

CONTENT

Chapter 1	INTRODUCTION	1-1
Chapter 2	GENERAL FEATURES	2-1
	Specification	2-1
	Processor	2-3
	Math Coprocessor	2-6
	Memory System	2-8
	I/O Subsystem	2-11
	System Functions	2-12
Chapter 3	INSTALLING COMPONENTS	3-1
	Installing 80387SX Math Coprocessor	3-1
	System Memory Configuration	3-3
	Control of System Speed	3-8
	System Board Jumper Setting	3-10
	System Board Connectors	3-11

Chapter 4 TECHNICAL INFORMATION 4-1

Memory Mapping	4-1
I/O Address Map	4-2
System Timers	4-4
System Interrupts	4-6
Direct Memory Access (DMA)	4-7
Real Time Clock and CMOS RAM	4-9
CMOS RAM Address Map	4-10
Real Time Clock Information	4-11
System Expansion Bus	4-12

APPENDIX A SYSTEM BIOS A-1

Self-Test	A-1
System Setup	A-4

APPENDIX B OPERATION & MAINTENANCE B-1

Keeping the System Cool	B-2
Cleaning the "Golden Finger"	B-2
Cleaning the Motherboard	B-3

APPENDIX C SYSTEM BOARD LAYOUT C-1

Chapter 1

Introduction

The Panther-II system board is a high performance system board that represents a significant technological advance over the conventional 386SX designs. It offers an increased power and flexibility architecture by supporting 80386SX processor speeds up to 33 Mhz (*See NOTE on preface*). The design utilizes advanced main frame techniques such as two or four way interleaving along with high speed page mode capability.

The Panther-II offers an inexpensive entrance to 386-specific applications. It combines the abilities of the 80386 and the 80286 machines. Like an 80386 machine, it processes instructions internally in 32-bit chunks. Like an 80286 machine, it operates with a 16-bit data bus and a 24-bit address bus. This construction allows the Panther-II system to run 386 software in essentially a 286 hardware environment.

For the memory system, It supports up to 16 MByte of DRAMs on the system board. System and Video shadowing features are supported on all 16K boundaries between 640K and 1M. It is also optimized to allow mixing of DRAM types to give end user the maximum flexibility in choosing the correct memory capacity for their applications. This flexibility in configuration allows you to select an ideal cost/performance combination.

INTRODUCTION

The Panther-II is a fully PC/AT compatible system board implemented with a highly integrated chip sets to provide high performance, reliability and compatibility. It is based on the 386SX CPU which can access the world's largest existing microcomputer software base, including the growing 32-bit software.

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

Regarding to the issue of compatibility, Panther-II system is fully hardware and software compatible with associated PC-AT products. This means that virtually all the hardware and software that is available for the PC/AT can also be run on a system you build around the Panther-II system. It supports MS-DOS, Xenix, Unix and all PC/AT application programs. Users can run applications designed for the PC/AT on Panther-II without any modification. Multitasking and multi-user capabilities are fully functional on this system board.

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

power supplies.

Panther-II is a perfect choice for CAD/CAM workstation, file server and end user applications. It is designed for the most advanced computer-based applications for today and in the future.

INTRODUCTION

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Chapter 2

General Features

SPECIFICATION

Processor Subsystem :

Intel 80386SX CPU
Optional 80387SX Co-processor

Speed :

Turbo/normal speed
Software/hardware selectable

Memory Subsystem :

16MB maximum using 4M SIMMs
2MB using 256Kbx4 DRAM chips
Page/Interleave memory:
- Page mode memory
- 2-way and 4-way interleave mode
System BIOS shadow
Video BIOS shadow
Parity Check option
512K Eprom BIOS

GENERAL FEATURES

I/O Subsystem :

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

System Support Functions :

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

Other Features :

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

PROCESSOR

The 80386SX Microprocessor is a 32-bit CPU with a 16-bit external data bus and a 24-bit external address bus. The 386SX CPU brings the high-performance software of the Intel386 Architecture to mid-range systems. It provides the performance benefits of a 32-bit programming architecture with the cost saving associated with 16-bit hardware systems.

The 386SX Microprocessor is 100% object code compatible with the 386DX, 286 and 8086 microprocessors. It provide 386DX based systems optimized for performance and 386SX CPU based systems optimized for cost, both sharing the same operating systems and application software. Unlike the 286-based systems against which it competes, the 386SX inherits the 386's protected and virtual 8086 modes and internal 32-bit processing.

Instruction pipeling, high bus bandwidth, and a very high performance ALU ensure short average instruction execution times and high system throughput. The 386SX CPU is capable of execution at sustained rates of 2.5-3.0 million instructions per second.

The integrated memory management unit (MMU) includes an address translation cache, advanced multi-tasking hardware, and a four-level hardware-enforced protection mechanism to support operating systems. The virtual machine

capability of the 386SX CPU allows simultaneous execution of applications from multiple operating systems such as MS-DOS and UNIX.

80386SX is not only an enhanced version of 80286, but designed to overcome the deficiencies of 80286. It allows you to make use of application software that a 286 just can't handle. For example, a very important attribute of any multi-tasking/multi-user operating system is its ability to rapidly switch between tasks or processes. The 386SX Microprocessor directly supports this operation by providing a task switch instruction in hardware.

The 386SX Microprocessor has two modes of operation: Real Address Mode (Real Mode), and Protected Virtual Address Mode (Protected Mode). Real Mode has the same base architecture as the 8086, but allows access to the 32-bit register set of the 386SX Microprocessor.

The complete capabilities of the 386SX Microprocessor are unlocked when the processor operates in Protected Virtual Address Mode. Protected Mode vastly increases the linear address space to four gigabytes and allows the running of virtual memory programs of almost unlimited size. In addition, Protected Mode allows the 386SX Microprocessor to run all of the existing 386DX CPU, 80286 and 8086 CPU's software, while providing a sophisticated memory management and a hardware-assisted protection mechanism. Protected Mode allows the use of additional instructions specially optimized for supporting

multitasking operating system.

The 386SX Microprocessor also offers four levels of protection which are optimized to support a multi-tasking operating system and to isolate and protect user programs from each other and the operating system.

MATH COPROCESSOR

The demand for sophisticated, number-crunching scientific and business applications has rapidly increased in recent years. 80386SX features an integer Arithmetic Logic Unit which only handles simple integer operations such as addition and multiplication. Floating-point operations which are actually utilized by applications must be accomplished through software routines.

To overcome this obstacle, external Math coprocessor is necessary. The Math coprocessor contains complex hardware and large data registers for floating-point numeric operations.

The 387SX Math CoProcessor is an extension to the Intel 386 microprocessor architecture. The combination of the 387SX with the 386SX Microprocessor dramatically increases the processing speed of computer application software which utilizes mathematical operations. This makes an ideal computer workstation platform for applications such as financial modelling and spreadsheet, CAD/CAM, or graphics.

The 387SX Math CoProcessor adds over seventy mnemonics to the 386SX Microprocessor instruction set. Specific 387SX math operations include logarithmic, arithmetic, exponential, and trigonometric functions. The 387SX supports integer, extended integer, floating point and BCD data formats, and fully conforms to the

ANSI/IEEE floating point standard. The math coprocessor offloads the complicated math functions from the CPU. Therefore, it handles in one instruction what would have required many steps with the CPU. So you can save time on your favourite spreadsheet, database, engineering, scientific and graphics packages.

The 387SX CoProcessor is object code compatible with the 387DX and upward object code compatible from the 80287 and 8087 Math Co-processors.

In real-address mode and virtual-8086 mode, the 386SX Microprocessor and 387SX Math Coprocessor is completely upward compatible with software for the 8086/8087 and 80286/80287 real-address mode systems.

In protected mode, the 386SX Microprocessor and 387SX Math Coprocessor is completely upward compatible with software for the 80286/80287 protected mode system.

In all modes, the 386SX Microprocessor and 387SX Math Coprocessor is completely compatible with software for the 386 Microprocessor/387 Math Coprocessor system.

MEMORY SYSTEM

Panther-II supports the use of 256K, 1M and 4M DRAMs device configurations for up to 16MB of on-board system memory.

Both page mode and interleave operation are incorporated on the system board DRAM. Page mode is enabled or disabled for each pair of DRAM banks independently. When on, it is active on all memory maps for the enabled bank pairs. Interleaving requires pairs of banks. Both page mode and interleave are automatically enabled. One bank of memory refers to as 2 modules of SIMM or 4 pieces of DIP DRAM. Detailed operation of each is given in the following sections.

Interleave Operation

Two-way interleaving is automatically enabled whenever both memory banks of a pair are populated with same DRAM types. If all four banks are populated with same DRAMs, four-way interleaving automatically occurs. If the four memory banks are not populated with same DRAMs, two-way interleaving occurs on pairs that are of the same type.

In a system with three banks populated, the first two banks perform two-way interleave if they are of the same DRAM type. Next table

shows the automatic interleaving options that occur versus the number of populated banks. In the table, Bank 0,1,2 and 3 are the designations for each of the four DRAM banks. In the columns below these designators, "Yes" or "No", indicate whether the bank is populated.

Automatic Interleave vs Memory Map

Bank		A Bank Address Mode	Bank		B Bank Address Mode
0	1		2	3	
Yes	No	Linear	No	No	N/A
Yes	Yes	2-Way Interleave	No	No	N/A
Yes	Yes	2-Way Interleave	Yes	No	Linear
Yes	Yes	2-Way Interleave 0 and 1*	Yes	Yes	2-Way Interleave 2 and 3*

- * This is for the case where Banks A and B contain different types of DRAMS. If all four banks contain the same DRAM type then four-way interleaving is automatically activated.

Page Mode Operation

Memory Interleaving operates independently of page mode. Page mode is active whether one bank or both are populated. The page mode operation results in no additional wait state penalty for either reads or writes which immediately follow reads to the same DRAM page.

When pairs of banks are installed interleaving is automatically enabled. The

combination of page mode with interleaving results in the best possible combination of fast system memory operation using the most cost effective DRAMs.

Shadow RAM

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

Memory Remapping

If shadow RAM is not used at memory area 0D0000H:0FFFFFFH, remapping is possible. Then, local memory areas 0A0000H:0BFFFFFFH and 0D0000H:0FFFFFFH (each 128K bytes) are mapped to the top of total memory for it to be used as extended memory. Memory areas 0F0000H-0FFFFFFH (system BIOS) and 0C0000H-0CFFFFFFH (video BIOS) are reserved for shadow RAM.

I/O SUBSYSTEM

It is very important that a high speed system should be compatible with existing peripherals without downgrading the performance. The Panther-II system is exactly designed with this capability in mind. To be compatible with the existing add-on cards, user has the option of defining the I/O speed. If for example, the peripheral card is not capable of operating at high speed, user can define a slow speed for I/O slot operation while still maintain the rest of the system at very high speed.

SYSTEM FUNCTIONS

System functions include :

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

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

Chapter 3

Installing Components

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

If installation sounds risky, let your dealer install the 80387SX. If you make a mistake, you could damage the 80387SX or your computer.

INSTALLING 80387SX MATH COPROCESSOR

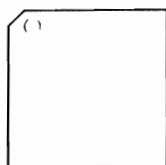
Math coprocessor 80387SX is available in a 68-pin PLCC package. Find the 80387SX socket on the system board, it's located on U16 at the corner of the motherboard. The socket is a 68-pin PLCC socket, align the chip so that its orientation mark matches up with that of the socket. When you are sure the pins are aligned correctly, press firmly and evenly on the 80387SX into the socket. Make sure that the coprocessor is firmly inserted into the socket.

The speed rating of 80387SX should match that of the system speed for a optimum and reliable operation. Refer to the table below to determine the correct speed rating of the 80387SX.

Panther-II	Math Coprocessor
33 Mhz System	80387SX-33
25 Mhz System	80387SX-25
20 Mhz System	80387SX-20
16 Mhz System	80387SX-16

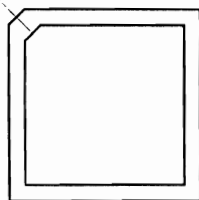
INSTALLING COMPONENTS

Orientation Mark



80387SX Coprocessor

Orientation Mark



Numeric Coprocessor Socket

SYSTEM MEMORY CONFIGURATION

Four DIP memory banks and two SIMM memory banks are available on Panther-II, these memory banks are designated as BANK 0 to BANK 3 in the motherboard. User has the option of either using DIP type DRAM or SIMM type memory modules. Still if the user prefers, he could use both types together. That means you could make use of DIP and SIMM type memory simultaneously. Please note that however, you cannot install both memory types marked with the same bank reference. For example if you had already installed DIP memory into 'BANK 0', you can no longer install SIMM into the memory modules referenced as 'BANK 0'.

One bank of memory refers to 2 SIMM modules or 6 DIP memory chips (4x44256 + 2x41256). For the SIMM memory, user can install 256K, 1M or 4M SIMM; therefore it has a maximum memory capacity of 16 Megabytes. On the other hand; if purely DIP DRAM are used, it will allow up to 2 Megabytes of memory. The DIP DRAM are organized in 4 banks as shown in next page :

DIP DRAM Memory Organization

Memory Bank	DIP Memory Location	DRAM Size
BANK 0	U39, U40, U41, U42	44256
	U38, U37 (parity)	41256
BANK 1	U33, U34, U35, U36	44256
	U32, U30 (parity)	41256
BANK 2	U26, U27, U28, U29	44256
	U31, U24 (parity)	41256
BANK 3	U20, U21, U22, U23	44256
	U25, U19 (parity)	41256

U38,U37, U32,U30, U31,U24 & U25,U19 are the parity bits for BANK 0 to BANK 3 respectively. In normal situation, those bits are not needed and the parity checking logic can be disabled. Hence, the user can left those sockets unpopulated and thus allowing you to minimize the system cost.

There are several combinations of DRAM types you may consider. So, a basic system can be equipped with fewer memory and later more memory can be added when upgrading the system. As a typical case, a basic system can be equipped with 2 Megabyte memory using 1MB SIMM and then memory size is later expanded to 10 Megabytes by putting another banks of 4M SIMM.

The memory size is detected automatically by system BIOS and indicated after power up. No switches or jumpers are required to be set for the memory size and DRAM type.

The different configurations of memory is illustrated in the next table. It shows the page mode, interleave options and the DRAM combinations available for each possible memory map. Since interleaving requires pairs of banks, various controls described act on memory in bank pairs. The short hand notation Bank A is used when describing something that affects memory banks 0 and 1 as a set. Similarly, Bank B is used to describe memory banks 2 and 3 as a set.

Memory Configuration Table

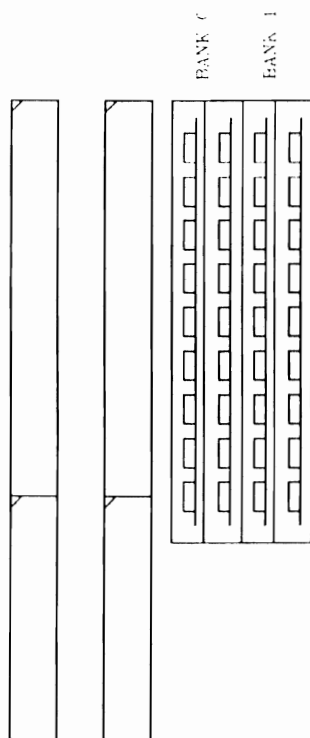
16-Bit		DRAM		Banks		Page/Interleave		Total Memory
Bank 0	Bank 1	Bank 2	Bank 3	A	B			
256K	256K	256K	256K	2/P	4/P			1.0MB
256K	256K			4/P				2.0MB
1M				Page				2.0MB
1M	1M			2/P				4.0MB
1M	4M			Page				10.0MB
4M	4M			2/P				16.0MB

Installing SIMM Modules

Whenever adding memory modules to the motherboard, install 2 modules at a time. Also make sure that the SIMM is installed in the correct orientation, the RAM chips on the modules should be facing the I/O slot. See the figure on next page for illustration.

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

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



RAM Module Orientation

CONTROL OF SYSTEM SPEED

System speed can be selected by hardware switch and keyboard. Connector P3 should be connected to the turbo switch of the case panel, this toggles the operation mode between turbo and normal mode when pressed.

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

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

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

SYSTEM BOARD JUMPER SETTING

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

Display Selection

JP6	Display Type
1-2	Monochrome Display *
2-3	CGA, EGA, VGA, PGA

* Default setting

'CMOS Setup' Reset Jumper

Sometimes, improper setup may cause the system to malfunction and you might not be able to correct such problem without clearing the entire CMOS Setup. The purpose of this jumper is for the user to reset the CMOS Setup in case of critical error occurred in the Setup. Make sure that the power is OFF before you do this operation. Also be certain that this jumper is re-installed to its normal position after resetting the CMOS Setup.

After the CMOS Setup is cleared, the Setup will be loaded with the BIOS default value upon power-up and you may continue to define the system configuration as usual.

JP2	Function
1-2	Normal operation *
2-3	Reset CMOS Setup

* Default setting

SYSTEM BOARD CONNECTORS

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

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

Pin assignments of the connectors are illustrated as follows :

P 1 - Hardware Reset Connector

Pin	Assignment
1	Selection Pin
2	Ground

P 2 - Speaker Connector

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

P 3 - Turbo Switch Connector

Pin	Assignment
1	Selection Pin
2	Ground

P 4 - Turbo LED Connector

Pin	Assignment
1	+5 Vdc
2	LED signal

P 5 - Power LED & Ext-Lock Connector

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

P6-P7 - Power Supply Connector

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

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

P 8 - External Battery Connector

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

KB 1 - Keyboard Connector

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

Chapter 4

Technical Information

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

MEMORY MAPPING

Address	Range	Function
000000-7FFFFF	000K-512K	System Board Memory (512K)
080000-09FFFF	512K-640K	System Board Memory (128K)
0A0000-0BFFFF	640K-768K	Display Buffer (128K)
0C0000-0DFFFF	768K-896K	Adaptor ROM / Shadow RAM (128K)
0E0000-0EFFFF	896K-960K	System ROM / Shadow RAM (64K)
0F0000-0FFFFF	960K-1024K	System BIOS ROM / Shadow RAM (64K)
100000-7FFFFFFF	1024K-8192K	System Memory
800000-FFFFFFFF	8192K-16384K	System Memory

I/O ADDRESS MAP

I/O Address Map on System Board

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

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

I/O address hex 100 to 3FF are available on the I/O channel.

ADDRESS (HEX)	DEVICE
1F0-1F8	Fixed Disk
200-207	Game I/O
278-27F	Parallel Printer Port 2
2F8-2FF	Serial Port 2
300-31F	Prototype Card
360-36F	Reserved
378-37F	Parallel Printer Port 1
380-38F	SDLC, bisynchronous 2
3A0-3AF	Bisynchronous 1
3B0-3BF	Monochrome Display and Printer Adapter
3C0-3CF	Reserved
3D0-3DF	Color Graphics Monitor Adapter
3F0-3F7	Diskette Controller
3F8-3FF	Serial Port 1

SYSTEM TIMERS

Panther-II has three build-in programmable timer/counters defined as channels 0 through 2 :

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

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

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

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

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

SYSTEM INTERRUPTS

Sixteen levels of system interrupts are provided on Panther-II. The following shows the interrupt-level assignments in decreasing priority.

Level	Function
Microprocessor NMI	Parity or I/O Channel Check
Interrupt Controllers	
CTLR 1 CTLR 2	
IRQ0	Timer Output 0
IRQ1	Keyboard (Output Buffer Full)
IRQ2	Interrupt from CTLR 2
IRQ8	Real-time Clock Interrupt
IRQ9	Software Redirected to INT 0AH (IRQ2)
IRQ10	Reserved
IRQ11	Reserved
IRQ12	Reserved
IRQ13	Coprocessor
IRQ14	Fixed Disk Controller
IRQ15	Reserved
IRQ3	Serial Port 2
IRQ4	Serial Port 1
IRQ5	Parallel Port 2
IRQ6	Diskette Controller
IRQ7	Parallel Port 1

DIRECT MEMORY ACCESS (DMA)

Panther-II supports seven DMA channels.

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

The following shows the addresses for the page register.

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

REAL TIME CLOCK AND CMOS RAM

Real time clock is build-in for maintaining the time and date. This subsystem also contains 114 bytes of RAM in addition to the Clock/Calendar. The Clock/Calendar information and RAM are kept active by connecting the device to an external battery when system power is turned off. Upon you turn the system power on, CMOS will load the recorded configuration into the system so that the system can function in the right track with the equipped devices. However, if you have not configured the CMOS, or the battery which supports the power to the CMOS is weakened, you need to redefine the necessary parameters whenever the system is boot up. The following page shows the CMOS RAM addresses.

CMOS RAM ADDRESS MAP

Addresses	Description
00-0D	* Real-time clock information
0E	* Diagnostic status byte
0F	* Shutdown status byte
10	Diskette drive type byte - drives A and B
11	Reserved
12	Fixed disk type byte - drives C and D
13	Reserved
14	Equipment byte
15	Low base memory byte
16	High base memory byte
17	Low expansion memory byte
18	High expansion memory byte
19-2D	Reserved
2E-2F	2-byte CMOS checksum
30	* Low expansion memory byte
31	* High expansion memory byte
32	* Date century byte
33	* Information flags (set during power on)
34-7F	User RAM (Standby)

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

REAL TIME CLOCK INFORMATION

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

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

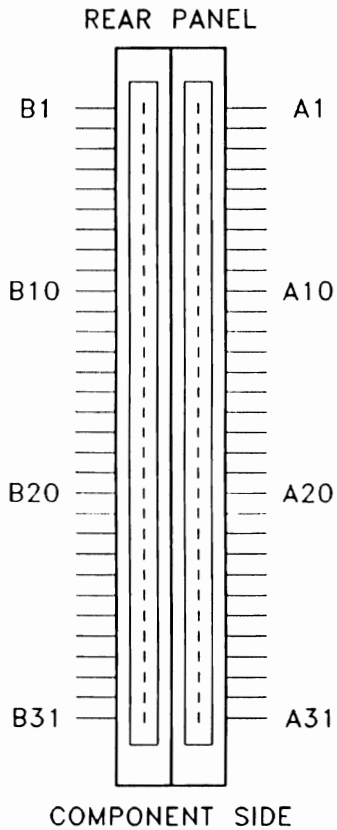
SYSTEM EXPANSION BUS

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

The I/O channel supports:

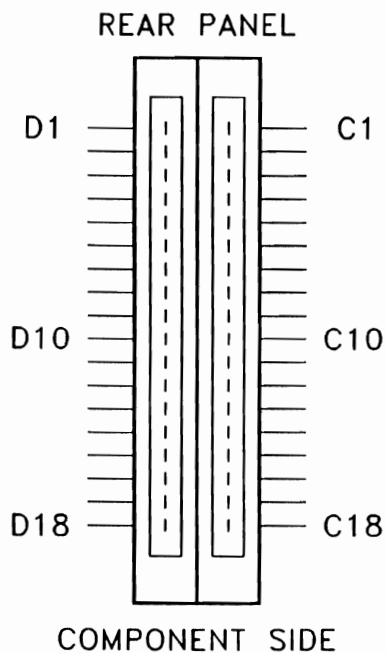
- * I/O address space from hex 100 to hex 3FF
- * Selection of data access (either 8 or 16 bit)
- * 24 bit memory addresses (16MB)
- * Interrupts
- * DMA channels
- * Memory refresh signal

The following figure shows the pin numbering for I/O channel connectors JA1 to JA6.



TECHNICAL INFORMATION

The following figure shows the pin numbering for I/O channel connectors JB1-JB4.



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

I/O Channel (A-Side)

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

I/O Channel (B-Side)

I/O Pin	Signal Name	I/O
B1	GND	Ground
B2	RESET DRV	I
B3	+5 Vdc	Power
B4	IRQ9	I
B5	-5 Vdc	Power
B6	DRQ2	I
B7	-12 Vdc	Power
B8	0WS	I
B9	+12 Vdc	Power
B10	GND	Ground
B11	-SMEMW	O
B12	-SMEMR	O
B13	-IOW	I/O
B14	-IOR	I/O
B15	-DACK3	I
B16	DRQ3	O
B17	-DACK1	I
B18	DRQ1	O
B19	-Refresh	I/O
B20	CLK	O
B21	IRQ7	I
B22	IRQ6	I
B23	IRQ5	I
B24	IRQ4	I
B25	IRQ3	I
B26	-DACK2	O
B27	T/C	O
B28	BALE	O
B29	+5 Vdc	Power
B30	OSC	O
B31	GND	Ground

I/O Channel (C-Side)

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

I/O Channel (D-Side)

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

Appendix A

AMI System BIOS

The system BIOS of Panther-II provides an interface for operating systems and applications to access the hardware. It is fully compatible with standard AT BIOS and works flawlessly in the network system. It also performs self-test after reset and includes a setup program to configure the system.

SELF-TEST

To ensure that the computer hardware is functional, the system BIOS will carry out a self-test upon reset. The test is very intensive and covers all parts of hardware. It takes a while before messages are shown on the screen. It does not mean that the system is not working when the screen is blank. So wait for a while after turning on the power and listen carefully to the speaker. Some errors are reported by a number of beep sounds. After completing the self-test, the BIOS will display some messages on the screen.

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

These fatal errors are usually communicated through a series of audible beeps. The numbers on the fatal error list below correspond to the number of beeps for the corresponding error. All errors listed, with the exception of #8, are fatal errors.

No. of Beeps	Error Message
1	DRAM Refresh Failure
2	Base 64KB Memory Parity Error
3	Base 64KB Memory Failure
4	System Time Failure
5	Processor Error
6	Keyboard Controller Gate A20 Failure
7	Processor Exception Interrupt Error
8	Display Memory Read / Write Error (Video Adapter)
9	ROM Checksum Error
10	CMOS Shutdown Register Read/Write Error

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

System Configuration (C) Copyright 1985-1990, American Megatrends Inc.,

Main Processor	80386	Base Memory Size	: 640 KB
Numeric Processor	None	Ext Memory Size	: 256 KB
Floppy Drive A:	1.2 MB, 5¼"	Hard Disk C Type	2
Floppy Drive B	1.44MB, 3½"	Hard Disk D Type	None
Display Type	VGA or EGA	Serial Port(s)	None
ROM-BIOS Date	05/10/91	Parallel Port(s)	: 3BC

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

SYSTEM SETUP

The BIOS incorporates five setup sections:

- (1) Standard CMOS Setup
- (2) Advanced CMOS Setup
- (3) Advanced Chipset Setup
- (4) Auto Configuration with BIOS Defaults
- (5) Hard Disk Utilities

It is important that all the setup procedures should be completed before operating the system. Otherwise, the system may not run properly with the incorrect setup information. Run the setup again if the configuration is changed.

To enter the setup section, press 'DEL' when the following message is shown after the power-on memory test :

Hit if you want to run SETUP

Whenever the system BIOS finds that the configuration of the system is altered, a message will be shown and you may press 'F1' to run setup. Then the following messages are shown on the screen.

BIOS SETUP PROGRAM - AMI BIOS SETUP UTILITIES

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STANDARD CMOS SETUP

ADVANCED CMOS SETUP

ADVANCED CHIPSET SETUP

AUTO CONFIGURATION WITH BIOS DEFAULTS

HARD DISK UTILITY

WRITE TO CMOS AND EXIT

DO NOT WRITE TO CMOS AND EXIT

Standard CMOS setup for Changing Time, Date, Hard Disk Type, etc.

(1) STANDARD CMOS SETUP

The memory size is automatically detected by the BIOS. So you are only required to set the date, time, hard disk type, floppy drives type, display type and keyboard. The system configuration information are shown as follows:

BIOS SETUP PROGRAM - STANDARD CMOS SETUP	
(C) 1990 American Megatrends Inc., All Rights Reserved	
Date (mn/date/year) : Sun, Jul 01, 1990	Base memory size 640 KB
Time (hour/min/sec) : 12 : 05 : 30	Ext. memory size : 256 KB
Daylight Saving : Disabled	Cyln Head WPcom LZone Sect Size
Hard Disk C: type : Not Installed	
Hard Disk D: type : Not Installed	
Floppy Drive A: : 1.2 MB, 5%	
Floppy Drive B: : 1.44 MB, 3%	
Primary Display : VGA or EGA	
Keyboard : Installed	

Month : Jan, Feb, Dec
Date : 01, 02, 03, 31
Year : 1901, 1902, 2099

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	1	2	3	4
5	6	7	8	9	10	11

ESC:Exit,I-1-:Select F2/F3:Color,PgUp/PgDn:Modify

OPTION 1 TIME AND DATE

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

OPTION 2 FIXED DISK DRIVE

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

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

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

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

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

OPTION 3 FLOPPY DISK DRIVE

Four types of floppy disk drives are supported:

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

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

OPTION 4 DISPLAY

Four types of display are supported:

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

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

OPTION 5 KEYBOARD

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

(2)

ADVANCED CMOS SETUP

All the registers of the chipsets are set to default values by the system BIOS. Usually, there is no need to modify these registers unless the configuration is changed. Since improper settings of these registers may cause the system to malfunction, check your settings carefully before exit.

In ADVANCED CMOS SETUP, the main menu is shown as below:

BIOS SETUP PROGRAM - ADVANCED CMOS SETUP		
<C> 1990 American Megatrends Inc., All Rights Reserved		
Typematic Rate Programming	: Disabled	Adapter ROM Shadow D800,16K : Disabled
Typematic Rate Delay (Msec)	: 500	Adapter ROM Shadow DC00,16K : Disabled
Typematic Rate (Chars/Sec)	: 15	Adapter ROM Shadow E000,16K : Disabled
Above 1 MB Memory Test	: Disabled	Adapter ROM Shadow E800,16K : Disabled
Memory Test Tick Sound	: Enabled	Adapter ROM Shadow EC00,16K : Disabled
Hit Message Display	: Enabled	Adapter ROM Shadow E000,16K : Disabled
Hard Disk Type 47 RAM Area	: 0:300	System ROM Shadow F000,16K : Disabled
Wait for <F1> if Any Error	: Enabled	
System Boot Up Num Lock	: On	
Numeric Processor	: Disabled	
Floppy Drive Seek At Boot	: Enabled	
System Boot Up Sequence	: A:, C:	
Video ROM Shadow C000,16K	: Enabled	
Video ROM Shadow C400,16K	: Enabled	
Adapter ROM Shadow C800,16K	: Disabled	
Adapter ROM Shadow CC00,16K	: Disabled	
Adapter ROM Shadow D000,16K	: Disabled	
Adapter ROM Shadow D400,16K	: Disabled	

After changing the registers' settings, test your system first to make sure that the settings are correct. It is likely that your system becomes unstable and you need to setup the registers again.

In this section, you simply use the up and down arrow keys to move between options and press PgUp/PgDn to scroll bit value. After you finish the Setup, press 'Esc' to return to main menu. The BIOS will set the registers accordingly.

A short description follows for each of the options on the Advanced CMOS Setup Screen. If any problem in some options, press the <F1> Help Key.

Typematic Rate Programming :

By enabling this option, the user can adjust the rate at which a keystroke is repeated. The options "Typematic Rate Delay" and "Typematic Rate" also affect this rate. When a key is pressed and held down, the character appears on the screen and, after a delay set by the Typematic Rate Delay, it keeps on repeating at a rate set by the Typematic Rate Value. When two or more keys are pressed and held down simultaneously, only the last key pressed will be repeated at the typematic rate. This stops when the last key pressed is released, even if other keys are depressed.

Above 1 MB Memory Test :

If the option is enabled, the memory above 1MB will be tested. If disabled, it takes less time for memory test.

Hard Disk Type 47 Data Area :

The AMI BIOS SETUP features two user-definable hard disk types. Normally, the data for these disk types are stored at 0:300 in lower system RAM. However, if a problem occurs with some software regarding hard disk, try setting this option to 'DOS 1 KB'. 1KB in the main memory will be allocated for hard disk type storage and the main memory is reduced to 639 KB.

If shadow RAM for system BIOS (F000H) is enabled, the hard disk type 47 will be added to the standard hard disk type table. Hence the hard disk type 47 data area is not needed and this option is ignored. Hard disk type 47 will be considered as a standard hard disk type by software.

System Boot Up Num Lock :

The "num lock" option on the keyboard is usually turned on after power on. This option allows you to turn the "num lock" off after power on. So you can use the arrow keys on the numeric keypad without pressing the "num lock" key.

Numeric Processor :

These options allow the user to mark the 80387SX Math coprocessor as present or absent.

Floppy Drive Seek At Boot :

The default for this option is "Enabled". If disabled, it allows a fast boot.

System Boot Up Sequence :

This option allows you to choose which drive the system will boot from first. The default setting is 'A:, C:'. It allows you to boot from device A if necessary. However, it will directly boot from hard disk when selecting 'C:, A:'. The BIOS will not read the floppy disk A unless there is no drive C: installed. Thus it takes less time for boot up.

Video, Adapter and System ROM shadow

There are two options of shadow RAM for video adapter, ten options of shadow RAM for add-on card and one for the system BIOS. For the option System ROM, the content of the system at F000H segment BIOS is copied to the on board memory. For the option Video ROM, the video ROM at C000H segment or C4000H segment are copied to memory.

If you install an add-on card which ROM BIOS locates at one of the Adapter ROM shadow options, you may select corresponding option to shadow this ROM. Sometimes, there may be problem after enabling the shadow memory on the add-on card. In this case, you cannot enable the shadow RAM function for this add-on card.

(3) ADVANCED CHIPSET SETUP

DRAM Read Wait State :

Options of '0 W/S' & '1 W/S' are available. Check carefully whether your DRAM is suitable for the number of wait states you want to select. Improper setting can cause instability of the system.

A setting of '0 W/S' will enable the system to maximize its performance with zero wait state memory access under the page/interleave scheme. On the other hand, a setting of '1 W/S' will allow the use of less expensive slow DRAM but with performance reduction.

As a general rule:

For 33Mhz system, you may select '0 W/S' if DRAM with access time of 70ns or faster is used, otherwise select '1 W/S'.

For 25MHz and 20MHz system, you may select '0 W/S' if DRAM with access time of 80ns or faster is used, otherwise select '1 W S'.

For 16MHz system, you may select '0 W/S' if DRAM with access time of 100ns or faster is used, otherwise select '1 W/S'.

Since the specification of DRAM varies among different manufacturers; the above rule is not a guarantee, you should consult your local dealer for the detail information.

DRAM Write Wait State :

See 'DRAM Read Wait State' description above.

ATCLK Select

This controls the frequency at which the I/O peripherals operate. The I/O performance can be improved by selecting a higher AT bus clock. However care should be exercised in setting it, make sure that the peripheral cards are capable of operating at higher speed before making changes, otherwise problem could arise.

Options of 'CLK2/8', 'CLK2/6' & 'CLK2/4' are available, refer to the following table for the corresponding I/O speed of different systems. It is strongly recommended that the AT-Bus speed be kept at or below 8.33 so as to comply with ISA AT-Bus specification.

System Speed	ATCLK Select(I/O Bus Speed)		
	CLK2/8	CLK2/6 ⁺	CLK2/4
16MHz	4	5.33	8*
20MHz	5	6.67*	10
25MHz	6.25	8.33*	12.5
33MHz	8*	11	16.5

⁺ Default

* Recommended values

256KB Memory Relocation :

The 256KB memory below 1MB boundary can be used by software as extended memory if this option is enabled, therefore it is advisable to enable this option. Otherwise, this area can only be accessed as shadow RAM function.

However, 256KB memory relocation is automatically invalidated to avoid memory contention if any memory segment between 0D0000H to 0EFFFFH is enabled as shadow RAM in the Advanced CMOS setup.

(4) **AUTO CONFIGURATION WITH
BIOS DEFAULTS**

The Auto configuration with BIOS default is used to set the internal registers of the system to its optimum performance together with high reliability. Once the Auto Configuration is applied, the Advanced CMOS Setup is automatically re-configured with the default settings; the user need not bother about the settings in the ADVANCED CMOS SETUP. But you will still required to set those options in the STANDARD CMOS SETUP after the Auto Configuration is used.

(5) HARD DISK UTILITY

Hard Disk Utility program option is invoked by selecting the 'HARD DISK UTILITY' at the Main Setup Menu, the screen is shown as below :

BIOS SETUP PROGRAM - HARD DISK UTILITY <C> 1990 American Megatrends Inc., All Rights Reserved																																		
<table><thead><tr><th></th><th></th><th></th><th>Cylin</th><th>Head</th><th>WPcom</th><th>LZone</th><th>Sect</th><th>Size (MB)</th></tr></thead><tbody><tr><td>Hard Disk C:</td><td>Type</td><td>47 USER TYPE</td><td>1314</td><td>7</td><td>1314</td><td>1314</td><td>17</td><td>76</td></tr><tr><td>Hard Disk D:</td><td>Type :</td><td colspan="7">Not Installed</td></tr></tbody></table>											Cylin	Head	WPcom	LZone	Sect	Size (MB)	Hard Disk C:	Type	47 USER TYPE	1314	7	1314	1314	17	76	Hard Disk D:	Type :	Not Installed						
			Cylin	Head	WPcom	LZone	Sect	Size (MB)																										
Hard Disk C:	Type	47 USER TYPE	1314	7	1314	1314	17	76																										
Hard Disk D:	Type :	Not Installed																																
Hard Disk Type can be changed from the STANDARD CMOS SETUP option in Main Menu																																		
<table><tr><td>Hard Disk Format</td></tr><tr><td>Auto Interleave</td></tr><tr><td>Media Analysis</td></tr></table>								Hard Disk Format	Auto Interleave	Media Analysis																								
Hard Disk Format																																		
Auto Interleave																																		
Media Analysis																																		

There are three options in the hard disk utility : Hard Disk Format, Auto Interleave, and Media Analysis.

For a new hard disk (drive), the manufacturer of the hard drive usually provides a list of "bad tracks" with the hard drive. Your hard disk manual might also include the optimum interleave factor.

In this case, assuming that you have a list of bad tracks and know the interleave factor, it will not be necessary to take the auto interleave and media analysis options. Simply follow the instructions in the Hard Disk Format. If you have a bad track list but have not been provided with the optimum interleave factor, follow the instructions in the Auto Interleave Section.

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BIOS SETUP PROGRAM - HARD DISK UTILITY
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Hard Disk C:  Type  47 USER TYPE  1314  7  1314  1314  17  76
Hard Disk D:  Type  Not Installed

Auto Interleave

Disk Drive (C/D)  ? C
Disk Drive Type   ? 47
Mark Bad Tracks (Y/N) ? N
Proceed (Y/N)     ?

Bad Track %

Ms.  Cyl.  Head

```

Use the Hard Disk Format option to integrate a new hard disk to the system, or to reformat a used hard disk which has developed some bad tracks. To find these bad tracks on a used drive, select the Media Analysis option.

The value for Disk Drive is C for a C: Drive or D for a D: Drive. If two disk drives have been previously entered at the Standard CMOS Setup Screen, then the ID (C/D) will appear to the right of the question mark following the Disk Drive field. Choose which drive you wish to format by selecting the appropriate letter and pressing <ENTER>. If only one drive was selected at the Standard CMOS Setup Screen, the cursor

OPTION 3 MEDIA ANALYSIS UTILITY

BIOS SETUP PROGRAM - HARD DISK UTILITY						
<C> 1990 American Megatrends Inc., All Rights Reserved						
			Cylin	Head	WPcom	LZone
						Sect
						Size (MB)
Hard Disk C:	Type :	47 USER TYPE	1314	7	1314	1314
Hard Disk D:	Type :	Not Installed	17			76

Media Analysis	
Disk Drive (C/D)	? C
Disk Drive Type	? 47
Proceed (Y/N)	?

The Media Analysis Utility performs a series of tests to locate bad tracks on the hard disk. All bad tracks on the hard disk will be listed in the Bad Track List Box. Since this test writes to all cylinders and heads on the hard disk to verify andy bad tacks, the test may require several minutes to complete.

Appendix B

Operation and Maintenance

Some components of the Panther-II or computer components are static-sensitive devices and can be damaged by static discharges. To prevent such damage, the device may be wrapped in a conductive, anti-static bag; certain precautions should be taken before removing the device from its bags.

When installing or removing any add-on card, DRAM module or coprocessor, care should be taken when handling these devices. Touch an unpaint metal part of your system unit (for example, the screws on the rear of the system unit) with one hand, then hold the component you are installing on the other hand. This will place your body, the component, and the system unit at the same ground potential, preventing an accidental static discharge. Be sure to handle circuit boards by the edges only and do not touch the component pins or solder joints. Grasp diskette drives or fixed disk drives by their frames to avoid touching the circuit board. Memory chips or co-processor should be held by their bodies only, not by their pins.

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

KEEPING THE SYSTEM COOL

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

CLEANING THE "GOLDEN FINGER"

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

CLEANING THE MOTHERBOARD

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

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Appendix C

System Board Layout

