JAGUAR V
386
System Manual

The material in this manual is for information only and is subject to change without notice.

REVISION: 1.0

RADIO FREQUENCY INTERFERENCE STATEMENT

This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference with radio and television reception.

If this equipment does cause interference to radio or TV reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

* *Reorient the receiving antenna.*
* *Relocate the computer away from the receiver.*
* *Move the computer away from the receiver.*
* *Plug the power cord of computer into a different outlet so that computer and receiver are on different branch circuits.*
* *Ensure that card slot covers are in place when no card is installed.*
* *Ensure that card mounting screws, attachment connector screws, and ground wires are tightly secured.*
* *If peripherals are used with this system, it is suggested to use shielded, grounded cables, with in-line filters if necessary.*

If necessary, the user should consult the dealer service representative for additional suggestions.

The manufacturer is not responsible for any radio or TV interferences caused by unauthorized modifications to this equipment. It is the responsibility of the user to correct such interferences.

Note

1. Electronic components are sensitive to dust and dirt. Do inspect and clean the computer system regularly.

2. Turn off the power whenever you install or remove any connector, memory module and add-on card. Before turning on the power, make sure that all the connectors, memory modules and add-on cards are secured.

3. After power is on, please wait for a minute. The system BIOS are going through a self-test during this period and nothing is shown on the screen. After the self-test, the system BIOS will initialize the display adaptor and show messages.

4. The SIMM sockets are fragile device. Do not force the SIMM modules into the sockets. It may break the locking latches.

Preface

The manual provides information about the installation and maintenance of OCTEK JAGUAR V-386DX motherboard. In-depth explanations of the functions of this motherboard are provided. In the appendix, the system BIOS setup is explained.

The content in this manual is only for reference and is intended to provide basic information for the general users. There are also some technical information for hardware and software engineers.

In this manual, there are 4 chapters. Chapter 1 contains a brief introduction and specification of OCTEK JAGUAR V-386DX motherboard. In the Chapter 2, the functions of OCTEK JAGUAR V-386DX are explained. It also outlines many advanced features of the CPU and the system architecture. Chapter 3 explains the installation of coprocessor, DRAM modules and jumpers. Some technical information are provided in the Chapter 4.

System BIOS is described in the attached BIOS Manual.

Additional information are given in Appendix A and B for the maintenance purpose.

CONTENT

Chapter 1
Introduction

OCTEK JAGUAR V-386DX consists of 32-bit 80386 microprocessor, a large cache memory and highly integrated chipsets to provide high performance, reliability and compatibility. OCTEK JAGUAR V-386DX is a perfect choice for CAD/CAM workstation and file server and supports sophisticated 32-bit computing applications and multi-user operating systems.

To speed up the performance of the system, built-in 8KB cache memory to support 16MB cacheable memory. Frequently used program codes can be fetched by CPU from the high speed cache memory without wait state. Furthermore, access to the main memory is accelerated because the cache controller and the memory controller are integrated together, and operate concurrently. Thus the overhead of accessing the main memory is minimized.

Aimed at supporting advanced CAD/CAM applications, OCTEK JAGUAR V-386DX supports INTEL 80387 or compatible. The total memory on board is 32MB.

Compatibility and reliability are important issues. I/O channel is compatible to standard AT bus. Therefore any AT compatible peripherals may be used on OCTEK JAGUAR V-386DX. On board POWERGOOD generator is essential to ensure the reliability of the system and is well-designed to work with all power supplies.

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Chapter 2
General Features

SPECIFICATION

Processor :

AMD 80386DX CPU
with optional 80387DX Math Co-processor

Speed :

Turbo/normal speed
Software/hardware selectable

I/O Slot :

Compatible to standard AT bus
Two 8-bit and Four 16-bit slots
Programmable AT bus speed
Support back to back I/O recovery
option to allow slow peripheral device

Cache Memory :

Built-in 8KB Cache Memory
2-way set associative with copy back cache controller
Two block of Non-cacheable regions control

Memory :

Shadow RAM for System BIOS and Video BIOS
SIMM sockets for 256K , 1M or 4M modules
32M bytes on board
Page mode with programmable wait state for different DRAM configuration

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

Other Features :

On board POWERGOOD generation
External battery connector
Hardware turbo switch
Hardware reset switch

PROCESSOR

80386DX is a 32-bit microprocessor with 32-bit external data bus and 32-bit external address bus. Therefore it processes more data at the same time than 80286 and can access a large memory size which is necessary for 32-bit applications. To combine the wider bus structure and all the advanced functions on chip, total 275,000 transistors are integrated together.

80386DX is aimed to provide advanced facilities to sophisticated software, but still remains compatible with existing software in the market. It can operate at real mode and protected mode. In Real mode the 386DX operates as a very fast 8086, but with 32-bit extensions if desired. Real mode is required primarily to setup the processor for Protected mode operation. Protected mode provides access to the sophisticated memory management, paging and privilege capabilities of the processor. Furthermore, new mechanism allows switching between Real mode and Protected mode at high speed operation.

The Protected mode of 80386 is fully compatible with 80286. All privilege - level and I/O protection system are supported. New system control instructions, memory paging, I/O permission bit map are provided to make 80386 ideal for multi-tasking operation systems.

In addition, a virtual 8086 mode is provided. In this mode, the CPU can be considered by the programs as being divided into several 8086 CPUs and each program has their own CPU and memory space. Several programs for XT/AT as well as operating systems for 80286 and 80386DX can be executed simultaneously. Programs are isolated and protected from each other by 80386DX. Each program can be considered as running at a XT/AT.

80386DX includes many new instructions for system control, high level language support and

processor control. These instructions are used in protected mode. New operation systems and software can make use of these instructions for their advanced features, such as concurrent operation and virtual memory.

MATH COPROCESSOR

The demand for sophisticated, number-crunching scientific and business applications has rapidly increased in recent years. 80386DX 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.

80387 is upward object-code compatible from 80287 and 8087, but runs 6 to 11 times faster than 80287 used in AT. It fully implements the IEEE 754 Binary Floating-point Arithmetic standard with a high precision 80-bits internal architecture.

CACHE MEMORY

The system performance can not simply be improved by increasing the clock rate of the system. The performance depends on many factors, such as system architecture and memory configuration.

A cache memory system with low cost DRAM as main memory and high speed SRAM as cache memory becomes the only choice for high performance system in terms of price and performance. The frequently used data code instructions are kept in the high speed cache memory. Therefore, most of the memory operations are carried out in the cache memory instead of the slow speed main memory.

The cache controller of OCTEK JAGUAR V-386DX is integrated into the chipset, which will simplify the system design and reduce the chip count. Furthermore, built-in 8KB SRAM as unified cache support up to 16MB byte cacheable memory. In this cacheable range, it is integrated two non-cacheable area which flexible for different system configuration.

Copy Back Cache

A sophisticated copy back scheme is implemented in OCTEK JAGUAR V-386DX. In a cache-based system, the performance is downgraded when there is a lot of write operation because the CPU has to update both cache memory and main memory simultaneously. Therefore, wait state is needed in most write operations.

In a copy back cache system, the amount of write operation to main memory is minimized. The CPU writes the data to the cache memory if the data on the same location is already in the cache memory. The main memory is not updated yet and the operation completes in a single cycle.
So, it implies that writing to the same location need not initiate a main memory write operation. The main memory is only needed to be updated when the data from main memory has to replace the same location in the cache memory.

MEMORY SYSTEM

Two banks of DRAMs can be installed on motherboard and 256K, 1MB and 4MB DRAM SIMM modules are supported. One bank of DRAM refers to four pieces of SIMM modules. The maximum memory size is 32MB when using 4MB DRAM for all banks.

The DRAM controller supports Page mode. Successive memory accesses within the same page need not require wait state and thus CPU can run at full speed.

To enhance the system performance, shadow RAM mode is supported. In shadow RAM mode, system BIOS and video BIOS contained in low speed memory such as EPROM and ROM are copied into DRAM. Improvement is significant because access to DRAM is much faster than ROM.

Hidden Refresh

In the original PC/AT design, the CPU suspends its operation during memory refresh. The memory refresh cycle takes about 5% of CPU time which is a short period of time in a slow machine. Nevertheless, in a 33MHz machine, it will significantly downgrade the system performance since the CPU can complete more operations in the same period.

In OCTEK JAGUAR V-386DX, a hidden refresh function is provided. When the hidden refresh function is enabled, the CPU will not stop its operation and the memory refresh operation is transparent to the CPU access. The chipset will monitor the whole system. If the CPU is accessing the main memory, the memory refresh operation is postponed and will be carried out when there is no access to main memory. Special refresh mechanism is implemented to reduce the period of memory refresh operation.

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 OCTEK JAGUAR V-386DX is designed to be compatible with standard AT bus. All the expansion cards conformed to the standard AT bus can be used in OCTEK JAGUAR V-386DX without problem.

Chapter 3
Installing Components

Important Note : Turn off the power before installing or replacing any component.

INSTALLING MATH COPROCESSOR

Math coprocessor 80387 is PGA device and it has 68 pins. To install Math coprocessor, be sure to line up pin 1 of the Math coprocessor with pin 1 of the socket as shown below. Make sure that the coprocessor is firmly inserted into the socket.

Before installing the Math coprocessor, make sure all the pins are straight. The pins are very fragile. Once these pins are bent, the coprocessor may be damaged.

Check whether the system BIOS can find the coprocessor after reset. The system BIOS will display a list of devices on the motherboard after self-test. If the coprocessor is installed, it should show the type of coprocessor.

INSTALLING RAM MODULES

OCTEK JAGUAR V-386DX has eight sockets for SIMM modules. Whenever adding memory modules to the motherboard, install four modules at the same time. Also make sure that the chips on the modules face toward the memory expansion slot as shown in the next page.

To install a module, the module edge is 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.

If the BIOS reports an memory error or parity error, drag out the modules and insert them again. If the locking latches are damaged, contact your dealer to replace the socket.

INSTALLING EXTERNAL BATTERY

To back up the information stored in CMOS RAM, an external battery is needed to provide power after the system is turned off. The connector (P8) for the battery is located beside the keyboard connector on the rear of the board. A 3.6V battery is used. Turn off the power before install the battery. The location of the connector P8 is shown below.

CONFIGURATION OF MEMORY

The configuration of the memory is very flexible. It can install 256KB , 1MB or 4MB SIMM modules are acceptable. There are several combinations of DRAM types you may consider. So, a basic system can be equipped with fewer memory and the system can be upgraded by installing the extended memory. The different configurations of memory is illustrated at the next page.

There are totally two banks of DRAM. The memory size is detected automatically by system BIOS. This detection is performed during memory test and the size is indicated after reset. No jumper is needed to be set for the memory size and DRAM type.

To determine what DRAM speed rating to be used is depended on the system speed and wait state. The highest performance is accomplished by using zero wait state, but high speed DRAM has to be used.

The wait state setting is applied to two banks of memory. Therefore make sure to install DRAM modules with the same speed rating, or accommodate the wait state setting to the new DRAM type.

The number of wait state is assigned in the BIOS setup. Improper setting may cause the system malfunction. In this case, reset the CMOS setup using JP3. Then reset the system and go through the system setup again.

DRAM CONFIGURATION

	Bank 1 SIMM (1-4)	*Bank 0 SIMM (5-8)*	*Total Memory*
1	*X*	*256K*	*1M*
2	*256K*	*256K*	*2M*
3	*X*	*1M*	*4M*
4	*1M*	*256K*	*5M*
5	*1M*	*1M*	*8M*
6	*X*	*4M*	*16M*
7	*4M*	*1M*	*20M*
8	*4M*	*4M*	*32M*

CONTROL OF SYSTEM SPEED

System speed can be controlled by hardware switch and keyboard. Connector P3 is connected to the turbo switch of the case. When the system speed is fast, the turbo LED of the case should be turned on.

To change the speed by keyboard, use '-' and '+' of the numeric keypad. Press 'Ctrl', 'Alt' and '-' for slow speed and Press 'Ctrl', 'Alt' and '+' for fast speed.

Whenever the system speed is set to slow by turbo switch, it cannot be changed by keyboard, and vice versa.

RESET CMOS SETUP INFORMATION

Sometimes, the improper setting of system setup may make the system malfunction. In this case, turn off the power and disconnect the external battery. Then place a jumper on JP3 (2-3) for a while. The internal CMOS status register will be cleared. Then remove the jumper and turn on the power. The BIOS finds the CMOS status register is reset and regards the setup information as invalid. So it will prompt you to correct the information. In normal operation, JP3 place in (1-2).

SYSTEM BOARD JUMPER SETTING

There is a option which allow user to select by hardware switches.

Display Selection

JP1	
1-2	*CGA, EGA VGA **
2-3	*Monochrome Display*

*Note : * factory 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

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Chapter 4
Technical Information

This section provides technical information about OCTEK JAGUAR V-386DX and is intended for advanced users interested in the basic design and operation of OCTEK JAGUAR V-386DX.

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)*
100000-7FFFFF	*1024K-8192K*	*System Memory*
800000-FFFFFF	*8192K-16318K*	*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

OCTEK JAGUAR V-386DX has three programmable timer/counters controlled by chipset and they are 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*

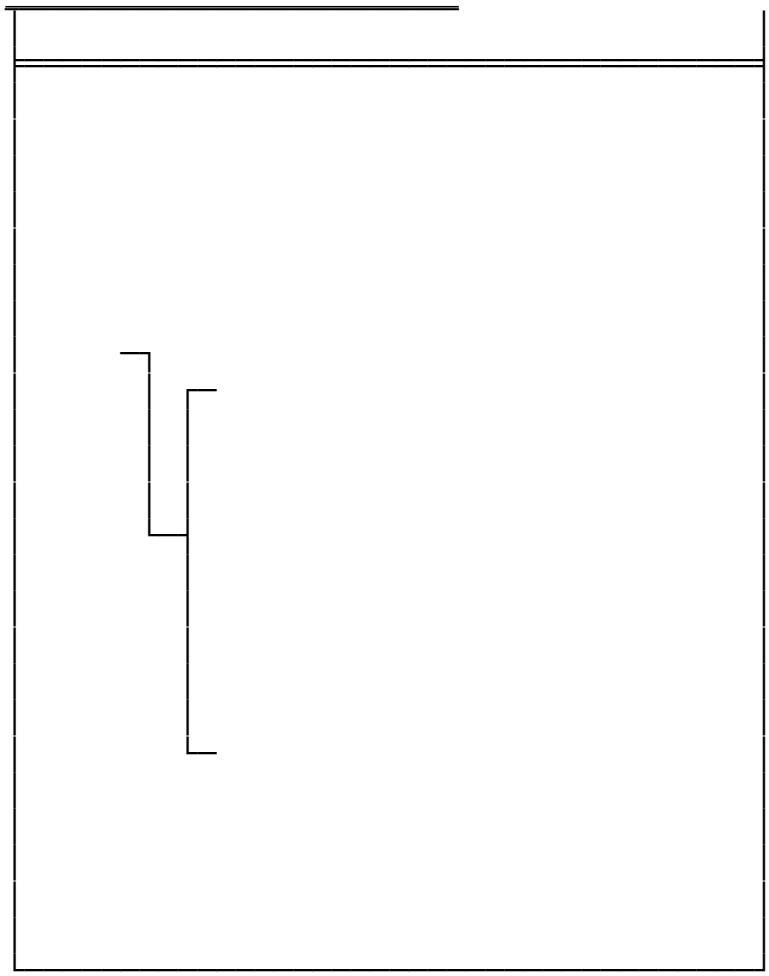
Note : Channel 1 is programmed to generate a 15-micro-second period signal.

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 OCTEK JAGUAR V-386DX. 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)

OCTEK JAGUAR V-386DX 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 and CMOS RAM are contained on board. Real time clock provides the system date and time. CMOS RAM stores system information. Both are backed up by battery and will not lose information after power off. The following page shows the CMOS RAM Address Map.

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)*
34-3F	*Reserved*

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

OCTEK JAGUAR V-386DX provides four 16-bit and two 8-bit slots.

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.

The following figure shows the pin numbering for I/O channel connectors JB2-JB5.

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

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Appendix A
Operation and Maintenance

STATIC ELECTRICITY

When installing or removing any add-on card, DRAM module or coprocessor, you should discharge the static electricity on your body. Static electricity is dangerous to electronic device and can build-up on your body. When you touch the add-on card or motherboard, it is likely to damage the device. To discharge the static electricity, touch the metal of your computer. When handling the add-on card, don't contact the components on the cards or their "golden finger". Hold the cards by their edges.

KEEPING THE SYSTEM COOL

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. The temperature inside the computer system may be very high. In order to keep the system running stably, the temperature must be kept at a low level. A easy way to do this is to keep the cool air circulating inside the case. The power supply contains a fan to blow air out of the case. If you find that the temperature is still very high, it would be better to install another fan inside the case. Using a larger case is recommended if there are a number of add-on cards and disk drives in the system.

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 the add-on card may not work properly. Use a pencil eraser to clean the "golden finger" if dirt is found.

CLEANING THE MOTHERBOARD

The computer system should be kept clean. Dust and dirt is harmful to electronic devices. To prevent dust from accumulating on the mother-board, 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.

Appendix B
Troubleshooting

SYSTEM UNSTABLE

If the system hangs after memory test, possible cause is the improper setting of wait state for memory operation. The number of wait state must match the speed of the DRAM. Reset the CMOS RAM and set up the wait state. Try to increase the number of wait state.

MAIN MEMORY ERROR

After power up, the monitor remains blank, and there are beep sounds indicating a main memory failure. In this case, turn off the power and remove all SIMM modules. Carefully place the modules back to the sockets and make sure that all the modules are locked by the locking latches firmly.

In some other cases, the total memory found by the BIOS is different from the actual amount of memory on board. It is also a memory failure and you can follow the instruction above.

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Appendix C
System Board Layout