

PAM-0057V

High Performance
Pentium PCI Mainboard
User's Guide



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P/N: 155100-8622



WARNING

For the system to operate normally, please make sure JP2 of the mainboard is set as below. Refer to Fig. 3 in this manual for the location JP2.



If JP2 is shorted to 2-3, no CMOS data can be retained.

CAUTION

The motherboard is an electrostatic sensitive device. Don't open or handle except at a static-free workstation.

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CHAPTER 1

INTRODUCTION

Preface

The motherboard is a 4 layer, 2/3 baby AT size high performance mainboard. It is developed around the pentium microprocessor with 64 bit access to data transfer and MMX technology. It includes VIA VT82C580VPX Apollo-VPX System Chipset, Winbond W83877F Super I/O Chip.

Features

Processor

- ?? Intel Pentium/MMX, Cyrix 6x86/6x86L/6x86MX and AMD K5/K6 CPU.
- ?? The mainboard can run with following speeds:
90, 100, 120, 133, 150, 166, 200, 233, 266 and 300MHz

Chipset

- ?? VIA VT82C585VP (System Controller)
- ?? VIA VT82C586 (ISA Bus and IDE Controller)
- ?? VIA VT82C587VP (Data Buffer)
- ?? Winbond W83877F (Super I/O Controller)

Cache Size

- ?? Built in 0/256/512KB Synchronised Pipelined Burst Mode SRAM to achieve the high Pentium system performance.

Main Memory

- ?? Support Mixed Memory Technologies: Extend Data Output (EDO), Standard Page Mode (SPM), Fast Page Mode (FPM) and Synchronous DRAM (SDRAM) can work together.
- ?? Memory configurations from 4MB to 256MB are possible using combination of 512K*32 to 8M*32 SIMM module (32 bit no-parity 72-pin SIMM module) and 2M*32 to 8M*32 SDRAM DIMM module.
- ?? DIMM socket for SDRAM (3.3V unbuffered).

Multi I/O

- ?? On board Multi-I/O supports two serial, one parallel ports and floppy drive controller.
- ?? Serial ports are 16550 Fast UART compatible.
- ?? Parallel port has EPP and ECP capabilities.
- ?? PS/2 keyboard and PS/2 mouse connector is provided.
- ?? IrDA and optional Fast IR is provided.
- ?? Two standard USB connectors are provided.

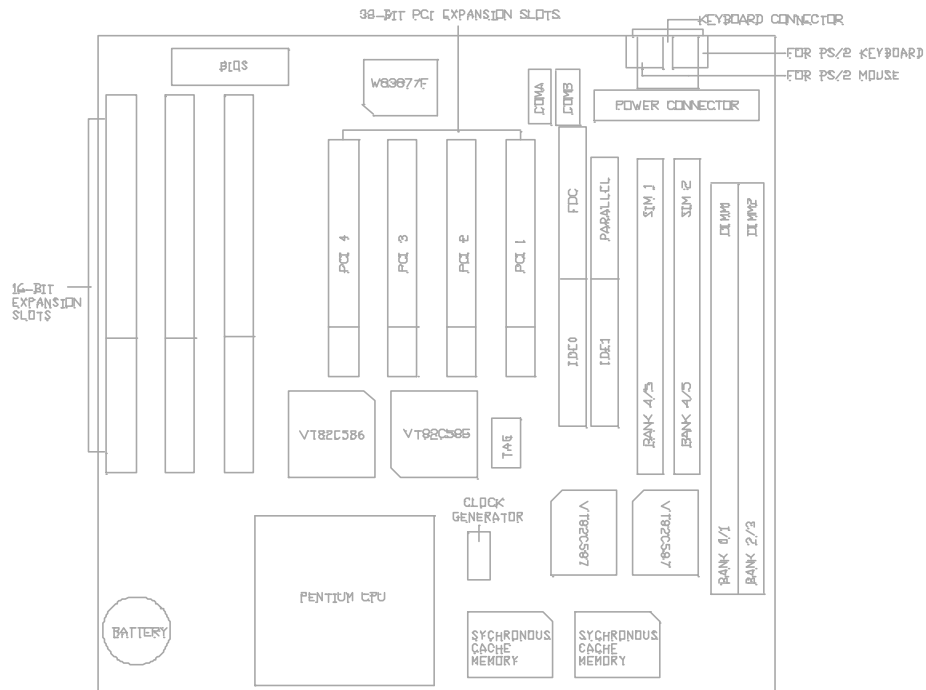


Fig. 1 Key Components of the Mainboard

PCI IDE

- ?? On board supports PCI Master IDE Controller, two connectors support up to four IDE devices such as HDD, CD ROM drive and Tape Back-up drives LS-120, etc.
- ?? PCI Master IDE controller supports PIO Mode 3 and 4 devices, I/O data transfer rate can be up to 17Mb/s.
- ?? Ultra DMA Mode supported. Transfer rate can be up to 33MB/s.

System BIOS

- ?? Award BIOS (128KB Flash EPROM).

Slots

- ?? Four PCI slots
- ?? Three ISA slots

Form Factor

- ?? 220mm (W) x 230mm (L) 4 Layer

Environment

Working Specifications

Actual Field MTBF (hours)	104,515 hours
Preventive Maintenance	Not Required

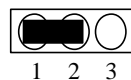
Environmental Limits

	Operating	Non-operating
Temperature	0 to 50 degree Celsius	-10 to 65 Degree Celsius
Relative Humidity		
(without condensation)	8 to 85%	5 to 95%
Altitude	10,000ft	40,000ft
Vibration	1,000Hz	
Electricity	4.75 ? 5.25V	

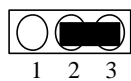
CHAPTER 2

JUMPER SETTINGS

2.1 JUMPERS PRESENTATION



Pins 1 and 2 are shorted with a jumper cap.



Pins 2 and 3 are shorted with a jumper cap.



The jumper is shorted when the jumper cap is placed over the two pins of the jumper.



The jumper is open when the jumper cap is removed from jumper.

2.2 CPU TYPE

2.2.1 INTEL PENTIUM CPU

The pentium processors have different operation voltage. In order to using the CPU Voltage correctly, the following is the marking for identify the CPU type.



**Fig. 2a CPU Description
(Bottom Side)**

Description :

X = Voltage Specification (S or V)

S = Standard Voltage (3.4V)

V = VRE 3.4 - 3.6V (3.5V)

Z = Dual Processing Support (S or U)

S = Support DP/MP/UP

U = Not tested to support DP

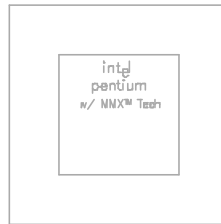
Y = Timing Specification (S or M)

S = Standard EDS timings

M = Min Valid Delay Spec.

2.2.2 INTEL PENTIUM w/ MMX? TECH (P55C) CPU

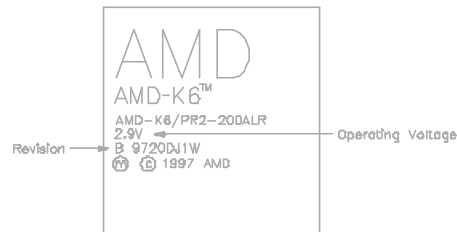
The Intel Pentium w/ MMX? Tech (P55C) CPU is offered with dual voltage supply - 2.8V for core and 3.3V (I/O) interface. The following is the marking for identify the CPU type. (The following diagram is provided as an example only. It does not necessarily indicate a valid product marking.)



**Fig. 2b CPU Description
(Top Side)**

2.2.3 AMD-K6 CPU

The AMD-K6 CPU family require dual voltage power for operation. The AMD-K6/166, 200 require a voltage of 2.9V core and 3.3V I/O. The AMD-K6/233 require a voltage of 3.2V core and 3.3V I/O. (The following diagram is provided as an example only. It does not necessarily indicate a valid product marking.)

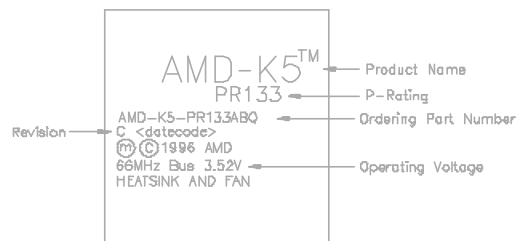


**Fig. 2c CPU Description
(Top Side)**

Operating Voltage	I/O Voltage	Core Voltage
2.2V	3.3V	2.2V
2.9V	3.3V	2.9V
3.2V	3.3V	3.2V

2.2.4 AMD-K5 CPU

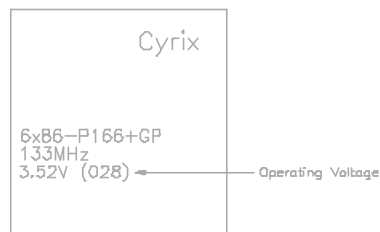
The AMD-K5 family CPU operates on different operation voltage depending on the CPU type. The operating voltage can be known through the marking on the surface of the CPU. (The following diagram is provided as an example only. It does not necessarily indicate a valid product marking.)



**Fig. 2d CPU Description
(Top Side)**

2.2.5 CYRIX 6x86 CPU

The Cyrix 6x86 has different nominal voltage depends on different lot. Please refer to the CPU marking.



**Fig. 2e CPU Description
(Top Side)**

Marketing	Recommended Nominal Voltage
3.3V or 3.52V	3.52V
028	3.52V
016	3.3V
Blank	3.52V

2.2.6 CYRIX 6x86L CPU

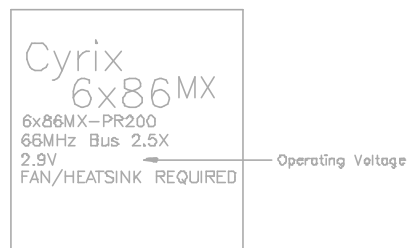
The Cyrix 6x86L has different I/O and core voltage. Please refer to the CPU marking.



**Fig. 2f CPU Description
(Top Side)**

2.2.7 CYRIX 6x86MX CPU

The Cyrix 6x86MX has different I/O and Core Voltage. Please refer to the CPU marking.



**Fig. 2g CPU Description
(Top Side)**

	I/O Voltage	Core Voltage
Cyrix 6x86MX	3.3V	2.9V
Cyrix 6x86L	3.3V	2.8V

2.2.8 IDT WinCHIP C6 CPU

The IDE WinChip C6 CPU has different operation voltage. Please refer to the CPU marking to identify the operating voltage.



Fig. 2h CPU Description

2.3 GRAPHICAL DESCRIPTION OF JUMPER SETTINGS

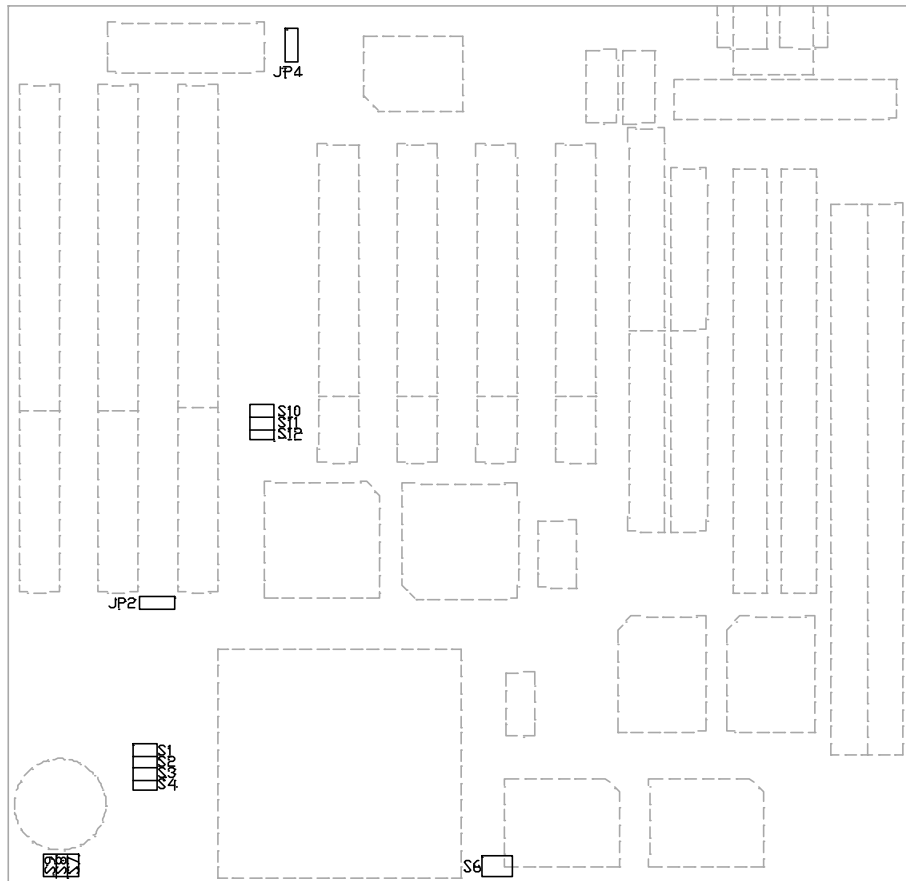


Fig. 3 Jumper Location of the mainboard

2.4 CPU VOLTAGE

1. 3.3V Single Voltage CPU: P54C, P54CT, 3.3V IDT WinChip C6

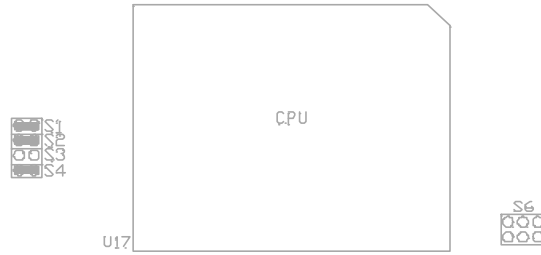


Fig. 4a CPU Type - 3.3V

2. 3.5V Single Voltage CPU: P54C-VRE, AMD-K5, Cyrix 6x86, 3.5V IDT WinChip C6

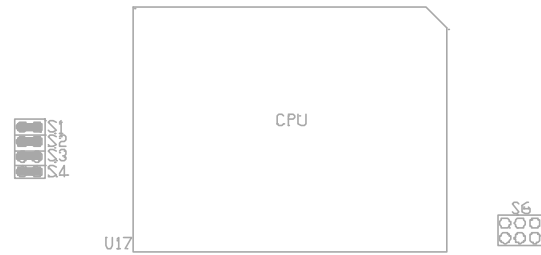


Fig. 4b CPU Type - 3.5V

3. 3.3V (I/O)/2.8V (core) Dual Voltage CPU: P55C, Cyrix 6x86L

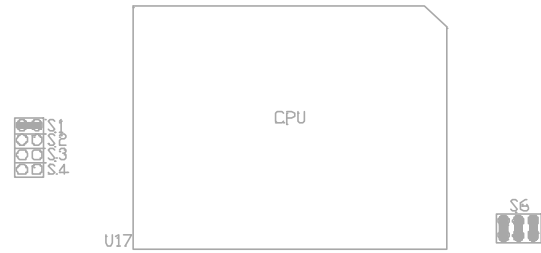


Fig. 4c CPU Type - 3.3V/2.8V

Chapter 2

4. 3.3V (I/O)/2.9V (core) Dual Voltage CPU: AMD-K6/166 and 200, Cyrix 6x86MX, Cyrix MII

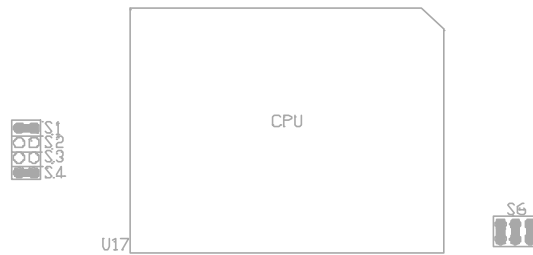


Fig. 4d CPU Type - 3.3V/2.9V

5. 3.3V (I/O)/3.2V (core) Dual Voltage CPU: AMD-K6/233

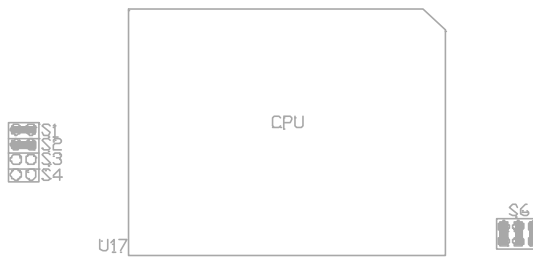


Fig. 4e CPU Type - 3.3V/3.2V

6. 3.3V (I/O)/2.2V (core) Dual Voltage CPU: AMD-K6 (2.2V) and K6-2

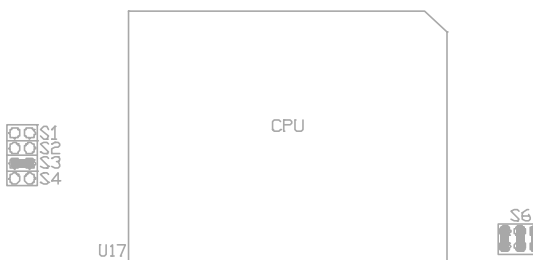


Fig. 4f CPU Type - 3.3V/2.2V

2.5 CPU TO BUS FREQUENCY RATIO (S7,S8,S9)

These jumpers set the frequency ratio between the Internal frequency of the CPU and the External frequency (called the Bus clock) within the CPU. These must be set together with the below jumpers CPU External (Bus) Frequency Selection.

2.6 CPU EXTERNAL (BUS) FREQUENCY SELECTION (S10,S11,S12)

These switches tell the clock generator what frequency to send to the CPU. The Bus clock times the Bus Ratio equals the CPU's Internal frequency.

2.7 CPU SPEED (S7 - S12)


CPU Type	Freq.	Ratio	Bus Freq.	Ratio Setting			Bus Freq. Setting		
				S7	S8	S9	S10	S11	S12
Pentium	90MHz	1.5x	60MHz	open	open	open	close	open	open
Pentium	100MHz	1.5x	66MHz	open	open	open	open	open	open
Pentium	120MHz	2.0x	60MHz	close	open	open	close	open	open
Pentium	133MHz	2.0x	66MHz	close	open	open	open	open	open
Pentium	150MHz	2.5x	60MHz	close	close	open	close	open	open
Pentium	166MHz	2.5x	66MHz	close	close	open	open	open	open
Pentium	200MHz	3.0x	66MHz	open	close	open	open	open	open
Pentium w/MMX	166MHz	2.5x	66MHz	close	close	open	open	open	open
Pentium w/MMX	200MHz	3.0x	66MHz	open	close	open	open	open	open
Pentium w/MMX	233MHz	3.5x	66MHz	open	open	open	open	open	open
AMD-K5-PR166	166MHz	2.5x	66MHz	close	close	open	open	open	open
AMD-K5-PR133	133MHz	2.0x	66MHz	close	open	open	open	open	open
AMD-K5-PR120	120MHz	2.0x	60MHz	close	open	open	close	open	open
AMD-K6/300	300MHz	4.5x	66MHz	close	close	close	open	open	open
AMD-K6/266	266MHz	4.0x	66MHz	close	open	close	open	open	open
AMD-K6-2/266	266MHz	4.0x	66MHz	close	open	close	open	open	open
AMD-K6/233	233MHz	3.5x	66MHz	open	open	open	open	open	open
AMD-K6/200	200MHz	3.0x	66MHz	open	close	open	open	open	open
To be continued.....									

Table 1a

Chapter 2

CPU Type	Freq.	Ratio	Bus Freq.	Ratio Setting			Bus Freq. Setting		
				S7	S8	S9	S10	S11	S12
AMD-K6/166	166MHz	2.5x	66MHz	close	close	open	open	open	open
Cyrix MII-300	233MHz	3.5x	66MHz	open	open	open	open	open	open
Cyrix MII-300	225MHz	3.0x	75MHz	open	close	open	open	close	open
Cyrix 6x86MX-PR233	200MHz	3.0x	66MHz	open	close	open	open	open	open
Cyrix 6x86MX-PR233	188MHz	2.5x	75MHz	close	close	open	open	close	open
Cyrix 6x86MX-PR200	166MHz	2.5x	66MHz	close	close	open	open	open	open
Cyrix 6x86MX-PR200	150MHz	2.0x	75MHz	close	open	open	open	close	open
Cyrix 6x86MX-PR166	150MHz	2.5x	60MHz	close	close	open	close	open	open
Cyrix 6x86L-PR200	150MHz	2.0x	75MHz	close	open	open	open	close	open
Cyrix 6x86L-PR166	133MHz	2.0x	66MHz	close	open	open	open	open	open
Cyrix 6x86L-PR150	120MHz	2.0x	60MHz	close	open	open	close	open	open
IDT WinChip C6-180	180MHz	3x	60MHz	open	close	open	close	open	open
IDT WinChip C6-200	200MHz	3x	66MHz	open	close	open	open	open	open

Table 1b

 Reserve for future support

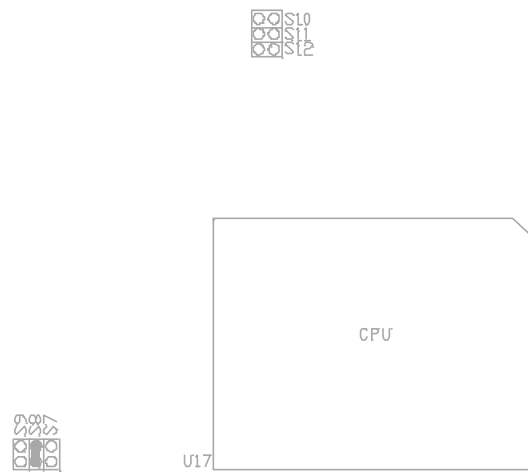


Fig. 5 Example: CPU speed jumper setting for 200MHz Intel Pentium w/ MMX

2.8 JP2 - CLEAR CMOS DATA

JP2 is used to clear the content of the CMOS Data in the RTC.

1. Normal Mode

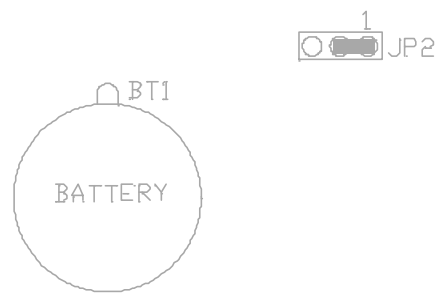


Fig. 6a

2. Reset Content of RTC

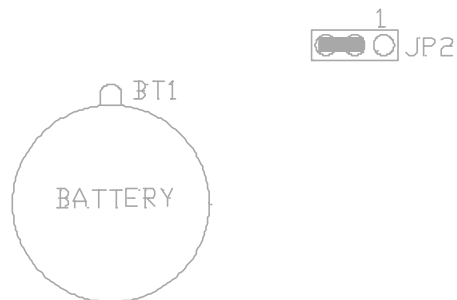


Fig. 6b

2.9 JP4 - VOLTAGE SELECTION FOR SYSTEM ROM

1. 5V Flash EPROM on System ROM

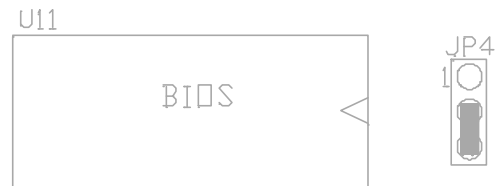


Fig. 7a

2. 12V Flash EPROM on System ROM

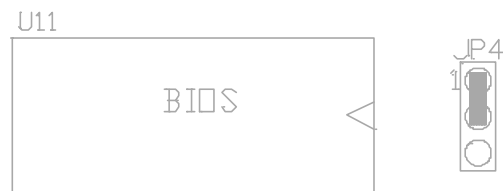


Fig. 7b

2.10 MEMORY CONFIGURATION

The mainboard lets user upgrade system memory via SIMM or DIMM sockets on the mainboard. On board memory is located in six banks: Bank 0-Bank 5. Two SIMM sockets (SIM1, SIM2) are provided for SPM, FPM and EDO RAM SIMM and two DIMM sockets (DIMM1, DIMM2) are available for the 3.3V unbuffered SDRAM and EDO DIMM.

Remarks: *The type of SIM1 and SIM2 must be same.
Only 3.3V unbuffered DIMM can be used.
Both single sided and double sided SIMM or DIMM can be supported.*

Table 6 provide the typical memory configurations supported by the mainboard.

Bank 0/1 (DIMM1)	Bank 2/3 (DIMM2)	Bank 4.5 (SIM1/2)
Installed	None	None
None	Installed	None
Installed	Installed	None
None	None	Installed
Installed	None	Installed
None	Installed	Installed
Installed	Installed	Installed

Table 2

The memory size of SIMM can be 8MB, 16MB, 32MB or 64MB. The memory of DIMM can be 8MB, 16MB, 32MB, 64MB or 128MB.

Note: *Please notice that only 16M bit SDRAM type DIMM is allowed to work with SIMM.*

CHAPTER 3

CONNECTOR CONFIGURATION

Once the mainboard has been fastened into system case, the next step is to connect the internal cables and external cables. The mainboard connectors have varying numbers of pins and are the points of contact between the mainboard and other parts of the computer.

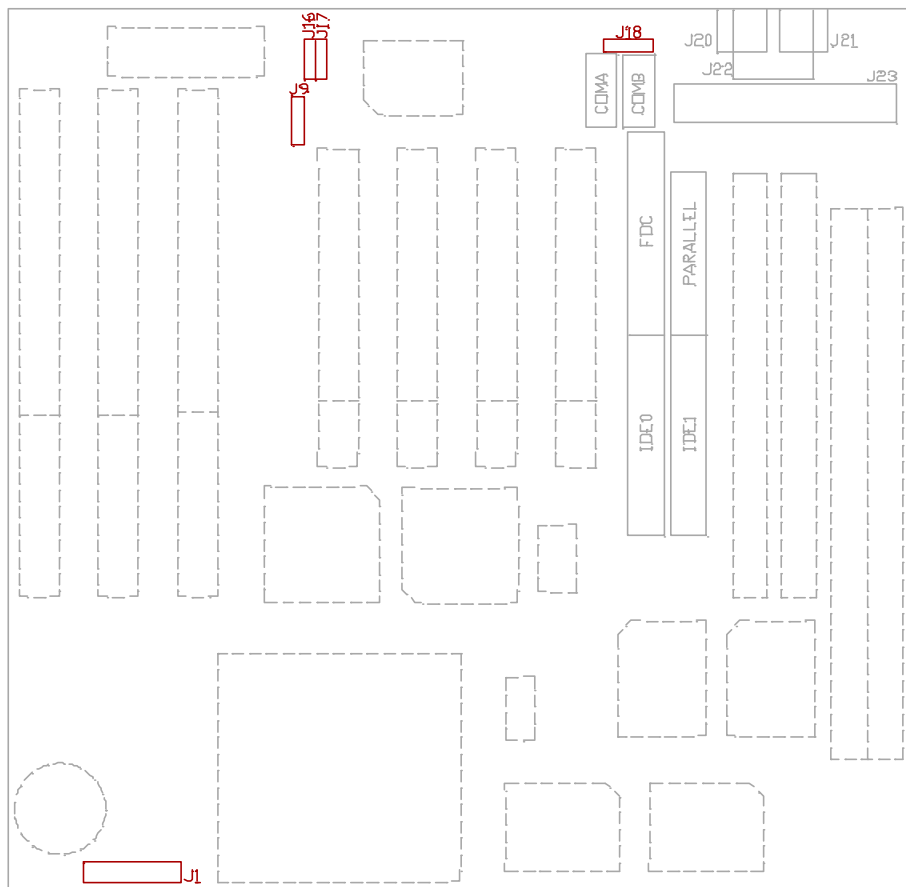


Fig 8 Connector Location

3.1 J1 - RESET SWITCH, SMI SWITCH, SPEAKER, TURBO LED, KEYLOCK AND HDD LED CONNECTOR

J1 is a 2x10 pin header for Hard Disk LED, Keyboard Lock, Turbo LED, Suspense Switch, Reset Switch and Speaker Connector.

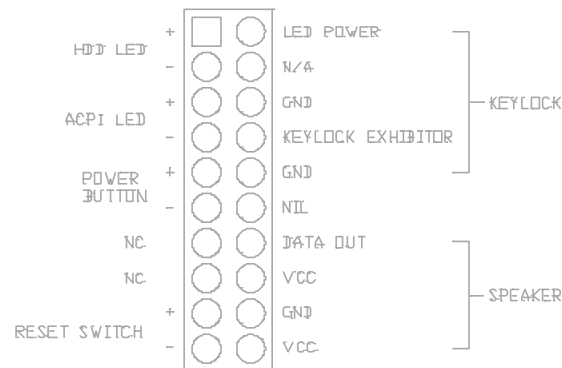


Fig. 9

3.2 J9 - IrDA AND FAST IR CONNECTOR

If the "UART2 Mode" in the BIOS Integrated Peripheral Setup Menu is selected as HPSIR or ASKIR, the J9 will be used as the interface for the IrDA.



Fig. 10 IrDA and Fast IR Connector

3.3 J10, J11 - PRIMARY/SECONDARY IDE CONNECTORS

J10 is the Primary IDE connector, and J11 is the Secondary IDE connector. These connectors support the provided IDE hard disk ribbon cable. After connecting the single end to the board, connect the two plugs on the other end to the IDE device, such as hard disk.

3.4 J12 - FLOPPY DRIVE CONTROLLER

This connector supports the floppy drive ribbon cable. After connecting the single end to the board, connect the two plugs on the other end to the floppy drive.

3.5 J13 - PARALLEL PORT CONNECTOR

This connector supports for the printer port ribbon cable. After connecting the single end to the board, connect the external parallel interface device to the D-Type 25-pin female connector on the other side.

3.6 J14, J15 - SERIAL PORT 1 AND 2

J14 is the UART1 interface for COM1 and J15 is the UART2 interface for COM2. These connectors support the provided serial port ribbon cable for connecting the external serial devices.

3.7 J16, J17 - UNIVERSAL SERIAL BUS PORTS 0 & 1

J16 is defined as USB0 and J17 is defined as USB1. These connectors support the optional USB cable for connecting the external USB device.

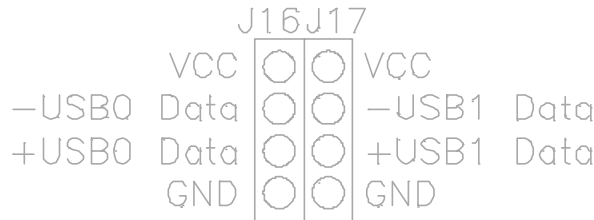


Fig. 11 USB0 & 1 Connector

3.8 J18 - EXTENSION PS/2 MOUSE CONNECTOR

J18 is a five-pin connector with polarity key located on the top of J14 (COM1 connector). It is connected with the PS/2 mouse connector cable to extend the PS/2 mouse connector to the rear of the system case.

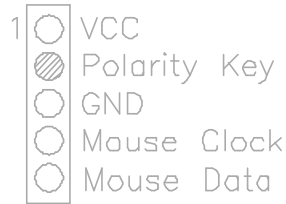


Fig. 12 Extension PS/2 mouse connector

3.9 J23 POWER SUPPLY CONNECTOR

The power supply connector has two six-pin male connectors. Plug the dual connectors from the power directly onto the board connector.

Pin	Description	Pin	Description
1	Power Good (Orange)	7	Ground (Black)
2	+5 VDC (Red)	8	Ground (Black)
3	+12 VDC (Yellow)	9	-5 VDC (White)
4	-12 VDC (Blue)	10	+5 VDC (Red)
5	Ground (Black)	11	+5 VDC (Red)
6	Ground (Black)	12	+5 VDC (Red)

Table 3: J23 - Power Supply Connector

CHAPTER 4

AWARD BIOS SETUP GUIDE

This following manual is specially provided for the BIOS supported system. After the configuration of the mainboard, and have assembled the components, user can turn on the completed system. At this point, run the software setup to ensure that the system information is correct.

The software setup of the system board is achieved through Basic Input-Output System (BIOS) programming. Use the BIOS setup program to tell the operating system what type of devices (such as disk drives) are connected to the system board.

The system setup is also called CMOS setup. Normally, users need to run system setup if either the hardware configuration is not identical with information contained in the CMOS RAM, or the CMOS RAM has lost power.

4.1 AWARD BIOS SETUP

The setup program provided with the mainboard is the Award BIOS from Award Software, Inc. Enter the AWARD Setup program's Main Menu as follows:

1. Turn on or reboot the system. After a series of diagnostic check, the following message appear:

“Press DEL to enter SETUP”

Chapter 4

2. Press the key to enter the AWARD BIOS setup program and the following screen appears:

ROM PCI/ISA BIOS (2A5LDG39)
CMOS SETUP UTILITY
AWARD SOFTWARE, INC.

STANDARD CMOS SETUP	INTEGRATED PERIPHERALS
BIOS FEATURES SETUP	SUPERVISOR PASSWORD
CHIPSET FEATURES SETUP	USER PASSWORD
POWER MANAGEMENT SETUP	IDE HDD AUTO DETECTION
PNP/PCI CONFIGURATION	HDD LOW LEVEL FORMAT
LOAD SETUP DEFAULTS	SAVE & EXIT SETUP
	EXIT WITHOUT SAVING
Esc : Quit	? ? ? ? : Select Item
F10 : Save & Exit Setup	(Shift)F2 : Change Color
Time, Date, Hard Disk Type...	

Fig. 13

3. Choose an option and press <Enter>. Modify the system parameters to reflect the options installed in the system. (see the following sections for more information).
4. Press <ESC> at anytime to return to the Main Menu.
5. In the Main Menu, choose “SAVE AND EXIT SETUP” to save change and reboot the system. Choosing “EXIT WITHOUT SAVING” to ignore all changes and exists the program.

4.2 STANDARD CMOS SETUP

ROM PCI/ISA BIOS (2A5LDG39)
STANDARD CMOS SETUP
AWARD SOFTWARE, INC.

Date (mm:dd:yy) : Mon, Sep 8 1997																		
Time (hh:mm:ss) : 19 : 1 : 14																		
HARD DISKS	TYPE	SIZE	CYLS	HEAD	PRECOMP	LANDZ	SECTOR	MODE										
Primary Master :	Auto	0	0	0	0	0	0	AUTO										
Primary Slave :	None	0	0	0	0	0	0	-----										
Secondary Master :	None	0	0	0	0	0	0	-----										
Secondary Slave :	None	0	0	0	0	0	0	-----										
Drive A : 1.44M , 3.5in.					<table border="1"> <tr> <td>Base Memory:</td> <td>0K</td> </tr> <tr> <td>Extended Memory:</td> <td>0K</td> </tr> <tr> <td>Other Memory:</td> <td>512K</td> </tr> <tr> <td colspan="2"><hr/></td> </tr> <tr> <td>Total Memory:</td> <td>512K</td> </tr> </table>				Base Memory:	0K	Extended Memory:	0K	Other Memory:	512K	<hr/>		Total Memory:	512K
Base Memory:	0K																	
Extended Memory:	0K																	
Other Memory:	512K																	
<hr/>																		
Total Memory:	512K																	
Drive B : None																		
Floppy 3 Mode Support : Disabled																		
Video : EGA/VGA																		
Halt On : All Errors																		
Esc : Quit		? ? ? ? : Select Item			PU/PD/+/- : Modify													
F1 : Help		(Shift)F2 : Change Color																

Fig. 14

Date(mm/dd/yy)	Type the current date.
Time(hh:mm:ss)	Type the current time.
Hard Disks	Choose from the standard hare disk types 1 to 45. Type 47 is user definable. Type Auto is for auto detect the hard disk type.
Drive A&B	Choose 360K, 5.25in.; 1.2M, 5.25in.; 720K, 3.5in.; 1.44M, 3.5in.; 2.88MB 3.5in. or None
Video	Choose EGA/VGA, CGA 40, CGA 80, or MONO,
Halt On	Choose All Errors; No Errors; All, But Keyboard; All, But Diskette or All, But Disk/Key
Floppy 3 Mode Support	Choose Enable to allow floppy drive support 3 mode

4.3 BIOS FEATURES SETUP

ROM PCI/ISA BIOS (2A5LDG39)
BIOS FEATURES SETUP
AWARD SOFTWARE, INC.

Virus Warning	: Disabled	Video BIOS Shadow	: Enabled
CPU Internal Cache	: Enabled	C8000-CBFFF Shadow	: Disabled
External Cache	: Enabled	CC000-CFFFF Shadow	: Disabled
Quick Power On Self Test	: Disabled	D0000-D3FFF Shadow	: Disabled
Boot Sequence	: A,C, SCSI	D4000-D7FFF Shadow	: Disabled
Swap Floppy Drive	: Disabled	D8000-DBFFF Shadow	: Disabled
Boot Up Floppy Seek	: Enabled	DC000-DFFFF Shadow	: Disabled
Boot Up Numlock Status	: On		
Boot Up System Speed	: High		
Gate A20 Option	: Fast		
Typematic Rate Setting	: Disabled		
Typematic Rate (Chars/Sec)	: 6		
Typematic Delay (Msec)	: 250		
Security Option	: Setup		
Assign IRQ for VGA	: Enabled		
PCI/VGA Palette Snoop	: Disabled		
OS Select For DRAM > 64MB	: Non-OS2		
		ESC: Quit	? ? ? ? : Select Item
		F1: Help	PU/PD/+/-: Modify
		F5: Old Values	(Shift)F2: Color
		F7: Load Setup Defaults	

Fig. 15 BIOS Setup Defaults

A short description of the screen items follows:

Virus Warning: When enabled, you receive a warning message if a program (specifically, a virus) attempts to write to the boot sector or the partition table of the hard disk drive. You should then run an anti-virus program.

CPU Internal Cache: Choose Enabled or Disabled. This option lets user choose whether to use CPU internal cache memory. The default is Enabled.

External Cache: Choose Enabled or Disabled. This option lets user choose whether to use secondary cache memory. The default is Enabled.

Quick Power On Self Test: Choose Enabled or Disabled. This option let the POST sequence runs longer for through tests.

Chapter 4

Boot Sequence: With the default setting the BIOS first attempts to boot from drive A: and then, if unsuccessful, from hard disk C: and SCSI. User can select other boot up sequence. Available sequences are “C,A,SCSI”, “C,CDROM,A”, “CDROM,C,A”, “D,A,SCSI”, “E,A,SCSI”, “F,A,SCSI”, “SCSI,A,C”, “SCSI,C,A”, “C only”, “LS120,C”.

Swap Floppy Drive: Choose Enabled or Disabled. This option lets end users to change the Drive A: or B: to others.

Boot Up Floppy Seek: Choose Enabled or Disabled. “Disabled” provides a fast boot and reduces the possibility of damage to the heads.

Boot Up NumLock Status: Choose On or Off. On puts numeric keypad in Num Lock mode at boot-up. Off puts numeric keypad in arrow key mode at boot-up.

Boot Up System Speed: Choose High or Low. Set the CPU timing at Boot Up, the default is high.

Typematic Rate Setting: Choose Enabled or Disabled. Enabled will determines the typematic rate defined by following two options.

Typematic Rate: The number selected 6,8,10... indicates how fast the number of characters can response in one second.

Typematic Delay (Msec): The number selected indicates the time period between two identical keys appear.

Security Option: Choose Setup or System. If system is selected, the password should be set.

PCI/VGA Palette Snoop: Select Disabled or Enabled. If Enabled the MPEG Card can synchronised with PCI/VGA.

OS Select For DRAM > 64MB: Select Disabled or Enabled. If the system memory is larger than 64MB and running OS/2, please enable this item. However, if it use other operating system, please disable this feature. Furthermore, if the system memory is less than 64MB, the BIOS will ignore this function.

Video BIOS Shadow: ROM Shadow copies Video BIOS code from slower ROM to faster RAM. Video BIOS can then execute from RAM.

C8000-CFFFF Shadow: If enabled and BIOS is present in this segment, then the BIOS is shadowed.

D0000-DFFFF Shadow: If enabled and BIOS is present in this segment, then the BIOS is shadowed.

4.4 CHIPSET FEATURES SETUP

The Advanced Chipset Setup option is used to change the values of the chipset registers. These registers control most of the system options in the computer.

Note: Change these Settings only if user is familiar with the Chipset.

ROM PCI/ISA BIOS (2A5LDG39)
CHIPSET FEATURES SETUP
AWARD SOFTWARE, INC.

DRAM Auto Configuration	: 60ns	OnChip USB	: Enabled
DRAM Timing Control	: Fast	USB Keyboard Support	: Disabled
SDRAM Cycle Length	: 3		
SDRAM Bank Interleave	: Disabled		
Sustained 3T Write	: Enabled		
2 Bank PBSRAM	: 3-1-1-1		
Read Pipeline	: Disabled		
Write Pipeline	: Enabled		
Cache Timing	: Fast		
Video BIOS Cacheable	: Enabled		
System BIOS Cacheable	: Enabled		
Memory Hole At 15Mb Addr.	: Disabled		
		ESC: Quit	? ? ? ? : Select Item
		F1: Help	PU/PD/+/-: Modify
		F5: Old Values	(Shift)F2: Color
		F7: Load Setup Defaults	

Fig. 16

A short description of the screen items follows:

DRAM Auto Configuration: Available options are “60ns”, “70ns” and “Disabled”, choose “60ns” or “70ns” according to the DRAM Module installed. When disabled, **DRAM Timing Control** should be set by manually.

DRAM Timing Control: When **DRAM Auto Configuration** is set as “Disabled”. The DRAM timing will be set with this item. Available options are “Normal”, “Medium”, “Fast” and “Turbo”.

SDRAM Cycle Length: This item will be shown only when SDRAM is installed. It is used to set the Read/Write cycle length for SDRAM. Available options are “3” and “2”. Default setting is “2”.

Chapter 4

SDRAM Bank Interleave: This item will be shown only when SDRAM is installed. If 2 bank of SDRAM is installed. Choose “Enabled” to get a better system performance.

Sustained 3T Write: Enable this feature will make sustained 3 cycle write access for PBSRAM to increase the performance.

2 Bank PBSRAM: Choose the Burst Read/Write timing for the pipeline burst SRAM is “2-1-1” or “3-1-1”.

Read Pipeline/Write Pipeline: These options will be set to enable or disable the pipeline read/write mode of the L2 Cache - the pipeline burst SRAM. To increase the performance, they are set to “Enabled”.

Cache Timing: This option is used to control the cache timing. The available options are “Fast” and “Fastest”.

Video BIOS Cacheable: Choose Enabled or Disabled. “Enabled” allows system BIOS be cacheable.

System BIOS Cacheable: Choose Enabled or Disabled. “Enabled” allows system BIOS be cacheable.

Memory Hole At 15Mb Addr.: Choose Enabled or Disabled. “Enabled” allows some linear VGA Cards to run larger frame port, or it can be reserved or some operating system.

OnChip USB: Choose Enabled or Disabled. “Enabled” allows the on board Universal Serial Bus (USB) Controller to be functioned.

USB Keyboard Support: This option only shown when OnChip USB Controller is enabled. Choose Enabled or Disabled to support the USB Keyboard.

4.5 POWER MANAGEMENT SETUP MENU

The Power Management Setup option is used to change the values of the chipset registers for system power management functions.

ROM PCI/ISA BIOS (2A5LDG39)			
POWER MANAGEMENT SETUP			
AWARD SOFTWARE, INC.			
Power Management	: User Define	IRQ3 (COM2)	: Enabled
PM Control by APM	: Yes	IRQ5 (LPT 2)	: Enabled
Video Off Option	: Susp, Stby ?? Off	IRQ6 (Floppy Disk)	: Enabled
Video off Method	: V/H SYNC+Blank	IRQ7 (LPT 1)	: Enabled
		IRQ8 (RTC Alarm)	: Disabled
		IRQ9 (IRQ2 Redir)	: Enabled
		IRQ10 (Reserved)	: Enabled
		IRQ11 (Reserved)	: Enabled
		IRQ12 (PS/2 Mouse)	: Enabled
		IRQ13 (Coprocessor)	: Enabled
		IRQ14 (Hard Disk)	: Enabled
		IRQ15 (Reserved)	: Enabled
PM Timers			
HDD Power Down	: Disabled		
Suspend Mode	: 1 Min		
PM Events			
VGA	: OFF		
LPT & COM	: LPT/COM		
HDD & FDD	: ON		
DMA/Master	: OFF		
		ESC: Quit ? ? ? ? : Select Item	
		F1: Help PU/PD/+/-: Modify	
		F5: Old Values (Shift)F2: Color	
		F7: Load Setup Defaults	

Fig. 17

A short description of the screen items follows:

Power Management: Available selection are “Disabled”, “User Define”, “Max Saving” and “Min Saving”:

“Disabled” will disable all the power saving functions.

“User Define” makes the time period waiting for Suspend Mode to be programmed.

“Max Saving” will set the time period waiting for Suspend Mode to be 10 seconds.

“Min Saving” will set the time period waiting for Suspend Mode to be 1 hour.

PM Control by APM: Available options are “Yes” and “No”. To choose “Yes” to let the Power Management Function to be control by the MS APM software.

Chapter 4

Video Off Option: Select the mode in which you want the monitor to blank. The options are “Always On”, “Suspend ?? Off”, “Susp. Stby ?? Off” and “All mode ?? Off”.

Video Off Method: Choose V/H SYNC+Blank, DPMS or Blank Screen. This is monitor Power Saving Method. V/H SYNC+Blank means turn off Vertical, Horizontal scanning and blank the screen. Blank Screen will blank the display screen. DPMS (Display Power Management System) can allow the System BIOS control the Display Card to turn off the Display.

HDD Power Down: To select the time period will turn the HDD off. Accessing the HDD again will take a few seconds for HDD to spin up for operation.

Suspend Mode: To set the time period waiting for Suspend Mode when the Power Management function is set to “User Define”.

VGA/LPT&COM/HDD&FDD/DMA/Master: All of these functions are used to control the wake up event from the Suspend Mode. Once the function is enabled, the corresponded activity will trigger the system back to the Normal Mode from the Suspend Mode.

IRQ 3 - IRQ15: When it is enabled, the system will monitor the activity of the corresponded system IRQ to turn on or off the power management functions.

4.6 PCI CONFIGURATION

The PCI Configuration Setup option is used to configure the PCI add-on Cards on PCI Slots. Without proper setup the PCI Add-on Cards might not function properly.

ROM PCI/ISA BIOS (2A5LDG39)
PNP/PCI CONFIGURATION
AWARD SOFTWARE, INC.

PNP OS Installed	: Yes	CPU to PCI Write Buffer	: Enabled
Resources Controlled By	: Manual	PCI Dynamic Bursting	: Enabled
Reset Configuration Data	: Disabled	PCI Master 0 WS Write	: Enabled
		PCI Peer Concurrency	: Enabled
		PCI Delay Transaction	: Enabled
IRQ-3 assigned to	: Legacy ISA		
IRQ-4 assigned to	: Legacy ISA	PCI IRQ Activated By	: Level
IRQ-5 assigned to	: PCI/ISA PnP	PCI IDE IRQ Map To	: PCI-AUTO
IRQ-7 assigned to	: Legacy ISA	Primary IDE INT#	: A
IRQ-9 assigned to	: PCI/ISA PnP	Secondary IDE INT#	: B
IRQ-10 assigned to	: PCI/ISA PnP		
IRQ-11 assigned to	: PCI/ISA PnP		
IRQ-12 assigned to	: PCI/ISA PnP		
IRQ-14 assigned to	: Legacy ISA		
IRQ-15 assigned to	: Legacy ISA		
DMA-0 assigned to	: PCI/ISA PnP	ESC: Quit	? ? ? ? : Select Item
DMA-1 assigned to	: PCI/ISA PnP	F1: Help	PU/PD/+/-: Modify
DMA-3 assigned to	: PCI/ISA PnP	F5: Old Values	(Shift)F2: Color
DMA-5 assigned to	: PCI/ISA PnP	F6: Load BIOS Defaults	
DMA-6 assigned to	: PCI/ISA PnP	F7: Load Setup Defaults	
DMA-7 assigned to	: PCI/ISA PnP		

Fig. 18

Note: Change these Settings only if user is familiar with the Chipset and all the PCI Add-on Cards functions.

A short description of the screen items follows:

Resources Controlled By: The Award Plug and Play BIOS can automatically configure all the boot and Plug and Play compatible device. If you select Auto, all the interrupt (IRQ) and DMA assignment fields disappear, as the BIOS automatically assigns them.

Reset Configuration Data: If enable this option, the BIOS will clear and reset the ESCD after hardware reset.

IRQ#/DMA# assigned to: These items will be shown only when “Resources Controlled By” option is set the “Manual”. The available options are “Legacy ISA” and “PCI/ISA PnP”. If the option is set to “Legacy ISA”, the BIOS will never assign the specified IRQ/DMA resource to PCI or ISA PnP Devices. If “PCI/ISA PnP” is chosen, the BIOS will make the specified IRQ/DMA have a chance to be assigned to the PCI or ISA PnP devices.

CPU to PCI Write Buffer: It is used to enable or disable the CPU to PCI Write Buffer.

PCI Dynamic Bursting: It is used to enable or disable the PCI dynamic bursting cycles.

PCI Master 0 WS Write: Choose enable to let the PCI Master using 0 wait state in write cycle.

PCI Peer Concurrency: Choose Enabled or Disabled. To enable this option will let the system active more than one PCI device at a time.

PCI Delay Transaction: Select “Enabled” to use the write buffer for the delay transaction cycles. It is selected to support the compliance of PCI Specification Version 2.1.

PCI IRQ Active By: Choose Level or Edge. The default settings is Level.

PCI IDE IRQ Map To: Choose PCI-AUTO, PCI-SLOT1, PCI-SLOT2, PCI-SLOT3, ISA. The default setting is PCI-AUTO.

4.7 INTEGRATED PERIPHERALS SETUP MENU

The Integrated Peripherals setup option is need to change the values of the I/O chipset registers for I/O functions.

ROM PCI/ISA BIOS (2A5LDG39)
INTEGRATED PERIPHERALS
AWARD SOFTWARE, INC.

OnChip IDE First Channel	: Enabled	Onboard Parallel Mode	: SPP
OnChip IDE Second Channel	: Enabled		
IDE Prefetch Mode	: Enabled		
IDE HDD Block Mode	: Enabled		
IDE Primary Master PIO	: Auto		
IDE Primary Slave PIO	: Auto		
IDE Secondary Master PIO	: Auto		
IDE Secondary Slave PIO	: Auto		
Primary Master UDMA	: Auto		
Primary Slave UDMA	: Auto		
Secondary Master UDMA	: Auto		
Secondary Slave UDMA	: Auto		
Onboard FDD Controller	: Enabled		
Onboard Serial Port 1	: 3F8/IRQ4		
Onboard Serial Port 2	: 2F8/IRQ3		
UART 2 Mode	: HPSIR		
IR Function Duplex	: Half	ESC: Quit	? ?? ? : Select Item
RxD, TxD Active	: Hi, Hi	F1: Help	PU/PD/+/-: Modify
Onboard Parallel Port	: 378/IRQ7	F5: Old Values	(Shift)F2: Color
		F7: Load Setup Defaults	

Fig. 19

A short description of the screen items follows:

OnChip IDE First Channel/OnChip IDE Second Channel: These items are used to enable or disable the onboard IDE Channel.

IDE Prefetch Mode: Choose “Enabled” to set the on board IDE controller to access the IDE device with faster Prefetch Mode.

IDE HDD Block Mode: This allows your hard disk controller to use the fast block mode to transfer data to your hard disk drive.

Chapter 4

IDE Primary Master PIO/IDE Primary Slave PIO/IDE Secondary Master PIO/IDE Secondary Slave PIO: Available selection are “Auto”, “Mode 0”, “Mode 1”, “Mode 2”, “Mode 3” and “Mode 4”. To choose “Auto”, the system BIOS will scan the IDE device and decide which mode of the device is . Otherwise the user should key in the mode of the device to the corresponding field.

Some harddisks cannot work properly with its corresponding timing, please set a slower timing.

Primary Master Ultra DMA/Primary Slave Ultra DMA/Secondary Master Ultra DMA/Secondary Slave Ultra DMA: Available selection are “Auto” or “Disabled”. To choose “Auto”, the system BIOS will scan the IDE device and decide Ultra DMA supported or not.

Onboard FDD Controller: Choose Enabled or Disabled. “Enabled” allows onboard Floppy Drive Controller to be functioned, otherwise the users should use other sources..

Onboard Serial Port 1: Choose None, Auto or from COM1, COM3, COM4 with different I/O Address. While choosing proper I/O Address, be sure not to cause Address conflict with other I/O devices.

Onboard Serial Port 2: Choose None, Auto or from COM1, COM2, COM3, COM4 with different I/O Address. While choosing proper I/O Address, be sure not to cause Address conflict with other I/O device.

UART 2 Mode: Choose Standard, ASKIR and HPSIR for IrDA serial Interface.

IR Function Duplex: This item will be shown only when **UART 2 Mode** is selected to ASKIR or HPSIR. The available options are “Full” and “Half”. It is used to choose the IR function working in full duplex mode or half duplex mode correspondingly.

RxD, TxD Active: This item will be shown only when **UART 2 Mode** is selected to ASKIR or HPSIR. The available options are “Hi, Hi”, “Hi, Lo”, “Lo, Hi” and “Lo, Lo”. It is used to configure the logic level of Receive and Transmit signal in IrDA interface.

Onboard Parallel Port: Choose None or with four different I/O Address and corresponding IRQx. While choosing proper I/O Address, be sure not to cause Address conflict with other I/O devices.

Onboard Parallel Mode: Choose SPP, EPP/SPP, ECP, ECP/EPP Mode. Make proper selection with the attached printer port device.

ECP Mode Use DMA: Choose “1” or “3” to select the DMA channel used for the ECP device. This item is shown if the **Onboard Parallel Mode** is chosen as “ECP” or “ECP/EPP” option.

Parallel Port EPP Type: Choose “EPP1.7” or “EPP1.9”, which is used to configure the EPP using either EPP1.7 or 1.9 timing specification. This item is shown if the **Parallel Mode** is

chosen as “EPP” or “ECP/EPP” option.

4.8 LOAD SETUP DEFAULTS MENU

This Main Menu item uses the default setup values. Use this option as a diagnostic aid if the system behaves erratically. Choose this item and the following message appears:

“Load SETUP Defaults (Y/N)? N”

To use the Power-On defaults, change the prompt to “Y” and press <Enter>.

4.9 SUPERVISOR PASSWORD

Two level of password is supported. Depending on the setting of the “Security Option” in the “BIOS FEATURES SETUP”, the system BIOS will ask for password every time booting up the System or entering BIOS Setup. With the supervisor password, both the system booting and BIOS setup changing is allowed.

This main menu item lets the user to set up the Supervisor Password.

Change the password as follows:

1. Choose “PASSWORD SETTING” in the Main Menu and press <Enter>. The following message appears:

“ENTER PASSWORD:”

2. Enter the Password and press <Enter>. The following message appears:

"CONFIRM PASSWORD:"

Important: Keep a safe record of the new password. If forget or lose the password, the only way to access the system is to disconnect the CMOS batteries and then re-enter the password.

4.10 USER PASSWORD

With the user password, only booting up the system is accepted, but changing the BIOS setup is not allowed.

4.11 IDE HDD AUTO DETECTION

When users can not find the Hard Disk information, it is very helpful to use this option.

1. Choose this item and press <Enter>.
2. After couple seconds, the screen will appear the Hard Disk information and following message:

“SELECT PRIMARY MASTER OPTION(N=SKIP): N”

3. Enter Y or N to confirm the acceptance then enter.
4. The process will repeat for Primary Slave, Secondary Master and Secondary Slave Hard Disks.

4.12 SCSI HARD DISK INSTALLATION

In Standard CMOS Setup Utility, select hard disk type to be “Not Installed”. In Advanced CMOS Setup Utility, Disable “Adapter ROM Shadow DC00”. On the SCSI Controller card, set the jumpers which configure the SCSI card BIOS segment address located at DC00 or DE00. Format the SCSI disk by the Formatter provided in the SCSI BIOS.

4.13 SAVE & EXIT SETUP MENU

When you select this function, the following message will appear at the centre of the screen to assist you to Save data to CMOS and Exit the Setup.

Save to CMOS and Exit (Y/N)?

4.14 EXIT WITHOUT SAVING MENU

When you select this function, the following message will appear at the centre of the screen to assist you to Abandon all Data and Exit Setup.

Quit Without Saving (Y/N)?

CHAPTER 5

FLASH AND DMI UTILITY

5.1 AWARD FLASH UTILITY

This section will provides instructions to guide you through updating your old BIOS. The file name we use to program here is *test.bin*, and the file name to save old BIOS is *2A59F000.OLD*. Please note that those file names are not absolute. They are only examples to let you have a more clear understanding of the updating process.

How to Begin

1. Please type “*awdflash*” and press the **ENTER** key to begin the updating process.
2. Once you enter, you will see a main menu displaying:

FLASH MEMORY WRITER V5.XX Copyright (C) 1996, Award Software, Inc.,	
For I430HX-2A59F000 Flash Type	DATE: 06/18/96
File Name to Program:	
Error Message:	

Fig. 20

3. Type the program name “*test.bin*”, and then press the **ENTER** key.
4. At the bottom of the menu, you will be requested to answer:

“Do You Want to Save BIOS (Y/N)?”

If you do not wish to save the old BIOS:

5. Please type “N”, and then press the ENTER key.
6. Then you will be request to answer:

“Are You Sure to Program?”

7. Answer “N” if you do not want to program, and then it will exit.

To save the old BIOS:

8. Please respond “Y”, and then press the ENTER key.
9. Move the cursor to “File Name to Save:”
10. Type file name “**2A59F000.OLD**”, and then press the **ENTER**.
(Your old BIOS will be saved in the file name you create. In this case, the old BIOS is saved in the file name, 2A59F000.OLD).
11. Then you will be requested to answer:

“Are You Sure to Program (Y/N)?”

12. Type “Y” to begin programming, and press the **ENTER** key.
13. When the programming is finished, the showing message will appear:

“Programming Flash Memory - 3FF00 0K



Message: Please Power off or Reset System”

14. Once you see the showing message “**Power Off or Reset System**”, please re-start your system.
15. When you power on the computer again, you will find your old BIOS has already been successfully updated.

Warning

Please note that Award Flash Utility cannot run under EMM386 or QEMM. Thus, when executing the command “**awdflash**”, and error message will appear:

“Error Message: Fail - Due to EMM386 or QEMM!”

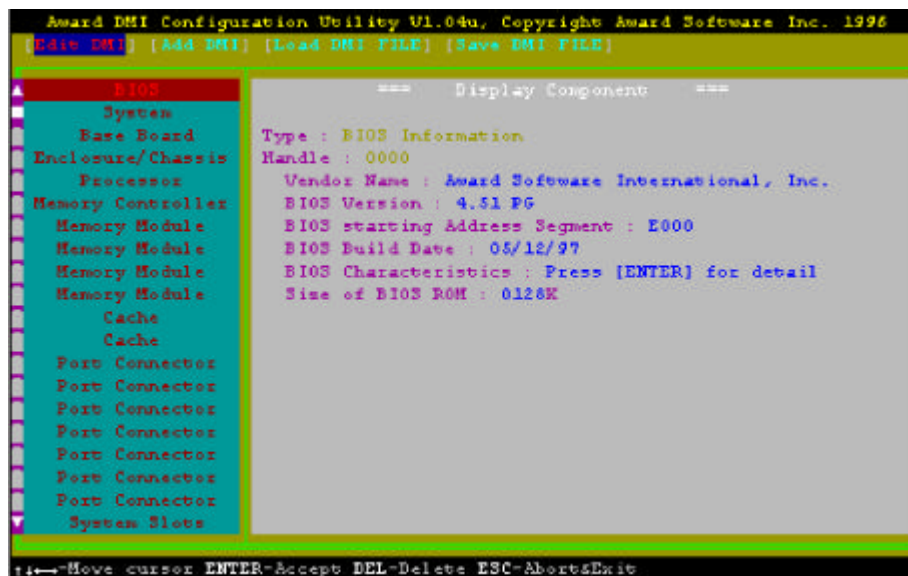
5.2 DESKTOP MANAGEMENT INTERFACE (DMI) OVERVIEW

This motherboard can support DMI within the BIOS level. DMI is able to auto-detect and record information pertinent to a computer's system such as the CPU type, CPU speed, and internal/external frequencies, and memory size. The onboard BIOS will detect as many system information as possible and store those collected information in a 4KB block in the motherboard's flash EPROM and allow the DMI to retrieve data from this database.

The DMI Configuration Utility (DMICFG.EXE) must be used in real mode in order for the program to run, the base memory must be at least 180K. Memory managers like HIMEM.SYS (required by windows) must not be installed. You can boot up from a system diskette without AUTOEXEC.BAT and CONFIG.SYS files, "REM" HIMEM.SYS in the CONFIG.SYS, or press <F5> during bootup to bypass your AUTOEXEC.BAT and CONFIG.SYS files.

Using the DMI Configuration Utility

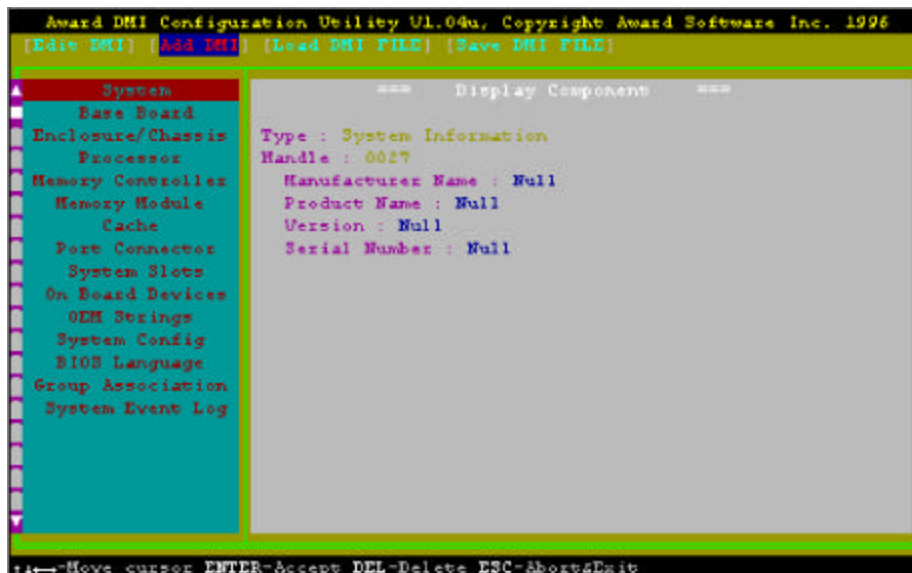
Edit DMI



Use the ? ? (left-right) cursors to move the top menu items and the ?? (up-down) cursor to move between the left hand menu items. The bottom of the screen will show the available keys for each screen. Press enter at the menu item to enter the right hand screen for editing. “Edit component” appears on top. The reversed color field is the current cursor position and the blue text are available for editing. The orange text shows auto-detected information and are not available for editing. The blue text “Press [ENTER] for detail” contains a second pop-up menu is available, use the + - (plus-minus) keys to change the settings. Enter to exit and save, ESC to exit and not save.

If the user has made changes, ESC will prompt you to answer Y or N. Enter Y to go back to the left-hand screen and save, enter N to go back to left-hand screen and not save. If editing has not been made, ESC will send you back to the left hand menu without any messages.

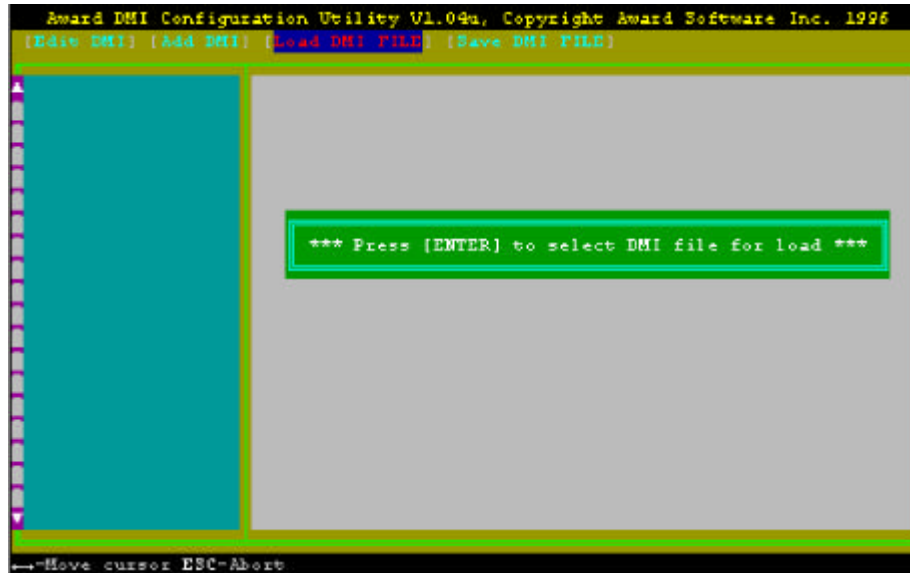
Add DMI



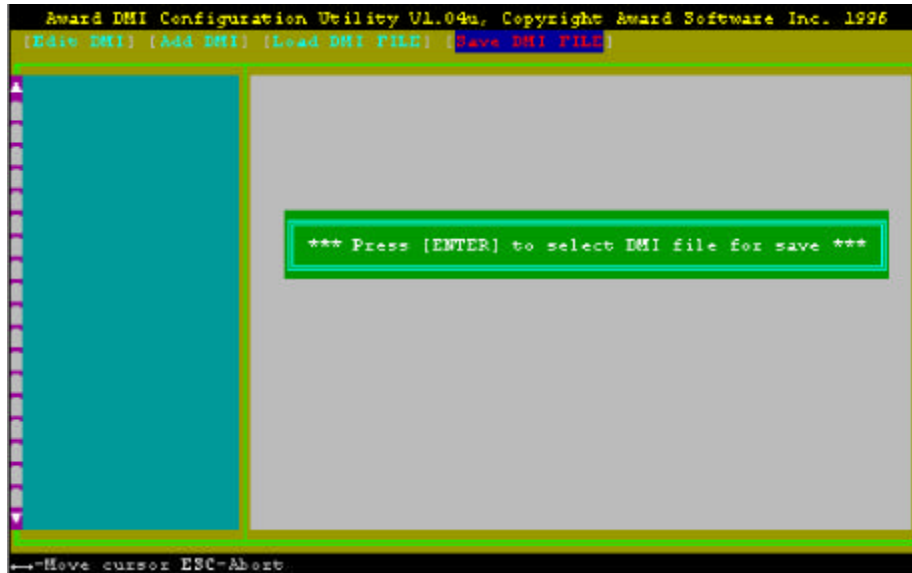
This DMI Configuration Utility also allows the system integrator or end user to add additional information into the DMI database such as serial numbers, housing configurations, and vendor information. Those information not detected by the motherboard BIOS and has to be manually entered through the DMI Configuration Utility and updated into the DMI database.

Chapter 5

Load DMI File



You can load the disk file to memory by entering a drive and path and file name here.

Save DMI File

You can save the DMI (normally only saved to flash ROM) to a file by entering the drive and path here. If you want to cancel save, you may press ESC and a message “Bad File Name” appears here to show it was not saved.

APPENDIX A

QUICK GUIDE

The table below summaries the functions and settings of each jumper of the motherboard.

Function		Jumper Settings	
CPU Voltage Selection	3.3V Single Voltage CPU For P54C, P54CT, 3.3V IDT WinChip C6	S1: close S2: close S3: open	S4: close S6: open
	3.5V Single CPU For 54C-VRE, AMD-K5, Cyrix 6x86, 3.5V IDT WinChip C6	S1: close S2: close S3: close	S4: close S6: open
	3.3V (I/O)/2.8V (core) Dual Voltage CPU For P55C, Cyrix 6x86L	S1: close S2: open S3: open	S4: open S6: close
	3.3V (I/O)/2.9V(core) Dual Voltage CPU For AMD K6/166, 200, Cyrix 6x86MX-PR166/200, Cyrix MII	S1: close S2: open S3: open	S4: close S6: close
	3.3V (I/O)/3.2V (core) Dual Voltage CPU For AMD K6/233	S1: close S2: close S3: open	S4: open S6: close
	3.3V (I/O)/2.2V (core) Dual Voltage CPU For AMD K6 (2.2V) and K6-2	S1: open S2: open S3: close	S4: open S6: close
CPU Speed Selection *Reserve* S12 open	For 90MHz Intel Pentium, AMD-K5-PR90 and AMD-K5-PR120 CPU	S7: open S8: open S9: open	S10: close S11: open
	For 100MHz and 233MHz Intel Pentium, AMD-K6/233, AMD-K5-PR100, AMD-K5-PR150 and Cyrix MII-300, using 66MHz, (for future support only) CPU	S7: open S8: open S9: open	S10: open S11: open
	For 120MHz Intel Pentium and Cyrix 6x86L-PR150 CPU	S7: close S8: open S9: open	S10: close S11: open
	For 133MHz Intel Pentium, AMD-K5-PR133 (REV C) and Cyrix 6x86L-PR166 CPU	S7: close S8: open S9: open	S10: open S11: open
	For 150MHz Intel Pentium and Cyrix 6x86MX-PR166 CPU	S7: close S8: close S9: open	S10: close S11: open
To be continued...			

Appendix A

Function		Jumper Settings	
CPU Speed Selection *Reserve* S12 open	For 150MHz Cyrix 6x86L/MX-PR200 CPU	S7: close S8: open S9: open	S10: open S11: close
	For 166MHz Intel Pentium, AMD-K6/166 and AMD-K5-PR166 CPU	S7: close S8: close S9: open	S10: open S11: open
	For 180MHz IDT WinChip C6-180 CPU	S7: open S8: close S9: open	S10: close S11: open
	For 200MHz Intel Pentium, AMD-K6/200, IDT WinChip C6-200 and Cyrix 6x86MX-PR233 (for future support only) CPU	S7: open S8: close S9: open	S10: open S11: open
	For Cyrix MII-300, using 75MHz, (for future support only) CPU	S7: open S8: close S9: open	S10: open S11: close
	For 266MHz AMD-K6/266 and AMD-K6-2/266 (for future support only) CPU	S7: close S8: open S9: close	S10: open S11: open
	For 300MHz AMD-K6/300 CPU	S7: close S8: close S9: close	S10: open S11: open
Clear RTC CMOS Data	Normal	JP2: 1-2 short	
	Clear	JP2: 2-3 short	
System ROM Selection	5V Flash EPROM	JP4: 2-3 short	
	12V Flash EPROM	JP4: 1-2 short	

Appendix A

Appendix A
