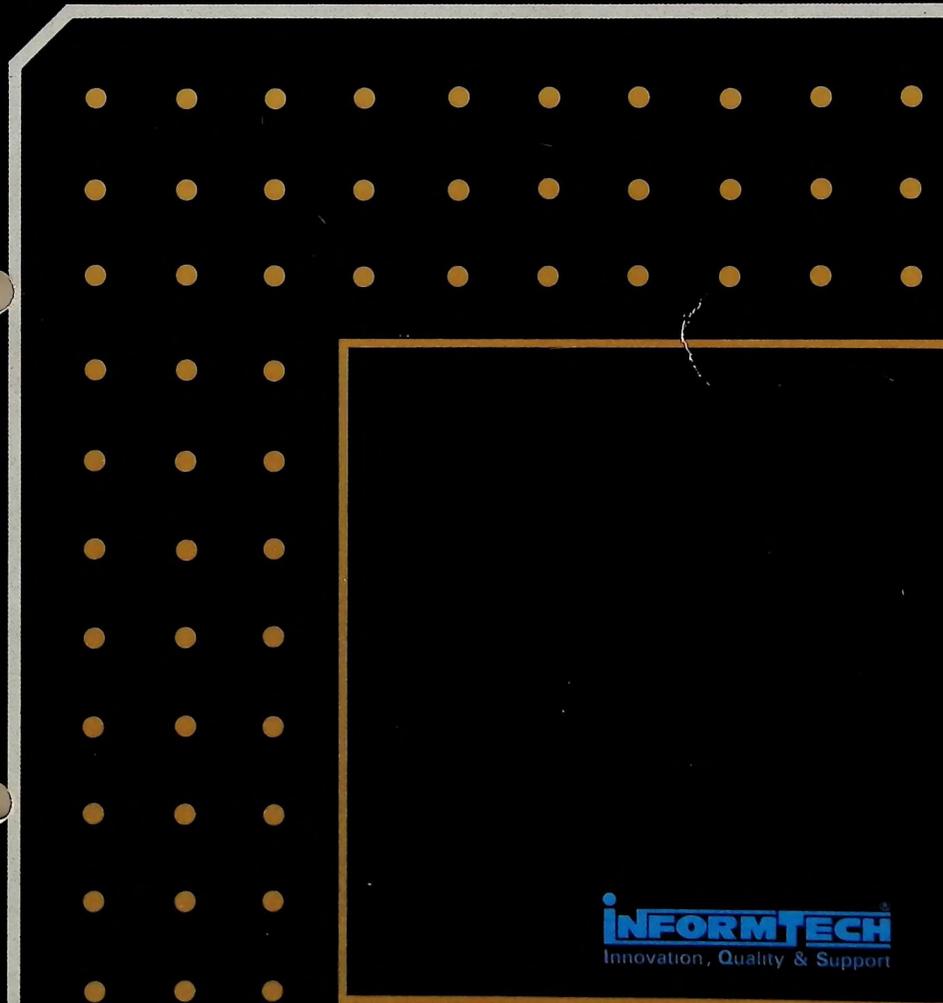


IT386

SYSTEM BOARD

REFERENCE MANUAL



INFORMTECH
Innovation, Quality & Support

1974

1975

1976



NOTICE TO USERS

The information in this manual is subject to change without prior notice.
We apologize for any inconvenience caused.

The information in this manual is designed for
IT386 Mini System Board with PHOENIX 386
C1.10.XX or above BIOS starting from C1.10.14

Version 1.40 - May, 1990

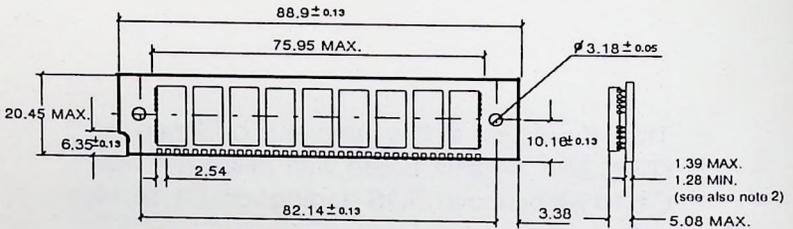
Trademark Acknowledgements

PC AT is a registered product trademark of IBM Corporation.
INFORMTECH is a registered trademark of Informtech Industrial Ltd.
Hercules Graphic Card is the product of Hercules Corporation.
Lotus 123 is the product of Lotus Development Corporation.
PHOENIX 386 ROM BIOS PLUS is the product of Phoenix Technologies Ltd.
INTEL is the trademark of Intel Corporation.

PRECAUTION

In order to keep the DRAM SIMM sockets on the motherboard in good mechanical condition, please pay attention to the following points in handling the DRAM modules:

1. The DRAM modules being used should follow the dimension descriptions of the outline drawing shown below:



ALL DIMENSIONS ARE IN mm

2. If the DRAM modules to be installed are not intended for permanent use (they will be removed after test, for example), then the thickness of the DRAM modules should be between 1.28 mm and 1.39 mm. Those with thickness exceeding this limit may adversely affect the reliability of the SIMM sockets in case thin DRAM modules are used in the future.

The thickness is measured at the conducting (gold fingers) region on the DRAM modules.

This restriction does not apply to DRAM modules that will stay on the board permanently.

3. Try to keep the loading and unloading of DRAM modules to a minimum.

Thank you for your attention.

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PART 1
INTRODUCTION

1.1 INTRODUCTION

IT386 High Performance Mini System Board (hereinafter referred to as IT386) is a great and versatile IBM PC AT compatible system board. It is the best system board for highly sophisticated applications such as Computer Networking, Artificial Intelligence, CAD/CAM, Database Management & Multi-User Applications.

IT386 employs INTEL 82385 Cache Controller together with 32KB Cache Memory to realize zero wait state memory fetching cycle. On the other hand, IT386 uses page mode memory access scheme so that the main memory fetching overhead can be minimized.

The maximum on board memory size is 4M Bytes which satisfies most requirements of general software packages and operating systems. In addition, a fast 32-bit memory I/O slot is equipped for the high speed extended memory card which provides another 12MB extended memory space for IT386, using 1M x 1 DRAM in DIP.

Moreover, IT386 employs Texas Instruments PC AT 3-CHIPSET for AT subsystem managing the Industrial Standard Architecture (ISA) which supports thousands of add-on cards.

Hence, the performance of IT386 is closed to a mini-computer system!

1.2 PRODUCT SPECIFICATIONS

For IT386-33

CPU	: INTEL 80386-33
CO-PROCESSOR (Optional)	: INTEL 80387-33, 80387-25 Weitek 3167-33
CACHE CONTROLLER	: INTEL 82385-33
CACHE MEMORY	: 32KB SRAM with Access Time of 25ns
CPU CLOCK RATE	: 33MHz, 25MHz (Jumper Selectable) 8MHz (Keyboard Switching or by Turbo Switch)
ON BOARD MEMORY SIZE:	1MB by 256K x 9 bit SIMM RAM 4MB by 1M x 9 bit SIMM RAM
SYSTEM EXPANSION	: 8 ISA Compatible Bus Slots 6 slots for 16-bit, 2 slots for 8-bit 1 Fast Slot for Memory Expansion
BUS SPEED	: 8MHz
BOARD SIZE	: BABY AT SIZE 8.6"W X 13"L, (218 W X 330 L, in mm)
MOUNTING HOLES	: Standard Size AT Mounting Holes

For IT386-25

CPU	: INTEL 80386-25
CO-PROCESSOR (Optional)	: INTEL 80387-25, 80387-20 Weitek 3167-25
CACHE CONTROLLER	: INTEL 82385-25
CACHE MEMORY	: 32KB SRAM with Access Time of 35ns
CPU CLOCK RATE	: 25MHz 8MHz (Keyboard Switching or by Turbo Switch)
ON BOARD MEMORY SIZE:	1MB by 256K x 9 bit SIMM RAM 4MB by 1M x 9 bit SIMM RAM
SYSTEM EXPANSION	: 8 ISA Compatible Bus Slots 6 slots for 16-bit, 2 slots for 8-bit 1 Fast Slot for Memory Expansion
BUS SPEED	: 8MHz
BOARD SIZE	: BABY AT SIZE 8.6"W X 13"L, (218 W X 330 L, in mm)
MOUNTING HOLES	: Standard Size AT Mounting Holes

1.3 FEATURES

High Performance CPU

The brain of IT386 is INTEL 80386 which is one of the most advanced CPU of INTEL Microprocessor family. The intelligent memory management unit (MMU) inside the CPU comes with advanced 32-bit architecture which provides the power and capability of IT386 up to a mini-computer performance.

In addition, the 386 microprocessor offers the downward compatibility with 8086/88 and 80286 - the less powerful CPU of INTEL microprocessor family. Thus, all the PC/XT/AT softwares can run on the IT386 transparently. The only difference you may find is the speed since IT386 operates much faster than the standard PC AT or other high speed 286 based systems.

On the other hand, the processor addresses up to four gigabytes of physical memory and 64 terabytes (2^{46}) of virtual memory with on chip internal memory management unit.

INTEL 80386 microprocessor offers different modes of operation - REAL MODE, PROTECT MODE & VIRTUAL MODE, which suit different applications. In Appendix D, a brief description about these modes are given. For further information, please consult other 386 programming guides or documents.

In the design of IT386, the CPU clock rate can be set to either 25MHz or 33MHz which depends on the CPU used. Users can consult their dealers for further information.

Intelligence Numeric-processor Interface

The design of IT386 supports two optional math-processors, INTEL 80387 and Weitek 3167 without any hardware modification. Both of them are high performance numeric-processors designed to extend the power of INTEL 80386 in number crunching. They are very useful in the mathematical intensive applications such as CAD/CAE, Artificial Intelligence, Scientific calculations or System Simulation.

The INTEL 80387 is downward compatible with 80287 and 8087 co-processor which are the previous versions of INTEL Co-processor family. On the contrasts, Weitek Co-processor is NOT compatible with 8087, 80287 or 80387. However, the Weitek co-processor, with the special designed applications, has several times the performance of the 80387 in similar applications.

For the detail information, please refer to the reference documents released by Intel Semiconductor Corporation and Weitek Corporation.

In Section 2.1 & 2.2, the operation guide of the co-processor will be given.

Cache Controller & Cache Memory

IT386 cache system is using INTEL 82385 as cache controller and 32KB high speed static RAM for cache memory.

The advantage of Cache System is to provide a buffer between high speed CPU and slow access time Main Memory. In the design of IT386, the cache controller offers a 2 ways set associative cache memory system. The average cache hit rate is over 95% which implies that the CPU works mostly with zero wait state while main memory can use cheaper low speed DRAM.

In addition, the cache system used in IT386 is software transparent. That means no any further modification in the software is required for the IT386. As a result, the Cache System in IT386 provides the capability and performance close to minicomputer architecture.

Basic Input/Output System (BIOS)

The BIOS used in IT386 is licensed from Phoenix Technologies, which is a proven PC AT compatible BIOS. Unlike the traditional 80286 PC AT compatible BIOS, Phoenix Technologies adopts the advance features of 80386 to improve the efficiency of the BIOS.

In addition, the extended features - Disk Caching and Intelligence Expanded Memory Manager Driver are provided with the BIOS of IT386. Thus, the speed of disk intensive applications can be greatly increased by Disk Caching. The Intelligent Expanded Memory Manager Driver comes with IT386 supports both Lotus-Intel-Microsoft Expanded Memory Specification 4.0 (LIM-EMS 4.0) and AST-Quadram-Ashton Tate Enhanced Expanded Memory Specification (EEMS) version 3.2. Hence, all the expanded-memory-using applications are supported by IT386.

One of the BIOS advanced features is the beep code. It is used to report the error that cannot be displayed during POST (Power On Self Test) and greatly simplify the technical support work.

Memory System

IT386 High Performance Mini System Board provides 4 SIMM RAM Sockets for the Dynamic Random Access Memory (DRAM) Modules. By using the 256K x 9 bits packages, the system can be configured as 1MB on board memory. If 1M x 9 bits packages are used, the on board main memory is 4MB.

In order to provide higher memory throughput, Page Mode Access Scheme is used in the memory interface to eliminate the DRAM fetching overhead.

Owing to the Cache Memory is used in the IT386 system board, the cheaper slow memory can be used for the high speed CPU operation. Jumper is provided for inserting a wait state in memory cycle for slower DRAM, thus increases the flexibility of selecting DRAM.

Since IT386 operates at 32-bit architecture, the four sockets are configured in single bank. All the DRAM modules in the same bank must be the same size and speed. The standard memory configuration is either 1M Byte or 4M Byte.

System Expansion

There are 8 Industrial Standard Architecture compatible bus slots on IT386 for system expansion interface. Five of them are 16-bit slots while the others are 8-bit slots. Hence, all the ISA compatible add-on cards can be installed in IT386 smoothly.

The bus speed of the expansion slot is set to 8MHz which is independent with CPU clock rate. This enable IT386 to work with all ISA compatible add-on cards. In addition, switch settings are provided for inserting different wait states in the slot to fine tune the operation of add-on cards.

Furthermore, IT386 is equipped with a 32-bit fast slot for IT-FEM386, the Fast Extended Memory Card, so that the bottle neck of general 8-bit/16-bit ISA memory card operation can be eliminated.

Chipset

The Chip Set used in IT386 is Texas Instruments PC/AT 3-CHIPSET. It consists of three Very Large Scale Integrated Circuit (VLSI) chips named as System Unit, Address Unit & Peripheral Unit.

The function of these chips is to provide the system Input/Output control logic and several programmable controllers are integrated in these chips. They are :

- Direct Memory Access (DMA) Controllers
- Interrupt Controllers
- Programmable Timer
- Real Time Clock

Besides these programmable devices, IT386 also utilizes the logic circuitry built in the Chip Set. For example, the Non-maskable interrupt decoding logic, DMA Page register, Address Decoder and the Real Time Clock. As a result, the reliability of IT386 is further guaranteed by reduced component count.

Shadow RAM Feature

A special designed memory decoder is implemented in IT386 for speeding up the execution of BIOS or Video Code in ROM. Under this scheme, all the contents in ROM will be copied to RAM during power up of the machine. Instead of accessing low speed ROM BIOS, all the execution of BIOS or Video Code is directed to RAM. Thus, the execution time of BIOS routines or Video ROM Code is reduced.

EEPROM & System Setup Program

The ROM based system setup program provided in the IT386 enables users to configure their system easily.

Unlike the traditional PC AT System Boards, IT386 employs Electrical Erasable Programmable Read Only Memory (EEPROM) to store the system setup parameters together with the CMOS RAM in the real time clock chip. EEPROM needs no constant power supply to keep the system parameters. As a result, the system parameters will never lose even the external battery fails. Nevertheless, external battery is still required for the real time clock operation.

Selectable System Clock Rate

IT386 has a special feature that is to set the system clock rate from 33MHz/25MHz to 8MHz by software switching or Turbo Switch. As a result, the speed dependent software package can also run under IT386.

On the other hand, IT386 provides jumpers for selecting different Co-processor Clock Rate such that users can select relatively low speed co-processor for their systems. Thus, cheaper system integration cost with reasonable system performance can be achieved.

2.1 CPU & CO-PROCESSOR CLOCK RATE

The clock rate of the CPU and co-processor is a critical factor in determining the performance of the system. The clock rate is the number of cycles per second that the processor can execute. The clock rate is determined by the system board and the processor. The clock rate is typically measured in MHz (Megahertz) or GHz (Gigahertz).

PART 2

OPERATION GUIDE

Model	CPU	Co-processor
Model 1	100 MHz	100 MHz
Model 2	133 MHz	133 MHz
Model 3	166 MHz	166 MHz
Model 4	200 MHz	200 MHz

Table 2.1: CPU & Co-processor Clock Rate

Ensure that the clock rate of the CPU and co-processor is set correctly in the BIOS. The clock rate is typically set in the BIOS menu. The clock rate is typically set to the value shown in the table above.

IBM System/386 Program

The IBM System/386 program is a high-level language program that is used to generate machine code for the IBM System/386 processor. It is a compiler that takes source code as input and produces object code as output. The program is written in assembly language and is located in the following directory:

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2.1 CPU & CO-PROCESSOR CLOCK RATE

CPU clock is used to control the operating speed of microprocessor in the mother board. It is a very important parameter in determining the System Board Performance. The CPU Clock Rate (or System Clock Rate) of IT386 can be set to either 33MHz or 25MHz.

The co-processor clock rate is used to control the operating speed of co-processor. It can be set to 33MHz, 25MHz or 20MHz. The settings of CPU and Co-processor clock rate are tabulated in Table 2.1.

CPU Clock	Co-processor Clock	J4	J5	J6	J9
33MHz	33MHz	1-2	Don't Care	1-2	1-2
33MHz	25MHz	1-2	1-2	2-3	1-2
25MHz	25MHz	2-3	2-4	1-2	2-3
25MHz	20MHz	2-3	1-3, 2-4	2-3	2-3

Table 2.1 CPU, Co-processor Clock Rate Selection

Caution: *If Weitek 3167 Co-processor is installed, the Co-processor clock rate must be set to the same as CPU clock.*

2.2 INSTALLATION OF CO-PROCESSOR

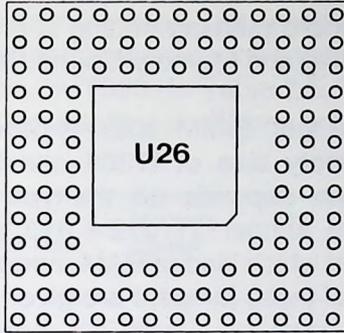
In the design of IT386, a socket is provided for the co-processor. Both INTEL 80387 and Weitek 3167 are supported by this socket. Users can plug in either of these two co-processors in the system board. The selection between them depends on the applications.

Although the numbers of pin are different between two co-processors, the pin-assignment of INTEL 80387 is compatible with Weitek 3167. Thus, the same socket is used for housing either INTEL 80387 or Weitek 3167 co-processor. Please refer to figure 2.1 for the installation of co-processor.

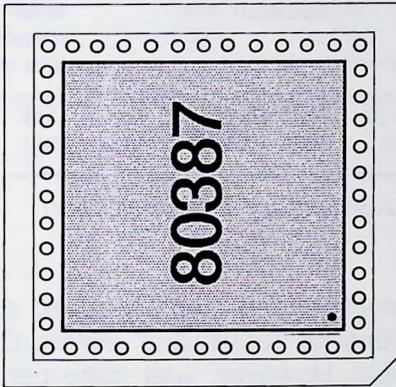
On the other hand, SW1-1 is used to inform IT386 that INTEL 80387 has been installed. The setting of SW1-1 are given in Table 2.2. If Weitek 3167 co-processor is installed, IT386 will detect it automatically.

Existence of INTEL 80387	SW1-1
Not Installed	OFF
Installed	ON

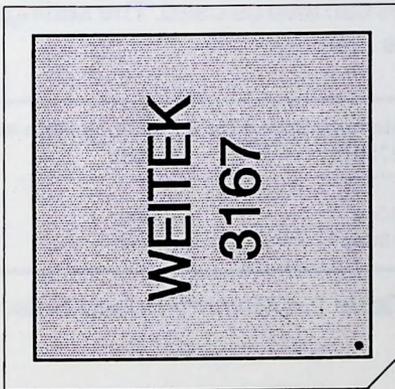
Table 2.2 Existence of INTEL 80387



(a)



(b)



(c)

Figure 2.1 (a) Socket of Co-processor (b) Housing of intel 80387
(c) Housing of Weitek 3167

2.3 ON BOARD MEMORY SETTING

The on board memory setting is divided into Memory Size Setting and Memory Speed Setting.

There are four SIMM sockets provided in the IT386. The memory size of IT386 can be either 1MB or 4MB which depends on the type of RAM modules used. The jumper J1, J12 & J13 are used to inform IT386 that which kind of RAM modules are used. The settings of these jumpers are given in Table 2.3.

Memory Type Installed	Location	Total Memory Size	J1	J12	J13
256K x 9 Bit	RM1, RM2, RM3, RM4	1MB	1-2	2-3	2-3
1M x 9 Bit	RM1, RM2, RM3, RM4	4MB	2-3	1-2	1-2

Table 2.3 Memory Type Selection

The recommended memory speed of IT386 are 80ns and 100ns for 33MHz and 25MHz CPU clock rate respectively. However, wait state can be inserted by setting the jumper J7 such that slower DRAM modules can also be used. The settings of J7 are listed in Table 2.4

Memory Speed for CPU Clock Rate at		J7
33MHz	25MHz	
80ns	100ns	OPEN
100ns	120ns	CLOSE

Table 2.4 Memory Speed Selection

Owing to Cache Memory is employed in IT386, inserting wait state to main memory fetching cycle will degrade the system performance insignificantly. Hence, cheaper memory can be used to enjoy the high performance of IT386. In Table 2.5, the number of wait state under different conditions are tabulated.

CPU Clock Rate	Memory Speed	J7	Number of Wait State	
			Page Hit	Non-Page hit
33MHz	80ns	OPEN	1	3
33MHz	100ns	CLOSE	2	4
25MHz	100ns	OPEN	1	3
25MHz	120ns	CLOSE	2	4

Table 2.5 Wait States in Memory Cycle under (a) 33MHz
(b) 25MHz

2.4 SYSTEM I/O BUS SETTINGS

There are many compatible add-on cards available in the market. Most of them are designed for I/O BUS CLOCK RATE between 6MHz and 8MHz. In IT386, a 8MHz AT BUS CLOCK is used to control the communication speed between add-on cards and mother board. On the other hand, the DMA clock is also determined by the AT BUS CLOCK and run with clock speed of 4MHz.

In order to fine tune the I/O operations between add-on cards and mother board, IT386 offers 2 switches for I/O MODE SELECTION. There are four different I/O bus MODES provided by IT386 to integrate the I/O operation. The settings of I/O Selection are tabulated in Table 2.6.

I/O Bus Mode	I/O Wait State		SW1-3	SW1-4
	8-bit	16-bit		
1	4	1	ON	ON
2	6	2	OFF	ON
3	8	3	ON	OFF
4	10	4	OFF	OFF

Table 2.6 I/O Bus Mode Selection

Note: Since ATBUS Clock are common to all the expansion slots, all the peripheral cards share the SAME I/O Bus speed. Thus, make sure that all the plug-in cards are capable at that I/O Bus Speed.

2.5 FAST SLOT SELECTION

Besides ISA slots, IT386 provides a 32-bit fast slot for Fast Extended Memory Card, IT-FEM386. Please refer to Appendix B and consult your local dealer for further information of IT-FEM386.

The jumper settings of fast slot selection are tabulated as follows :-

IT-FEM386	J25
Installed	2-3
Not Installed	1-2

Table 2.7 IT-FEM386 Jumper Settings

2.6 DISPLAY ADAPTER SELECTION

SW1-2 is used for illustrating which kind of display adapter is activated.

Adapter Type	SW1-2
Monochrome Adapter or Hercules Graphic Adapter	OFF
Color Graphic Adapter, Enhanced Graphic Adapter or Video Graphic Adapter	ON

Table 2.8 Display Adapter Type Setting

2.7 POWER GOOD SELECTION

J5 is used to select Power Good reset sources from either power supply or on board circuit. The on-board power good generator is used for XT upgrade, using XT power supply without Power Good signal or signal not complied with the required specification.

Power Good Signal Source	J18
Power Good Generator	2-3
Power Supply	1-2

Table 2.9 Power Good Signal Source Selection

2.8 BATTERY TYPE SELECTION

J19 is used to determine which kind of battery is being used in the system board such that the correct battery interface is used.

Battery Type	J9
Battery Pack, 4.5V (without internal current limiting resistor)	3-4
Battery Pack, 3.6V-4.5V (with internal current limiting resistor)	1-3
Battery Pack, 6V (without internal current limiting resistor)	1-2
Battery Pack, 6V	2-4

Table 2.10 Battery Type Selection

2.9 TURBO MODE SWITCHING

IT386 offers the feature of low speed (8MHz CPU clock rate) emulation. Users can change the CPU operating speed from 33MHz/25MHz, which depends on users' mother board, to 8MHz by either software switching or hardware switching methods. The switching methods are tabulated as follows:

Operating Mode	Procedure
Turbo Mode	Press "Ctrl-Alt-+" or "Ctrl-Alt-2"
Non-Turbo Mode	Press "Ctrl-Alt-" or "Ctrl-Alt-1"

Table 2.11a *Software Turbo Mode Switching*

Operating Mode	J8
Turbo Mode	OPEN
Non-Turbo Mode	CLOSE

Table 2.11b *Hardware Turbo Mode Switching*

CHAPTER 10: SYSTEMS SOFTWARE

The systems software is the software that is used to control the computer system. It includes the operating system, the compiler, the linker, and the loader. The operating system is the software that manages the hardware resources of the computer system. The compiler is the software that translates the source code into machine code. The linker is the software that links the object code into an executable program. The loader is the software that loads the executable program into memory and starts its execution.

10.1	Operating System	10.1
10.2	Compiler	10.2
10.3	Linker	10.3
10.4	Loader	10.4

CHAPTER 11: DATA REPRESENTATION

Data representation is the way in which data is stored and processed in a computer system. It includes the binary representation of data, the floating-point representation of real numbers, and the representation of characters and strings.

11.1	Binary Representation	11.1
11.2	Floating-Point Representation	11.2
11.3	Character and String Representation	11.3

PART 3
CONNECTOR PIN ASSIGNMENTS

PART 3
CONNECTOR PIN ASSIGNMENTS

3.1 SPEAKER CONNECTOR (P3)

Pin Number	Function
1	Speaker +
2	Key
3	GND
4	Speaker -

3.2 KEYLOCK & POWER LED CONNECTOR (P5)

Pin Number	Function
1	+5V
2	Key
3	GND
4	KB INHIBIT
5	GND

3.3 RESET CONNECTOR (P4)

P4	Function
Closed once	RESET THE SYSTEM
OPEN	NORMAL

3.4 EXTERNAL BATTERY CONNECTOR (P22)

Pin Number	Function
1	POSITION POLARITY +V
2	KEY
3	SPARE
4	GND

3.5 KEYBOARD CONNECTOR (P23/P20)

Pin Number	Function
1	CLOCK
2	DATA
3	SPARE
4	GND
5	+5V

3.6 TURBO LED CONNECTOR (P2)

Pin Number	Function
1	SPARE
2	SPARE
3	CATHODE
4	ANODE

3.7 POWER CONNECTOR (P21)

Pin Number	Function
1	Power Good
2	+5V
3	+12V
4	-12V
5	GND
6	GND
7	GND
8	GND
9	-5V
10	+5V
11	+5V
12	+5V

POWER SUPPLY CONNECTOR (PS)

Pin Number	Function
1	5V
2	5V
3	5V
4	5V
5	5V
6	5V
7	5V
8	5V
9	5V
10	5V
11	5V
12	5V
13	5V
14	5V
15	5V
16	5V
17	5V
18	5V
19	5V
20	5V
21	5V
22	5V
23	5V
24	5V
25	5V
26	5V
27	5V
28	5V
29	5V
30	5V
31	5V
32	5V
33	5V
34	5V
35	5V
36	5V
37	5V
38	5V
39	5V
40	5V

KEYBOARD CONNECTOR (KB)

Pin Number	Function
1	NC
2	NC
3	NC
4	NC
5	NC
6	NC
7	NC
8	NC
9	NC
10	NC
11	NC
12	NC
13	NC
14	NC
15	NC
16	NC
17	NC
18	NC
19	NC
20	NC
21	NC
22	NC
23	NC
24	NC
25	NC
26	NC
27	NC
28	NC
29	NC
30	NC
31	NC
32	NC
33	NC
34	NC
35	NC
36	NC
37	NC
38	NC
39	NC
40	NC

32 PIN DIO CONNECTOR (DIO)

Pin Number	Function
1	NC
2	NC
3	NC
4	NC
5	NC
6	NC
7	NC
8	NC
9	NC
10	NC
11	NC
12	NC
13	NC
14	NC
15	NC
16	NC
17	NC
18	NC
19	NC
20	NC
21	NC
22	NC
23	NC
24	NC
25	NC
26	NC
27	NC
28	NC
29	NC
30	NC
31	NC
32	NC

PART 4
ROM BASED CMOS SETUP
FUNCTION

PART 4
ROM BASED CMOS SETUP
FUNCTION

PHOENIX 386 BIOS supports ROM BASED SYSTEM setup function. It is used to modify certain basic characteristics of system configuration. During the boot up stage, the SYSTEM setup function can be activated by pressing CTRL-ALT-ESC on the keyboard.

The ROM based SYSTEM setup screen is shown as follows :

DATE(MM/DD/YY)	01/01/80					
TIME(HH:MM:SS)	00:00:00					
DISKETTE 1	1.2M					
DISKETTE 2	1.44					
		CYL	HEADS	SECTORS	PRECOMP	LDZ
DISK 1	22	733	4	17	300	615
DISK 2	NONE					
VIDEO	EGA/VGA					
BASE MEMORY	640					
EXTENDED MEMORY	1024					
SHADOW RAM	SYSTEM & VIDEO					
ERROR HALT	HALT ON ALL ERROR					
SPEED SELECT	HIGH					
EXTENDED FEATURES	ENABLE					

MOVES BETWEEN ITEMS, SELECT VALUES
F10 records changes, F1 exists, F2 for color toggle

The UP ARROW, DOWN ARROW and RETURN keys move a reverse video field among the lines displayed on the screen. Pressing the arrow keys moves this field vertically among the lines of the SETUP screen. You may change the values in individual fields as they are highlighted.

Pressing the F10-Key stores any changes made in the SETUP Program to real time clock CMOS RAM and EEPROM. The F5-Key must be pressed after F10 to confirm changes before they are written to EEPROM.

Pressing the F1-Key exits the SETUP Program without making any changes.

Pressing the F2-Key changes the video output from color to monochrome. This function is specifically designed to improve the quality of the SETUP screen on composite monitors.

SETUP Selections

Configuration selections presented by the SETUP program are :

1. DATE
2. TIME
3. DISKETTE 1
4. DISKETTE 2
5. DISK 1
6. DISK 2
7. VIDEO
8. BASE MEMORY
9. EXTENDED MEMORY
10. SHADOW RAM
11. ERROR HALT
12. SPEED SELECT
13. EXTENDED FEATURE

4.1 DATE

Type the current date into this position and press return. Type the date in the format : "MONTH/DATE/YEAR". The century is assumed to be 1900. The "/" must be typed separating the MONTH/DATE/YEAR. The back-space key can be used to correct typing mistakes.

After the date has been changed, press the UP ARROW or DOWN ARROW keys to move the highlight to another field or press F10 or F1-keys.

4.2 TIME

Type the current time into this position and press RETURN. Type the time in the format: "HOUR:MINUTE:SECONDS". The HOUR is calculated according to the 24-HOUR military-time clock. For example, 1 o'clock p.m. is typed as 13:00:00. It is not necessary to enter leading zeros in front of numbers, or enter values for the seconds. However, you will need to type the colon ":" to separate the hours and minutes.

After the time has been typed, press UP ARROW or DOWN ARROW keys to move to other fields or press F10 or F1-key to terminate the SETUP operation.

4.3 DISKETTE 1

The five choices for the "A" drive are:

1. NONE (No Floppy Drive)
2. 360K (5.25" Standard drive)
3. 1.2M (5.25" Quad-density drive)
4. 720K (3.5" High-density drive)
5. 1.44M (3.5" Quad-density drive)

The text in the parentheses are not displayed on the SETUP screen. Choices are selected when the DISKETTE 1 field is highlighted. Press the RIGHT ARROW or LEFT ARROW key to choose the correct floppy drive setting. After the diskette type has been set, press UP ARROW or DOWN ARROW keys to move to other fields or press F10 or F1-key to terminate the SETUP operation.

4.4 DISKETTE 2

The process for selecting DISKETTE 2 is the same as described for DISKETTE 1.

4.5 DISK 1

Selections 5 and 6 identify the type of fixed disk drive that has been installed in the computer. Table 4.1 shows the 47 types of drives in the SETUP drives table. The first 23 are IBM-AT Standard. Types 24 through 45 are exclusive to the PHOENIX Program. Types 46 and 47 are user-defined disk types.

Press the **RIGHT ARROW/LEFT ARROW** key or enter the type number to select fixed disk type. If a fixed disk has not been installed, select **NONE** or enter 0.

If your system contains a drive with characteristics not listed in the drive table, you must have a special driver for it to be loaded at boot time as listed in **CONFIG.SYS**. In such a case, select the drive type recommended by the drive manufacturer. Another method to enter the disk characteristic parameters is using the user define type (i.e. type 46 & 47) with BIOS shadow RAM enabled. The procedures to enter the parameters for disk type 46 and 47 are listed as follows :-

1. Type in 46/47 for the field DISK 1/2.
(BIOS shadow RAM is automatically enabled).
2. Press Alt-F4 to edit the disk parameters table.
3. Enter the parameters for the number of cylinders, heads, sectors, write precom., landing zone in the corresponding fields. Enter "-1" in precom if NONE is desired. Press the LEFT ARROW and RIGHT ARROW keys for moving among the fields. Users can consult their local system/disk dealer for further information about the disk parameters.
4. Press Alt-F4 to exit after the disk parameters have been input.

Since all the parameters are recorded in the EEPROM of IT386, users need not re-set the disk type table whenever system bootup. The fixed disk parameters can be changed only when another undefined fixed disk is used.

4.6 DISK 2

The procedure for choosing Selection 6 Disk 2 is outlined in 4.5.

DISK TYPE	CYL	HEADS	SECTOR	WRITE PRECOMP	LAND ZONE	EXAMPLE
1	306	4	17	128	305	TEAC SD510
2	615	4	17	300	615	MMI M112, 5412 Seagate ST255, ST4026
3	615	6	17	300	615	
4	940	8	17	512	940	
5	940	6	17	512	940	
6	615	4	17	None	615	Tandon TM262
7	462	8	17	256	511	
8	733	5	17	None	733	Tandon TM703
9	900	15	17	None	901	
10	820	3	17	None	820	
11	855	5	17	None	855	
12	855	7	17	None	855	
13	306	8	17	128	319	Disctron 526 MMI M125
14	733	7	17	None	733	
15	RESERVED					
16	612	4	17	None	663	Microscience, HH725 Syquest 3250, 3425
17	997	5	17	300	997	
18	997	7	17	None	997	
19	1024	7	17	512	1023	
20	733	5	17	300	732	
21	733	7	17	300	732	
22	733	5	17	300	733	Seagate ST4038
23	306	4	17	None	336	
24	977	5	17	None	976	Seagate 4051
25	1024	9	17	None	1023	Seagate 4096
26	642	8	17	128	664	NEC 3142

Table 4.1 The Fixed Disk Drive Table for the Phoenix C1.10.XX BIOS
(to be cont.)

Table 4.1(Cont.) The fixed Disk Drive Table for the Phoenix C1.10.XX BIOS

DISK TYPE	CYL.	HEADS	SECTOR	WRITE PRECOMP	LAND ZONE	EXAMPLE
27	1024	7	26	None	1024	Microscience 4090
28	832	6	33	None	832	Conner CP3184
29	1024	8	17	None	1023	Maxtor XT1085 Micropolis 1325
30	1024	11	17	None	1023	Maxtor XT1105 1120, 4780
31	918	11	17	None	1023	Maxtor XT1170
32	925	9	17	None	926	CDC 9415
33	615	4	25	128	615	RLL TYPE
34	615	8	25	128	615	RLL TYPE
35	905	9	25	128	905	RLL TYPE
36	805	4	26	None	805	RLL TYPE
37	805	2	26	None	805	RLL TYPE
38	776	8	33	None	776	Conner CP3104
39	918	15	17	None	1023	MAXTOR XT1140, XT4380
40	820	6	17	None	820	Seagate 251
41	1024	9	45	None	1024	Conner CP3204
42	872	6	17	None	872	Rodime RD3055
43	872	7	17	None	872	Rodime RD3065
44	1024	5	17	128	1024	Miniscribe 3053
45	809	6	17	128	852	Miniscribe 3650
46	USER DEFINED					
47	USER DEFINED					

Table 4.1 lists all the entries in the standard fixed disk drive table supplied with PHOENIX C1.10.XX BIOS program. Forty-five drive types are defined. The first 23 drives follow the standard AT-Style SETUP drive table. Drive Types 24 through 45 are pre-defined disk types. Type 46 and 47 are user defined disk parameters which are stored in the EEPROM of IT386.

4.7 VIDEO

This selection specifies the type of the video adapter used with the primary system monitor. To make a choice, you must determine which of four fundamental types that your adapter emulates.

The choices are :

1. EGA/VGA (Enhanced Graphic Adapter/Video Graphic Adapter)
2. COLOR 40 (Color Adapter, power up in 40 column mode)
3. COLOR 80 (Color Adapter, power up in 80 column mode)
4. MONO (Monochrome Adapter)

The text in the parentheses do not appear on the SETUP screen.

Pressing the LEFT ARROW/RIGHT ARROW keys to select the choices.

To specify a VGA, SEGA, or PGA monitor adapter, choose EGA/VGA. There is no selection for secondary video adapters in the SETUP program. A monitor adapter must be specified and installed for the system to boot normally even though the monitor need not be installed.

After the video adapter field has been set, press UP ARROW or DOWN ARROW keys to move to other fields or press F10 or F1 key to terminate the SETUP program.

4.8 BASE MEMORY

This value should be set to the amount of normal contiguous memory of your computer which is below 1 megabyte. This should not include the amount of extended, expanded or video memory that your system has.

To set this value, type in the amount of memory, in kilobytes, using the numeric keys on your keyboard. In IT386, this entry is 640, whatever you installed with 1M or 4M main memory.

4.9 EXTENDED MEMORY

This value should be set to the amount of memory your computer has above the 1 megabyte boundary.

To set this value, type in the amount of memory, in kilobytes, using the numeric keys on your keyboard.

At power up time, the computer determines how much memory is present. If the value entered is different from the value the computer found, it will ask you to confirm that you have entered the correct value. Press the F5 key if you are sure you have the correct number. Press other keys if you want to restore the previous value.

4.10 SHADOW RAM

System BIOS ROM & Video BIOS ROM can be mapped to shadow RAM. There are four options :

1. ALL DISABLE
2. SYSTEM ONLY
3. VIDEO ONLY
4. SYSTEM & VIDEO

System shadow RAM is applied for the System BIOS. If EGA/VGA card is installed, its Video BIOS can also be mapped to the shadow RAM by setting this field.

Note: Not all the add-on cards supports shadow memory. For example, some EGA cards with Page Mode do not support shadow memory. Please consult your dealer if any problem arises.

4.11 ERROR HALT

This setting determines if the computer will stop when an error is detected during power up.

For most situations, choice 1 "HALT ON ALL ERROR" should be used. For some special applications, however, the computer should not halt. For example, file servers may not use a keyboard and should not halt when a keyboard error is detected. Choices 2, 3, 6 and 7 will prevent this halt from being executed.

The eight choices are :

1. Halt on All Error
2. No Halt on Any Error
3. No Keyboard Error Halt
4. No CRT Error Halt
5. No Diskette Error Halt
6. No CRT or Keyboard Error Halt
7. No Diskette or Keyboard Error Halt
8. No Diskette or CRT Error Halt

Pressing the LEFT ARROW/RIGHT ARROW keys for choosing among the options.

After the halt condition has been set, press the UP ARROW or DOWN ARROW keys to move to other fields or pressing F10 or F1-key to terminate the SETUP program.

4.12 SPEED SELECT

The initial system operating speed can be chosen by the SETUP program.

There are two choices for selection :

1. LOW (Low Speed, 8MHz)
2. High (High Speed, either 25MHz or 33MHz)

The text in the parentheses are not displayed on the screen.

Press LEFT ARROW and RIGHT ARROW key for selecting the desired initial operating speed.

After the speed select status has been changed, press the UP ARROW or DOWN ARROW keys to move to other fields or press the F10 or F1-key to terminate the SETUP program.

4.13 EXTENDED FEATURES ENABLE

The Extended features can be enabled or disabled by pressing the LEFT ARROW and RIGHT ARROW key.

For the Extended Features Set Up procedures, please refer to Part 5 of this manual.

After the extended feature selection has been changed, press the UP ARROW or DOWN ARROW keys to move to other fields or pressing the F10 or F1 keys to terminate the SETUP program.

PART 5

EXTENDED FEATURES

EXTENDED SELECT

The extended select feature is available only when the extended select program is running.

When the extended select program is running, the extended select feature is available.

The extended select feature is available only when the extended select program is running.

The extended select feature is available only when the extended select program is running.

PARTS
EXTENDED FEATURES

The extended features are available only when the extended features program is running.

The extended features are available only when the extended features program is running.

EXTENDED FEATURES ENABLE

The extended features are available only when the extended features program is running.

The extended features are available only when the extended features program is running.

The extended features are available only when the extended features program is running.

5.1 EXTENDED FEATURES OVERVIEW

The Extended Features take advantage of the power of INTEL 80386 microprocessor to provide additional functionality for the AT-compatible systems running MS-DOS or PC-DOS. Up to now, we have implemented the Disk Caching and Expanded Memory Manager for the extended features.

Most applications for AT compatible will execute with no problems with Extended Features enabled. Since Extended Features run under VM86 mode of 80386, other protected mode programs may not run if Extended Features are enabled. For example, DESQview386, OS/2, XENIX and Windows/386 cannot run with extended features.

Extended Features are intended for a DOS 3.x or DOS 4.x environment. However, other real mode operating systems may be partially supported, as well as programs which do not use an operating system, such as games.

5.2 CONFIGURE EXTENDED FEATURE

Extended Features can be selected and configured by the XFCOM.COM utility which comes with IT386.

The Extended Features configuration process includes the generation of several screens and the CONFIG.SYS file. In general, each feature requires an additional screen. The up and down arrow keys control selection of configuration values. The left and right arrow keys control selection of configuration values.

5.3 MEMORY ASSIGNMENT FOR EXTENDED FEATURES

As each feature is configured, its extended memory requirements are calculated and SETUP determines the amount of extended memory that would remain if this feature were enabled as configured.

The Extended Features kernel and non-configurable features require approximately 100K. Extended memory allocation is somewhat imprecise, since some features require physical memory to be aligned on 4K or 64K boundaries.

If message "Unable to load [feature]" appears at boot time, the user must reconfigure, assigning less extended memory to one or more of the features.

Some features require the exclusive use of 16K windows or portions of the memory in the 640K and 1024K address range. Any windows that conflict with window assignments for other features or with peripheral cards or video adapter ROM or RAM assignments are reported. Users must configure features so that no conflicts are reported when Extended Features configuration is completed.

In order to configure the Extended Features, User can run the XFCOM.COM utility. The utility generates the screen message :

```
Enable Extended Features ?   Y
```

User can globally disable Extended Features by selecting "No" at the prompt, Enable Extended Features, on the SETUP screen. Afterward, reset the machine such that the system can disable the Extended Features.

5.4 DISK CACHING

Fixed Disk Caching can greatly speed system performance, particularly when using programs that repeatedly access the same fixed disk data. Caching does this by saving information, which is read from fixed disk, to the extended memory of IT386. Then when the application program attempts to read the same information from fixed disk again, the information is copied from fast RAM rather than from disk.

● Read-ahead Capability

Caching automatically reads an entire track of information. With track read-ahead, the time spent seeking to a certain cylinder and finding a certain sector is spent once rather than multiple times. This feature is particularly useful if much of the data on the disk drive is organized sequentially.

● Requirements

Cache sizes of 1MB or more work very well; cache sizes of 512KB to 1MB are quite useful; cache sizes of less than 256KB may hinder performance; and cache sizes of less than 64KB cannot be configured. The size of the cache is in addition to the amount of extended memory required by the driver and the extended features kernel.

Caching assumes the fixed disks are controlled via a standard AT-compatible fixed disk controller, but most RLL , SCSI and ESDI fixed disk controllers may be supported also. If the BIOS supports a controller, this feature also supports it. Moreover, if there is more than one fixed disk drive, the caching feature maintains separate caches, and the user can select caching on either, neither, or both drives. User can configure the second disk caching by the XFCON.COM utility.

An screen example is given as follows :-

EXTENDED FEATURES CONFIGURATION

Configuration Feature : CACHE

Hard disk drive 1 cache size
(0 to disable) 0KB

Physical extended memory available : 1024KB
Physical extended memory allocated : 100KB
Window assignment conflict(s) at :

Change entry : <char>, Del Next menu item : Exit : ESC

5.5 EXTENDED MEMORY MANAGER

Extended Memory Manager (EMM) provides expanded (paged) memory according to either LIM-EMS (Lotus-Intel-Microsoft Expanded Memory Specification) Version 4.0 or the AST-Quadram-Ashton Tate Enhanced Expanded Memory Specification (EEMS) Version 3.2 using INTEL 80386 memory paging. While these two specifications are not entirely compatible, as long as all currently-running, expanded-memory-using applications use one of these two, no conflicts result. EMM performs requests made through either interface.

Applications making use of EMS 4.0 or EEMS 3.2 include Lotus 123, Lotus Symphony, Quarterdeck Systems' DESQview & Microsoft Windows 2.03.

● Requirements

EMM requires an amount of extended memory equal to the amount of expanded memory configured (in addition to the amount of extended memory required by driver and the Extended Features kernel).

● Configuration

Selected using the menu items EMS 4.0 Expanded Memory Size : (0 to disable). If a buffer size of 0 is selected, the Extended Memory Manager (EMM) is not enabled. Otherwise, EMM is enabled and the selected size is allocated. The size may be any multiple of 16K (16K is the size of an EMS page) between 128KB and 32MB but sizes of 1MB or more are typical. If conventional memory windows (explained below) are selected, the required minimum size is increased by that amount of memory. 640KB is the starting address for conventional memory windows.

● Expanded Memory Windows

EMS needs at least four 16KB windows - analogous to the windows in high memory described above - residing in the 640KB to 1MB area. Four of the 16K windows must be contiguous; this is the 64KB EMS 3.2 compatible window.

The menu item **Start Address** for the required 64KB Window : selects the starting address for this 64K area. Typical values are C8000H, D0000H, E0000H. A0000H is the lowest address and E0000H is the highest memory address that may be used. The address should be selected to avoid conflicts with ROM and RAM on peripheral cards. An EGA video card ROM, for instance, typically occupies 16K to 32K starting at C0000H.

In addition to the four EMS 3.2 compatible windows, EMM will create paged memory windows where possible between the end of conventional memory and address F0000H. At initialization, it checks each 16K location in this region for existing RAM (such as video RAM) or for peripheral card option ROMs and places an extra window at this location if neither is found.

This search can be disabled by responding **No** to the menu item "**Create extra 16KB windows where possible?**". This menu item can be safely ignored unless a device conflict arises.

● Windows In Conventional Memory

Some programs such as DESQview can swap expanded memory pages in and out of a region of conventional memory. EMM can place windows in such a region. This region always ranges from an address selected by the **Start address for conventional memory windows (normally 640 for none)**: menu item to the end of conventional memory. The user may select 640 (the default) for no paged conventional memory, or a start address of 512KB, 384KB, 256KB or 128KB.

For example, if the system has 640KB of conventional memory, and starts conventional memory paging at 256K, then $(640 - 256) = 384$ K of conventional memory, and TSRs, applications programs and other systems programs may take up additional conventional memory. Most users would be wise to reverse conventional memory for memory-intensive applications.

EXTENDED FEATURE CONFIGURATION

Configuration Feature : EMM

EMS 4.0 Expanded Memory size

(0 to disable) 512KB

Start address for required 64KB window : C00000H

Create extra 16KB windows where possible? Yes

Start address for conventional memory windows

(normal 640 for none) : 640KB

Physical extended memory available : 1024KB

Physical extended memory allocated : 100KB

Window assignment conflict(s) at :

Change entry : <char>, Del Next menu item Exit : Esc

5.6 CONFIGURATION REVIEW SCREEN

The following screen appears after the user has configured all features :

EXTENDED FEATURES CONFIGURATION

Changes will take effect when machine reboots
F1 to continue Extended Feature Configuration
Esc to exit and reboot
F10 to exit without rebooting

Physical extended memory available : 1024KB
Physical extended memory available : 100KB
Window assignment conflict(s) at :

Striking F1 allows the user to go back and reconfigure any Extended Feature. The user may want to do this, for example, if the physical extended memory allocated is reported to exceed the amount of memory available or if a window assignment conflict is reported.

Note: *The user should check carefully if the available extended memory is large enough for the allocated extended memory spend for extended features. If the available extended memory is not enough for the extended features, users should Press F1 for reconfiguring memory allocation for Extended Features.*

● Initial Installation of Feature Files

The user is prompted to permit the creation of the feature configuration files the first time Extended Features are used.

After the feature configuration files are created, the user is prompted to allow the file C:\CONFIG.SYS to be automatically edited to include automatic invocation of these features.

The file C:\CONFIG.SYS must contain the following line(s) :

```
DEVICE=XFEATS\CACHE.XF      for Disk Caching
DEVICE=XFEATS\EMM.XF       for Extended Memory
                             Manager
```

There must be a separate line in CONFIG.SYS for each feature to be configured. These feature configuration files should generally be invoked at the beginning of the CONFIG.SYS files, before any other "DEVICE =" lines. The EMM.XF invocation should be the last line that invokes a feature. If the user does not use the automatic CONFIG.SYS editing option, these lines will have to be added manually.

5.7 PROTECTED MODE VIOLATIONS

Extended Features run in the virture 86 mode of the INTEL 80386. It will not operate with other programs such as DESQview, OS/2™, XENIX, Windows/386 and any others that directly enter protected mode will not run with Extended Features enabled.

If there is a conflict with another program, following screen appears. The F1 option will not appear if Extended Features does not detect DOS.

EXTENDED FEATURES CONFIGURATION

Protected operation attempted with BIOS Extended Features enabled.

You must disable Extended Features to run this program.

F1 to cancel this program

F2 to reboot

F3 to disable Extended Features and reboot

5.8 CORRUPTED FILES

If any feature configuration file becomes corrupted or is missing, the user must delete all feature files. For example : `DEL C:\XFEATS*.XF` deletes all existing feature files. Run XFCOM utility to recreate the feature files with the default configurations.

APPENDIX A
TABLES

A.1 SYSTEM INTERRUPT

LEVEL	Function
NMI	Parity or I/O Channel Check

INTERRUPT CONTROLLER

CTRL 1	CTRL 2	Function
IRQ0		Timer Output 0
IRQ1		Keyboard (Output Buffer Full)
IRQ2		Interrupt from CTRL 2
	IRQ8	Real Time Clock Interrupt
	IRQ9	Software Redirected to INT AH
	IRQ10	Reserved
	IRQ11	Reserved
	IRQ12	Reserved
	IRQ13	Co-Processor
	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

A.2 DMA (DIRECT MEMORY ACCESS)

The DMA channel assignments are as follows :

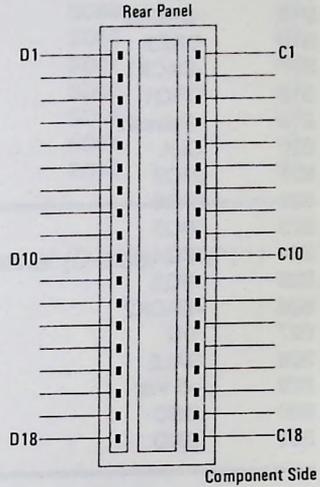
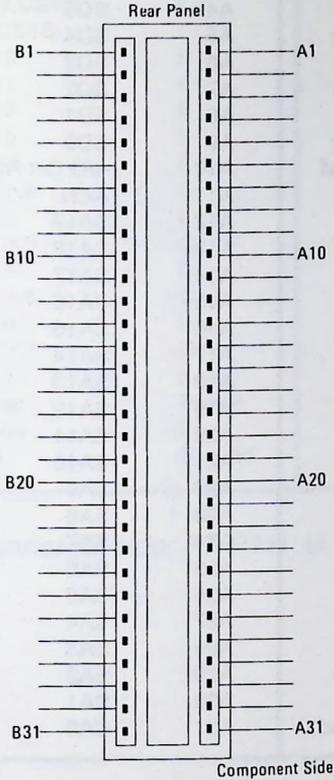
CTLR 1	CTLR 2
Ch 0-Spare	Ch 4-Cascade for CTLR 1
Ch 1-SDLC	Ch 5-Spare
Ch 2-Diskette	Ch 6-Spare
Ch 3-Spare	Ch 7-Spare

The address assignments are :

Page Register	I/O Hex Address
DMA Channel 0	0087
DMA Channel 1	0083
DMA Channel 2	0081
DMA Channel 3	0082
DMA Channel 5	0088
DMA Channel 6	0089
DMA Channel 7	008A
Memory Refresh	008F

A.3 I/O SLOT ARRANGEMENT

The numbering of the I/O slots are as follows:



I/O Channel Pin Numbering

P12-P17

I/O Channel Pin Numbering

P7-P11

Note: This board consists 8 I/O slots (5 with 36 pins and 62 pins card-edge socket, and 3 with only 62 pins card-edge socket).

I/O PIN	Signal Name	I/O	I/O PIN	Signal Name	I/O
B1	GND	Ground	A1	-I/O CH CK	I
B2	RESET DRV	O	A2	SD7	I/O
B3	+5 Vdc	Power	A3	SD6	I/O
B4	IRQ9	I	A4	SD5	I/O
B5	-5 Vdc	Power	A5	SD4	I/O
B6	DRQ2	I	A6	SD3	I/O
B7	-12 Vdc	Power	A7	SD2	I/O
B8	0 WS	I	A8	SD1	I/O
B9	+12 Vdc	Power	A9	SD0	I/O
B10	GND	Ground	A10	-I/O CH RDY	I
B11	-SMEMW	O	A11	AEN	O
B12	-SMEMR	O	A12	SA19	I/O
B13	-IOW	I/O	A13	SA18	I/O
B14	-IOR	I/O	A14	SA17	I/O
B15	-DACK3	O	A15	SA16	I/O
B16	DRZ3	I	A16	SA15	I/O
B17	-DACK1	O	A17	SA14	I/O
B18	DRQ1	I	A18	SA13	I/O
B19	-Refresh	I/O	A19	SA12	I/O
B20	CLK	O	A20	SA11	I/O
B21	IRQ7	I	A21	SA10	I/O
B22	IRQ6	I	A22	SA9	I/O
B23	IRQ5	I	A23	SA8	I/O
B24	IRQ4	I	A24	SA7	I/O
B25	IRQ3	I	A25	SA6	I/O
B26	-DACK2	O	A26	SA5	I/O
B27	T/C	O	A27	SA4	I/O
B28	BALE	O	A28	SA3	I/O
B29	+5 Vdc	Power	A29	SA2	I/O
B30	OSC	O	A30	SA1	I/O
B31	GND	Ground	A31	SA0	I/O

Note: I/O Channel (A side, P12-P17) I/O Channel (B side, P12-P17)

TABLE OF I/O EXTENSION SLOTS (to be cont.)

TABLE OF I/O EXTENSION SLOTS (Cont.)

I/O PIN	Signal Name	I/O	I/O PIN	Signal Name	I/O
D1	-MEM CS16	I	C1	SBHE	I/O
D2	-I/O CS16	I	C2	LA23	I/O
D3	IRQ10	I	C3	LA22	I/O
D4	IRQ11	I	C4	LA21	I/O
D5	IRQ12	I	C5	LA20	I/O
D6	IRQ15	I	C6	LA19	I/O
D7	IRQ14	I	C7	LA18	I/O
D8	-DACK0	O	C8	LA17	I/O
D9	DRQ0	I	C9	-MEMR	I/O
D10	-DACK5	O	C10	-MEMW	I/O
D11	DRQ5	I	C11	SD08	I/O
D12	-DACK6	O	C12	SD09	I/O
D13	DRQ6	I	C13	SD10	I/O
D14	-DACK7	O	C14	SD11	I/O
D15	DRQ7	I	C15	SD12	I/O
D16	+5 Vdc	Power	C16	SD13	I/O
D17	-Master	I	C17	SD14	I/O
D18	GND	Ground	C18	SD15	I/O

Note: I/O Channel (C-side, P7-P11) I/O Channel (D-side, P7-P11)

TABLE OF NO. EXTENSION & NO. LEVEL

NO. EXTENSION	NO. LEVEL	NO. EXTENSION	NO. LEVEL
000	000	000	000
001	001	001	001
002	002	002	002
003	003	003	003
004	004	004	004
005	005	005	005
006	006	006	006
007	007	007	007
008	008	008	008
009	009	009	009
010	010	010	010
011	011	011	011
012	012	012	012
013	013	013	013
014	014	014	014
015	015	015	015
016	016	016	016
017	017	017	017
018	018	018	018
019	019	019	019
020	020	020	020
021	021	021	021
022	022	022	022
023	023	023	023
024	024	024	024
025	025	025	025
026	026	026	026
027	027	027	027
028	028	028	028
029	029	029	029
030	030	030	030
031	031	031	031
032	032	032	032
033	033	033	033
034	034	034	034
035	035	035	035
036	036	036	036
037	037	037	037
038	038	038	038
039	039	039	039
040	040	040	040
041	041	041	041
042	042	042	042
043	043	043	043
044	044	044	044
045	045	045	045
046	046	046	046
047	047	047	047
048	048	048	048
049	049	049	049
050	050	050	050
051	051	051	051
052	052	052	052
053	053	053	053
054	054	054	054
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058	058	058	058
059	059	059	059
060	060	060	060
061	061	061	061
062	062	062	062
063	063	063	063
064	064	064	064
065	065	065	065
066	066	066	066
067	067	067	067
068	068	068	068
069	069	069	069
070	070	070	070
071	071	071	071
072	072	072	072
073	073	073	073
074	074	074	074
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076	076	076	076
077	077	077	077
078	078	078	078
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082	082	082	082
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089	089	089	089
090	090	090	090
091	091	091	091
092	092	092	092
093	093	093	093
094	094	094	094
095	095	095	095
096	096	096	096
097	097	097	097
098	098	098	098
099	099	099	099
100	100	100	100

TABLE OF NO. EXTENSION & NO. LEVEL (CONTINUED)

TABLE OF NO. EXTENSION & NO. LEVEL (CONTINUED)

APPENDIX B
IT-FEM 386

B.1 PRODUCT SPECIFICATIONS OF IT-FEM386

Memory Size	2MB to 12MB in 2MB increment
Memory Type	DIP RAM (1M x 1 Bit), Fast Page Mode 4MB On Board and 8MB On Piggy Back Board
DRAM Speed	100ns
Memory Arrangement	Extended Memory, Start Address at 1MB/4MB
Memory Management	Page Mode with Single Page Register
I/O Bus	One 32-bit Fast RAM BUS and One 8-bit ISA Bus
Board Size	Full Size XT Add-on Card
DIP Switch/Jumper	1. For Base Address at 1MB/4MB 2. For Enable of the RAM Banks

B.2 PIN ASSIGNMENT OF THE FAST SLOT

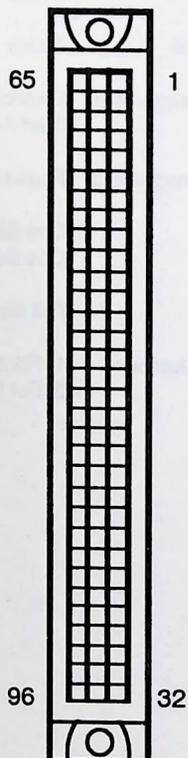


Fig B.1 Fast slot on mother board 32 x 3 DIN Connector

The signal description of the 32-bit Fast Slot is tabulated as follows:

I/O PIN	Signal Name	I/O
1	BA2	I
2	BA5	I
3	BA8	I
4	BA11	I
5	BA14	I
6	BA17	I
7	GBA20	I
8	BA23	I
9	-SBHE	I
10	BHLDA	I
11	BD0	I/O
12	BD3	I/O
13	BD6	I/O
14	BD9	I/O
15	BD12	I/O
16	BD15	I/O
17	BD18	I/O
18	BD21	I/O
19	BD24	I/O
20	BD27	I/O
21	BD30	I/O
22	GND	Ground
23	-GT8M	O
24	Z2	O
25	-FM32	O
26	-BADS	I
27	BM-/O	I
28	BD/-C	I
29	SD8	I/O
30	-BBE1	I
31	-BBE3	I
32	Vcc	Power

TABLE OF FAST SLOT PIN ASSIGNMENT (to be cont.)

TABLE OF FAST SLOT PIN ASSIGNMENT (Cont.)

I/O PIN	Signal Name	I/O
33	BA3	I
34	BA6	I
35	BA9	I
36	BA12	I
37	BA15	I
38	BA18	I
39	BA21	I
40	GND	Ground
41	-MEMW	I
42	NC	
43	BD1	I/O
44	BD4	I/O
45	BD7	I/O
46	BD10	I/O
47	BD13	I/O
48	BD16	I/O
49	BD19	I/O
50	BD22	I/O
51	BD25	I/O
52	BD28	I/O
53	BD31	I/O
54	GND	Ground
55	SD14	I/O
56	Z1	O
57	SD13	I/O
58	SD12	I/O
59	SD11	I/O
60	SD10	I/O
61	SD9	I/O
62	BA25	I
63	-MEMCS16	O
64	Vcc	Power

NC: No Collection

TABLE OF FAST SLOT PIN ASSIGNMENT (Cont.)

I/O PIN	Signal Name	I/O
65	BA4	I
66	BA7	I
67	BA10	I
68	BA13	I
69	BA16	I
70	BA19	I
71	BA22	I
72	GND	Ground
73	-MEMR	I
74	BA20	I
75	BD2	I/O
76	BD5	I/O
77	BD8	I/O
78	BD11	I/O
79	BD14	I/O
80	BD17	I/O
81	BD20	I/O
82	BD23	I/O
83	BD26	I/O
84	BD29	I/O
85	SD15	I/O
86	GND	Ground
87	-FMPAR	O
88	Z0	O
89	Z3	O
90	-FMREADY	O
91	BW/R	I
92	CLK	I
93	-BBE0	I
94	-BBE2	I
95	Vcc	Power
96	Vcc	Power

(Note: The following table is a reconstruction of the extremely faint content on the page. It appears to be a list of items with associated numerical values and possibly dates or codes.)

Item/Code	Value 1	Value 2	Value 3
101	100	100	100
102	100	100	100
103	100	100	100
104	100	100	100
105	100	100	100
106	100	100	100
107	100	100	100
108	100	100	100
109	100	100	100
110	100	100	100
111	100	100	100
112	100	100	100
113	100	100	100
114	100	100	100
115	100	100	100
116	100	100	100
117	100	100	100
118	100	100	100
119	100	100	100
120	100	100	100
121	100	100	100
122	100	100	100
123	100	100	100
124	100	100	100
125	100	100	100
126	100	100	100
127	100	100	100
128	100	100	100
129	100	100	100
130	100	100	100
131	100	100	100
132	100	100	100
133	100	100	100
134	100	100	100
135	100	100	100
136	100	100	100
137	100	100	100
138	100	100	100
139	100	100	100
140	100	100	100
141	100	100	100
142	100	100	100
143	100	100	100
144	100	100	100
145	100	100	100
146	100	100	100
147	100	100	100
148	100	100	100
149	100	100	100
150	100	100	100

Collection

ERROR MESSAGE OF POST

APPENDIX C
ERROR MESSAGE

APPENDIX C
ERROR MESSAGE

C.1 ERROR MESSAGE OF POST

Message	Possible Cause	Solution
CMOS checksum error	Power loss for the CMOS.	Run SETUP for re-init CMOS. Check the battery.
Diskette configuration error	The specified configuration is not supported.	Change the configuration. Check the diskette adapter.
Diskette drive reset failed	The diskette adapter has failed.	Check the diskette adapter.
Diskette drive 1 seek failure	The B: drive failed or is missing.	Check the B: drive.
Diskette drive 0 seek failure	The A: drive failed or is missing.	Check the A: drive.
Diskette drive reset failed	The diskette adapter has failed.	Check the diskette adapter.
Diskette read failure - strike F1 to retry boot	The diskette is either not formatted or defective.	Replace the diskette with a bootable diskette and retry.
Diskette type mismatch error	Invalid Configuration Information input.	Run SETUP
Display adapter failed using alternate	- The color/monochrome switch is set wrong. - The primary video adapter failed.	- Change the switch to the correct setting. - Check the primary video adapter.
Display type mismatch error	Invalid Configuration Information input.	Run SETUP
EEPROM fails	Hardware failure in the EEPROM circuit.	Not fatal, use CMOS instead, run SETUP. Contact qualified service personnel.
EEPROM uninitialized	EEPROM is not set.	Run SETUP
Errors found; disk X: Failed Initialization	POST reports fixed disk configuration information is incorrect.	Return SETUP and enter correct fixed disk information.

Message	Possible Cause	Solution
Errors found; Incorrect configuration information, memory size miscompare	POST reports the size of base or extended memory does not agree with configuration information.	Return SETUP and enter correct memory size.
Gate A20 failure	Protected mode cannot enable.	Check the system board.
Fixed disk configuration error	The specified configur- ation is not supported.	Correct the fixed disk configuration.
Fixed disk controller failure	The controller card has failed.	Replace the controller card.
Fixed disk failure	Bad disk	Retry boot. If that doesn't work, replace the fixed disk.
Fixed disk read failure - strike F1 to retry boot	The fixed disk is defective.	Retry boot. If that doesn't work, replace the fixed disk.
FDD controller failure	Disk and diskette controller failed.	Replace the controller card.
FDD A is not installed	Cannot find diskette controller for diskette drive A.	Either install or replace the controller card.
FDD B is not installed	Cannot find diskette controller for diskette drive B.	Either install or replace the controller card.
Invalid configuration information - please run SETUP program	- Memory size is incorrect. - Display adapter is configured incorrectly. - Wrong number of diskette drives.	Run the SETUP utility.
Keyboard clock line failure/ Keyboard data line failure	Either the keyboard or the keyboard cable connection is defective.	Make sure the keyboard cable and keyboard are connected properly.
Keyboard Controller failure	The Keyboard controller firmware has failed.	Check the keyboard controller.
Keyboard Stuck key failure	A key(s) is jammed.	Try pressing the key(s) again.

Message	Possible Cause	Solution
Memory address line failure at <i>hex-value</i> , read <i>hex-value</i> , expecting <i>hex-value</i>	Circuitry associated with the memory chips has failed.	Try turning the power off, then back on again. If the problem persists, contact qualified service personnel.
Memory data line failure at <i>hex-value</i> , read <i>hex-value</i> , expecting <i>hex-value</i>	One of the memory chips or associated circuitry failed.	Try turning the power off, then back on again. If the problem persists, contact qualified service personnel.
Memory high address line failure at <i>hex-value</i> , read <i>hex-value</i> , expecting <i>hex-value</i>	Circuitry associated with the memory chips has failed.	Try turning the power off, then back on again. If the problem persists, contact qualified service personnel.
Memory double word logic failure at <i>hex-value</i> , read <i>hex-value</i> , expecting <i>hex-value</i>	Memory chip circuitry failed.	Try turning the power off, then back on again. If the problem persists, contact qualified service personnel.
Memory odd/even logic failure at <i>hex-value</i> , read <i>hex-value</i> , expecting <i>hex-value</i>	Circuitry associated with the memory chips has failed.	Try turning the power off, then back on again. If the problem persists, contact qualified service personnel.
Memory parity failure at <i>hex-value</i> , read <i>hex-value</i> , expecting <i>hex-value</i>	One of the parity memory chips has failed.	Try turning the power off, then back on again. If the problem persists, contact qualified service personnel.
Memory write/read failure at <i>hex-value</i> , read <i>hex-value</i> , expecting <i>hex-value</i>	One of the memory chips has failed.	Turn the power off, then back on again. If the problem persists, contact qualified service personnel.
No boot device available - Strike F1 to retry boot	Either diskette drive A:, the fixed disk, or the diskette itself is defective.	Retry boot. If problem persists, replace the diskette or the fixed disk.
No boot sector on fixed disk - strike F1 to retry boot	The C: drive is not formatted or is not bootable.	Format the C: drive, make it bootable.
Not a boot diskette - strike F1 to retry boot	The diskette in drive A: is not formatted as a bootable diskette.	Replace the diskette with a bootable diskette and retry boot.

Message	Possible Cause	Solution
No timer tick interrupt	The timer chip has failed.	Turn the power off, then back on again. If the problem persists, contact qualified service personnel.
<i>Hex-value</i> optional ROM bad checksum = <i>hex-value</i>	The peripheral card contains a defective ROM.	Replace the peripheral card.
Real time clock data error	CMOS power loss	Run SETUP
Shutdown failure	The keyboard controller or its associated logic has failed.	Check the keyboard controller.
Time-of-day clock stopped	The CMOS time-of-day clock chip has failed.	Run SETUP
Time-of-day not set-please run SETUP program	Clock is not set.	Run SETUP
Timer chip counter 2 failed	Chip failed.	Turn the power off, then back on again. If the problem persists, contact qualified service personnel.
Timer or interrupt controller bad	Either the timer chip or the interrupt controller is defective.	Check the timer chip on the system board.
Unexpected interrupt in protected mode	The nonmaskable interrupt (NMI) port can't be disabled.	Check the timer chip or the interrupt controller on the system board.
Memory Size Error	Invalid Configuration Information is input	Run SETUP

C.2 RUN TIME ERROR MESSAGE

The error message tabulated below are displayed if an error occurs after the boot procedure is completed.

Message	Possible Cause	Solution
I/O card parity interrupt at <i>address</i> . Type (S)hut off NMI, (R)eboot, other keys to continue	The peripheral card has failed	Type (S)hut off NMI Note : This will only temporarily allow the user to continue, the user must replace the peripheral card
Memory parity interrupt at <i>address</i> . Type (S)hut off NMI, (R)eboot, other keys to continue	A memory chip(s) has failed	Type (S)hut off NMI Note : This will only temporarily allow the user to continue, the user must replace the peripheral card
Unexpected HW interrupt interrupt at <i>address</i> . Type (R)eboot, other keys to continue	This could be any hardware-related problem Note : Not displayed if the extended interrupt handler is not enabled	Check the hardware
Unexpected SW interrupt interrupt at <i>address</i> . Type (R)eboot, other keys to continue	There is an error(s) in the software program Note : Not displayed if the extended interrupt handler is not enabled	Try turning the machine off and then on again. If that doesn't work, check the program
Unexpected type 02 interrupt at <i>address</i> . Type (S)hut off NMI, (R)eboot, other keys to continue	There is an error(s) in the software program Note : Not displayed if the extended interrupt handler is not enabled	Try turning the machine off and then on again. If that doesn't work, check the program

C.3 EXTENDED FEATURES RUN-TIME MESSAGES

The following messages may be generated if another program conflicts with Extended Features.

Note: *F1 will always abort the conflicting program if any of the following messages are encountered. The Print Screen function will still operate if these messages are generated.*

Message	Possible Cause	Solution
Protected operation attempted with extended features enabled F1 to abort program F2 to reboot F3 to disable extended features and reboot	Another program entered the protected mode of the 80386 microprocessor while Extended Features were active	Press F1, F2, or F3
Halt at xxxx:xxxx F2 to reboot F3 to disable extended features and reboot	A halt was executed with interrupts disabled	Press F2 or F3
Protection violation at xxxx:xxxx F2 to reboot F3 to disable extended features and reboot	An exception 0DH occurs because of a segment limit or access rights byte violation	Press F2 or F3
Exception xx at xxxx:xxxx F2 to reboot F3 to disable extended features and reboot	The kernel cannot service an exception	Press F2 or F3

C.4 BEEP CODES

Sometimes POST errors cannot be reported on the screen. When an error occurs before the screen is initialized or when the system is set to loop on the system board tests, then the screen cannot display the error message. Beep codes are used to identify a POST error that occurs when the screen is not available.

e.g. A 2-1-4 beep code (a burst of 2 beeps, a single beep, and a burst of 4 beeps) indicates a failure of bit 3 in the first 64K of RAM.

The Beep Codes for fatal and non-fatal system board errors are listed separately on the following table :-

Beep Code	Contents Port (80h)	Description
none	01h	CPU register test in progress
1-1-3	02h	CMOS write/read failure
1-1-4	03h	ROM BIOS checksum failure
1-2-1	04h	Programmable interval timer failure
1-2-2	05h	DMA initialization failure
1-2-3	06h	DMA page register write/read failure
1-3-1	08h	RAM refresh verification failure
none	09h	First 64K RAM test in progress
1-3-3	0Ah	First 64K RAM chip or data line failure, multi-bit
1-3-4	0Bh	First 64K RAM odd/even logic failure
1-4-1	0Ch	Address line failure first 64K RAM
1-4-2	0Dh	Parity failure first 64K RAM
2-1-1	10h	Bit 0 first 64K RAM failure
2-1-2	11h	Bit 1 first 64K RAM failure
2-1-3	12h	Bit 2 first 64K RAM failure
2-1-4	13h	Bit 3 first 64K RAM failure
2-2-1	14h	Bit 4 first 64K RAM failure
2-2-2	15h	Bit 5 first 64K RAM failure
2-2-3	16h	Bit 6 first 64K RAM failure
2-2-4	17h	Bit 7 first 64K RAM failure
2-3-1	18h	Bit 8 first 64K RAM failure
2-3-2	19h	Bit 9 first 64K RAM failure
2-3-3	1Ah	Bit 10 first 64K RAM failure
2-3-4	1Bh	Bit 11 first 64K RAM failure
2-4-1	1Ch	Bit 12 first 64K RAM failure
2-4-2	1Dh	Bit 13 first 64K RAM failure
2-4-3	1Eh	Bit 14 first 64K RAM failure
2-4-4	1Fh	Bit 15 first 64K RAM failure

Beep Code	Contents Port (80h)	Description
3-1-1	20h	Slave DMA register failure
3-1-2	21h	Master DMA register failure
3-1-3	22h	Master interrupt mask register failure
3-1-4	23h	Slave interrupt mask register failure
none	25h	interrupt vector loading in progress
3-2-4	27h	Keyboard controller test failure
none	28h	CMOS power failure and checksum calculation in progress
none	29h	CMOS configuration validation in progress
3-3-4	2Bh	Screen initialization failure
3-4-1	2Ch	Screen retrace test failure
3-4-2	2Dh	Search for VIDEO ROM in progress
none	2Eh	Screen running with VIDEO ROM
none	30h	Screen operable
none	30h	Screen running with video ROM
none	31h	Monochrome monitor operable
none	32h	Color monitor (40 column) operable
none	33h	Color monitor (80 column) operable

APPENDIX D

GLOSSARY

Page	Page	Description
100	100	How to use the manual
101	101	What this manual covers
102	102	How to use the manual
103	103	How to use the manual
104	104	How to use the manual
105	105	How to use the manual
106	106	How to use the manual
107	107	How to use the manual
108	108	How to use the manual
109	109	How to use the manual
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123	123	How to use the manual
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137	137	How to use the manual
138	138	How to use the manual
139	139	How to use the manual
140	140	How to use the manual
141	141	How to use the manual
142	142	How to use the manual
143	143	How to use the manual
144	144	How to use the manual
145	145	How to use the manual
146	146	How to use the manual
147	147	How to use the manual
148	148	How to use the manual
149	149	How to use the manual
150	150	How to use the manual

BASE MEMORY - Base memory (also known as Conventional Memory) is the memory that DOS can manipulate. Usually, the base memory size can be 256KB, 512KB or 640KB.

BIOS - Basic Input/Output System which is a set of software routines stored in ROM of the computer providing the interface control between software and hardware.

CACHE MEMORY - Cache Memory is a very fast memory which sits between the high speed CPU and low speed Main Memory. It is used to provide a buffer between the main memory and CPU. Hence, instead of fetching information from main memory, CPU will get the desired information from CACHE. Owing to the fast access time of CACHE, CPU can operate smoothly and need not be waiting for the data and instruction fetching (i.e. Wait State). As a result, the efficiency of CPU can be maximized.

CACHE CONTROLLER - Cache Controller is used to "MONITOR" the main memory, cache memory and CPU of the computer system. As a result, the required data can be pre-fetched from main memory to the cache to achieve the zero wait state operation.

CACHE HIT RATE - the frequency of memory accesses that result in the desired information being found in the cache rather than the main memory. Usually, it is expressed in percentage. A cache system with over 90% hit rate is an excellent system.

CAD - Computer Aided Design

CAE - Computer Aided Engineering

CAM - Computer Aided Manufacturing

CHIP SET - Chip Set is a set of VLSI (Very Large Scale Integrated Circuit) designed for some specific application. e.g. AT Chip Set is a special design VLSI for integrating those MSIs, LSIs and SSI chips together.

DISK CACHING - Disk Caching has employed the extended memory as the buffer for storing the frequently access portion of hard disk contents. As a result, the system can fetch the data from memory rather than the external hard disk. Hence, the overhead of disk access can be minimized. A driver is required for the disk pre-fetching and writing. In IT386, a Disk Caching driver is provided for improving the disk access performance.

EXPANDED MEMORY - Expanded Memory is the bank-switched memory sub-system used for 286/386 based computer to circumvent the 1MB limitation of standard 8086/88 compatible packages. There are two standards for the expanded memory. Lotus-Intel-Microsoft EMS 4.0 and AST-Quadram-Ashton Tate EEMS 3.2. Users can consult the corresponding documents for the specifications.

EXPANDED MEMORY MANAGER - Expanded Memory Manager (EMM) is a driver for converting the Extended Memory to the Expanded Memory by means of software control. Usually, the expanded memory managers are different for the EMS specifications. However, the EMM comes with IT386 supports both specifications with the same driver. Hence, the problem of EMM compatibility is eliminated.

EXTENDED MEMORY - Extended Memory is the memory that is above the 1M boundary installed. It can be configured as expanded memory with the help of expanded memory manager.

ISA - Industrial Standard Architecture, the traditional Bus Expansion Slot used in IBM PC/XT/AT products.

RAM - Short form of Random Access Memory in which data can be read out or write in whenever power is supplied. It can be divided into SRAM (Static RAM) and DRAM (Dynamic RAM). The operation of SRAM is simpler than that of DRAM. The data accessing time of SRAM is faster so that it is usually used in the CACHE SYSTEM.

REAL MODE - When the microprocessor 80386 is reset or power up, it is initialized in the real mode which provides the capabilities of 8086. Under real mode, the maximum physical memory that can be addressed is 1MB. On the other hand, all the memory protection features are not available. Further, the segment size is limited to 64KB under real mode.

ROM - Short form of Read Only Memory in which data can be read out only. It is used for storing system program such as the BIOS.

PAGE MODE MEMORY INTERFACE - Page Mode Memory Interface is a technique in accessing DRAM chips such that the memory fetching overhead can be eliminated. In the traditional DRAM structure, the memory address has been divided into row address (high order bits) and column address (low order bits) which are equal in bit size. Whenever memory fetching cycle starts, the row address and column address will be input to the DRAM chip by multiplexing method.

Consider a sequence of memory fetching in which the address of memory locations are successive. Assume that all the cells involved are all on the same row in the memory chip. Owing to the memory address are loaded separately into the corresponding registers, it has to load the row address once only. Hence, only column addresses are required to change during the successive memory cycles. As a result, the overhead in row address loading can be eliminated. This technique of memory fetching is named as "PAGE MODE".

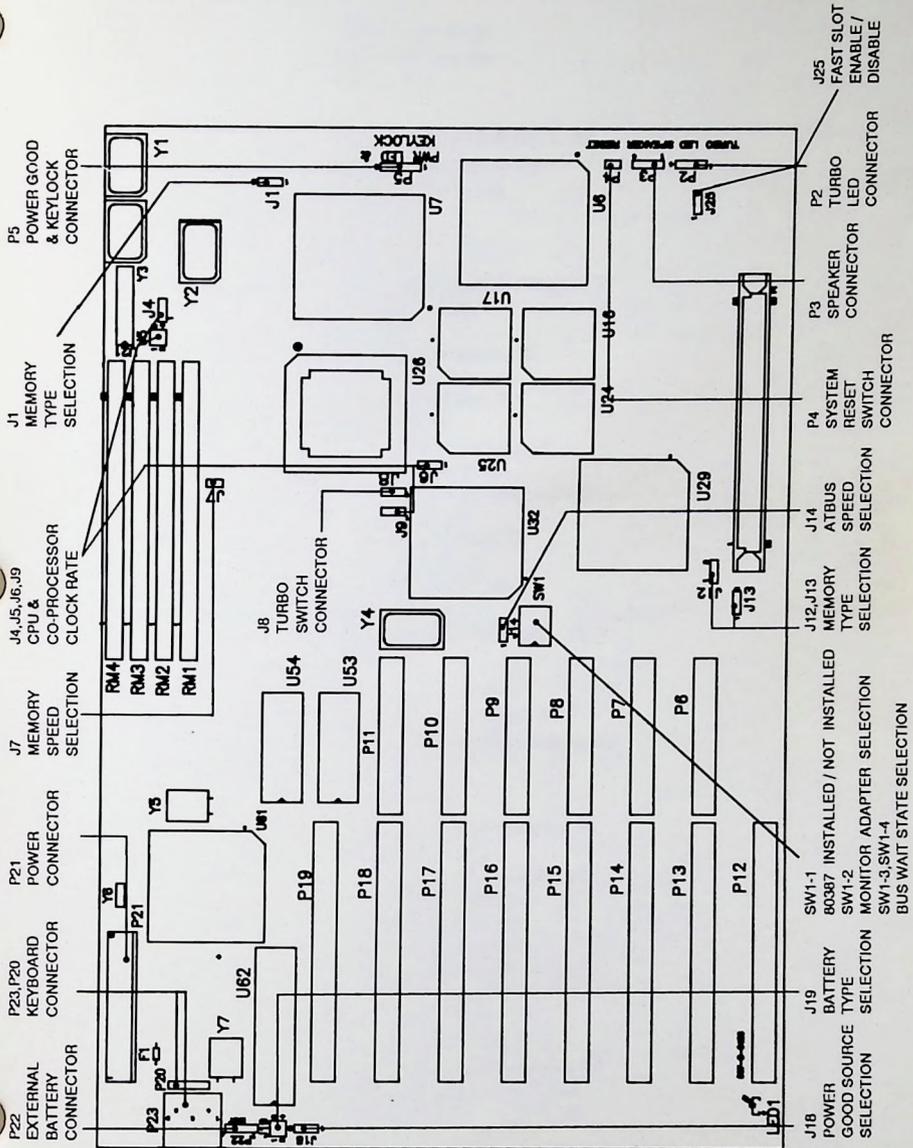
PROTECT MODE - INTEL 80386 provides features compatible with the 80286. It supports the memory protection, memory paging, I/O protection and virtual memory as that in the 80286. However, it offers the segmentation size up to 4 Gigabyte and 32-bit operation which are not provided in the 80286.

VIRTUAL 86 MODE - INTEL 80386 also offers the Virtual 86 mode to provided the feature of concurrent execution of Real Mode Applications with proper protection. Besides memory protection, 80386 also provides the feature of I/O protection.

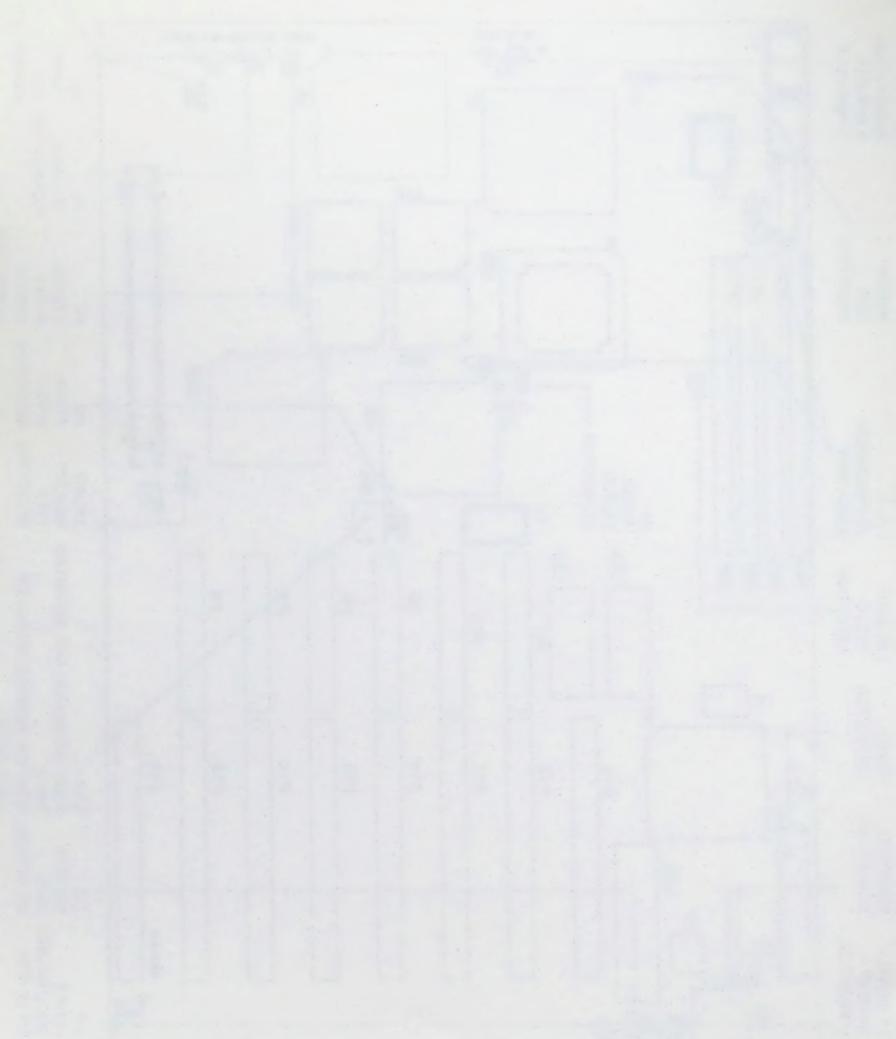
APPENDIX E
LAYOUT

APPENDIX E
LAYOUT

LAYOUT OF IT386 MINI SYSTEM BOARD



LAYOUT OF THE SYSTEM



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