system consists of four 32-bit Dynamic Random Access Memory (DRAM) memory banks. All banks are designed to use Single in-line memory module (SIMM) DRAM's. Please refer to figure 1-1 for reference to memory bank location.

NOTE

> If your motherboard is installed in the system and you are adding memory, it is highly recommended to remove the motherboard before attempting to install SIMM cards. The force required to insert the SIMM cards could cause the board to flex and damage could occur at the standoff area's.

5.1   Installing SIMM modules

You may use either 256Kx9 or 1Mx9 SIMM card's. Each SIMM bank must contain two SIMM card's and be filled as follows; Bank 0, or bank 0 and bank 1, or all banks. No other combination is allowed. Table 5.1 shows memory configuration.

SIMM TYPE	BANK0	BANK1	BANK2	BANK3	MEMORY SIZE
256Kx9	XXXXX				512KB
	XXXXX	XXXXX			1MB
	XXXXX	XXXXX	XXXXX	XXXXX	2MB

```
1Mx9 XXXXX                              2MB
      XXXXX      XXXXX
       4MB
      XXXXX      XXXXX       XXXXX
      XXXXX        8MB
```

You should use only one type of memory module on the motherboard. Refer to Table 5.2 for suggested manufacturers and part numbers.

Type SIMM   Board Speed   Manufacturer   Part Number

256Kx9   16 MHz   Hitachi   HB561409BL-12
                            Hitachi   HB561409B-10
                            Hitachi   HB561409BL-10

1Mx9   16MHz   Fujitsu   MB85235-12
                            Mitsubishi MH1M09A0JA-12
                            NEC   MC-421000A9-12
                            Toshiba   THM91000S-12
                            Fujitsu   MB85235-10
                            Mitsubishi MH1M09A0JA-10
                            NEC   MC-421000A9-10
                            Toshiba   THM91000S-10

Place AMI 386SX motherboard on a anti-static mat as outlined in the beginning of section 1. Rotate the board until the keyboard connector (J1) is to the top

left side, this will place the SIMM area to your bottom right. Please **Note that the banks are split**, this is to say that each pair of sockets contain either a pair of bank HI or bank LO sockets. Refer to Figure 5-1.

With the component side of the SIMM facing away from you, firmly push the card into the socket. When properly inserted the SIMM card will "click" into place as the latching pins engage. Use Figure 5-2 as reference to install the SIMM cards.

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This section describes the procedure you should use to install an Intel 80387SX Coprocessor on you SX motherboard.

6.1 Installing the 387SX

Using figure 1-1, locate U21 on the motherboard. It is the empty 144 pin PGA socket adjacent to the on-board battery socket. Pin 1 of the socket is marked by a diagonal corner of the square etched on the motherboard adjacent to the word "80387SX".

Align the pins and press the 387SX coprocessor firmly into the socket, making sure that pin 1 is aligned with pin 1 of the socket. Again, take every precaution to avoid electro static discharge hazard by following the procedure in section 1.

Turn on the system. Go to the set-up screen. (Refer to section 2 for details on the set-up screen). In the upper right corner box you should get the following message:

Numeric Processor: Installed

If this message is indeed displayed, the system has detected the 80387SX Coprocessor and you may assume that the installation process is complete.

If the Installed message is not display go through the installation procedure once again. Switch off the power, check the orientation of the 387SX, press the chip firmly to make sure that it is making good contact, then bring the system up again. If you still get the same result, call AMI, we will be happy to help you.

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