MCS 386SX/16V SYSTEM BOARD

First Edition April 1990

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MCS

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MCS 386SX/16V - INTRODUCTION

The MCS 386SX/16V personal computer system board is a high performance and low cost AT-compatible system board based on the Intel 80386SX microprocessor. It features a 32-bit software architecture which includes a 32-bit fully 80386 compatible CPU and 16-bit hardware architecture with 16-bit data and 24-bit address buses. These characteristics provide the performance benefit of 32-bit software architecture with system cost comparable to a 12 MHz 16-Bit 80286 personal computer system board.

On this i386SX based product, a custom Page mode memory controller is employed to optimise the performance of the CPU. This main memory controller allows the system to run at maximum speed while at the same time using low cost and widely available 80 ns DRAMs. System ROM BIOS and Video BIOS are also shadowed by the fast main memory allowing BIOS routines to execute at a much faster rate. Up to 7 MB of 32-Bit main memory can be directly installed onto the MCS 386SX/16V system board without taking up any of the expansion slots.

For hardware expansion, 6 16-bit PC/AT slots and 2 PC/XT slots are provided on the MCS 386SX/16V system board. All the expansion slots operating at 8 MHz bus speed are designed to maintain the de-facto IBM PC/AT bus standard even though the CPU itself runs at the maximum clock rate of 16 MHz. This ensures the user the access to the billions of dollars worth of established industry standard products currently available.

Software compatibility is achieved through the use of a customized BIOS from AWARD Software. The BIOS supports all the special features of the board and provides the necessary BIOS services to emulate an IBM PC/AT. In addition, a convenient soft-setup utility is built into the BIOS ROMs to eliminate the need for a diskette based setup program.

Typical applications for a system configured around a MCS 386SX/16V motherboard include :

* For business or accounting applications
* For DOS, OS/2 or UNIX software development
* For cost effective CPU intensive applications like Computer-Aided Design, desktop publishing and database management systems.
* As a network terminal or file server

MAIN FEATURES OF THE MCS 386SX/16V

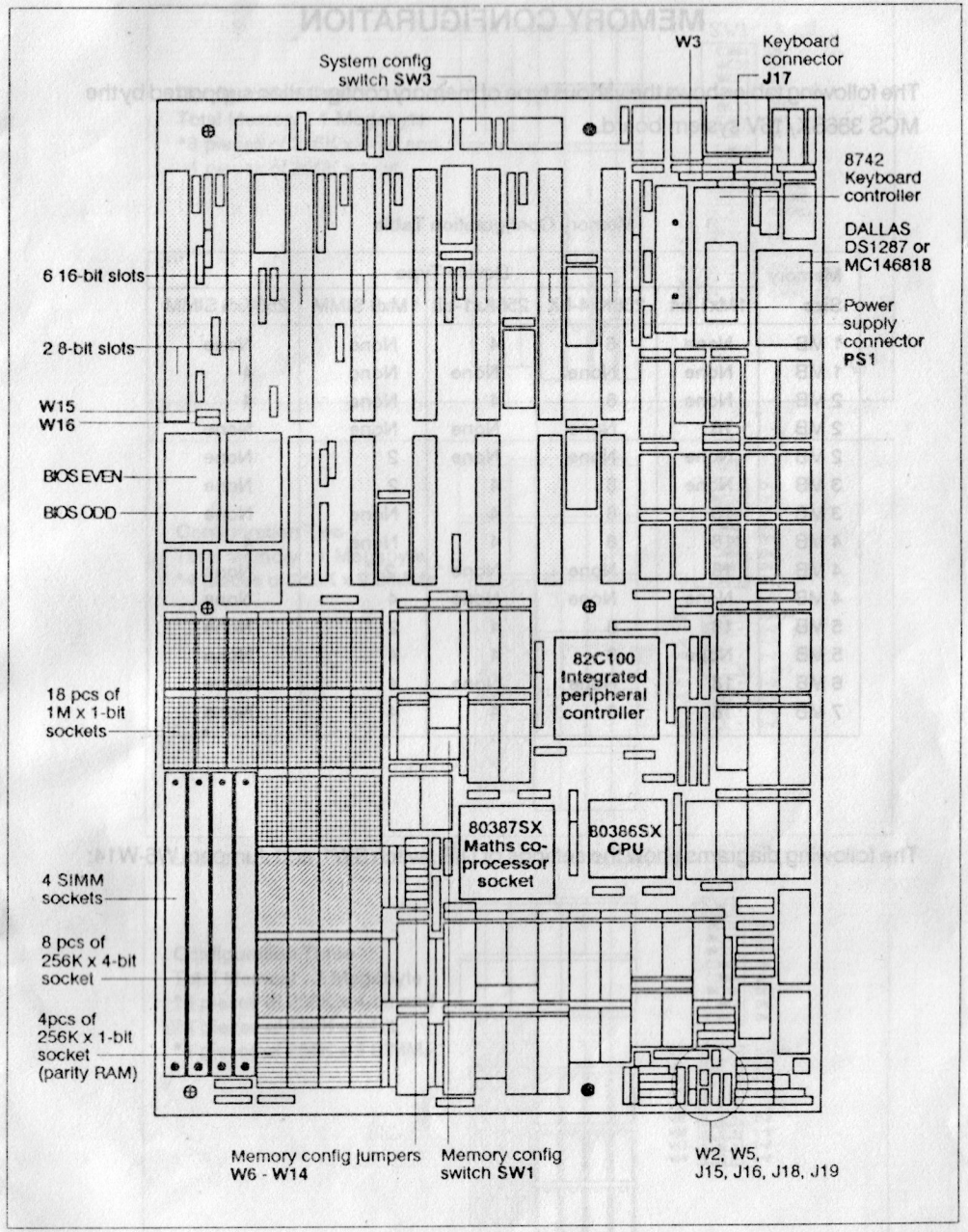
The following hightlight the main features of the MCS 386SX/16V system board:

* 32-bit Intel 80386SX microprocessor running at 16 MHz
* Socket for 80387SX Coprocessor
* Page mode main memory (DRAM) controller
  Page-hit memory cycles : 0 wait states
  Page-miss memory cycles : 2 wait states
* 1/2/3/4/5/6/7 MB of main memory on-board using DRAMs with access time of 80 ns.
* Supports various type of DRAM for lowest cost minimum system configurations:
  - 8 pcs of 44256 and 4 pcs 41256 (1 MBytes)
  - 18 pcs of 411000 (2 MBytes)
  - 4 pcs of 256k by 9 SIMM module (1 MBytes)
  - 2 pcs of 1Meg by 9 SIMM module (2 MBytes)
* Shadow ROM and Video BIOS
* On-board system support peripherals:
  - 7 DMA channels
  - 15 levels of interrupts
  - 6 programmable timer/counters
* Dallas real time clock to ensure clock accuracy
* 8 Expansion Slots comprising 6 16-bit and 2 8-bit slots
  Fully 8 MHz IBM PC/AT bus compatibility
* Customized ROM BIOS with built-in SETUP from AWARD Software
* High quality 4-layer Printed Circuit Board
* Standard BABY-AT form factor and mounting holes

System Board DIP Switch SW3 Settings			
SW No	Function	Configuration	Position
1	Soft-Turbo	Enabled Disabled	ON* OFF
2	80387SX	Installed Not Installed	ON* OFF
3	Display Type	CGA/EGA/VGA Monochrome	ON* OFF
4	OS/2 Optimisation	Enabled Disabled	ON* OFF

DIP Switch Block SW3

Default:
Setspeed enabled
80387SX installed
CGA/EGA/VGA adaptor
OS/2 optimisation enabled



MCS 386SX/16V System Board Layout

MEMORY CONFIGURATION

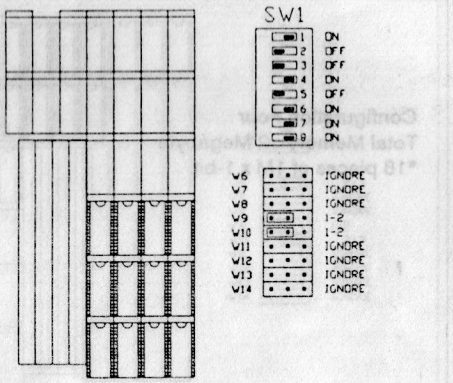
The following table shows the various type of memory configuration supported by the MCS 386SX/16V system board.

Memory Configuration Table

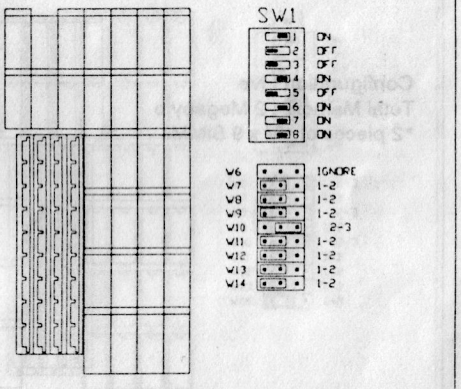
Memory Size	Device Type				
	1Mx1-bit	256Kx4-bit	256Kx1-bit	1Mx9 SIMM	256Kx9 SIMM
1 MB	None	8	4	None	None
1 MB	None	None	None	None	4
2 MB	None	8	4	None	4
2 MB	18	None	None	None	None
2 MB	None	None	None	2	None
3 MB	None	8	4	2	None
3 MB	18	8	4	None	None
4 MB	18	8	4	None	4
4 MB	18	None	None	2	None
4 MB	None	None	None	4	None
5 MB	18	8	4	2	None
5 MB	None	8	4	4	None
6 MB	18	None	None	4	None
7 MB	18	8	4	4	None

The following diagrams show the settings of DIP switch SW1 and Jumpers W6-W14:

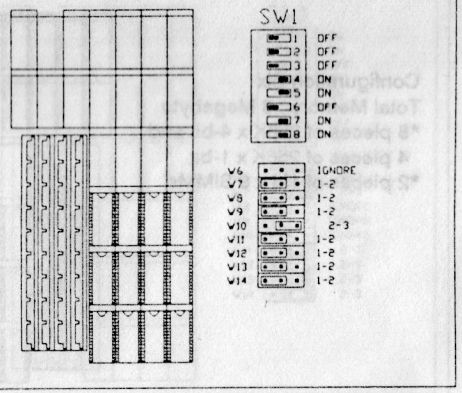
Configuration One
Total Memory : 1 Megabyte
*8 pieces of 256K x 4-bit and
4 pieces of 256K x 1-bit



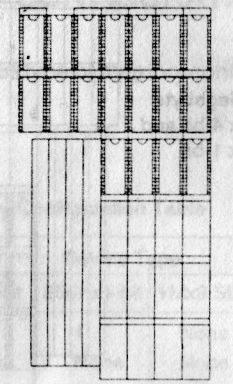
Configuration Two
Total Memory : 1 Megabyte
*4 pieces of 256K x 9 SIMMs

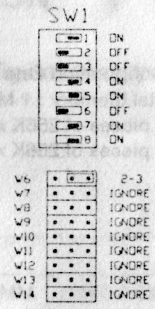


Configuration Three
Total Memory : 2 Megabyte
*8 pieces of 256K x 4-bit and
4 pieces of 256K x 1-bit
*4 pieces of 256K x 9 SIMMs

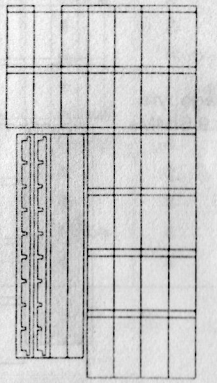


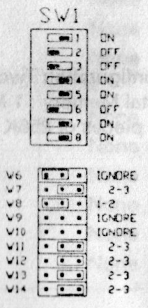
Configuration Four
Total Memory : 2 Megabyte
*18 pieces of 1M x 1-bit



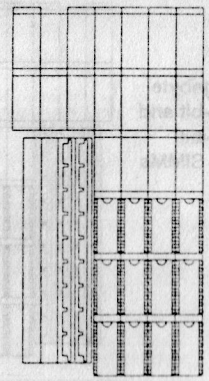


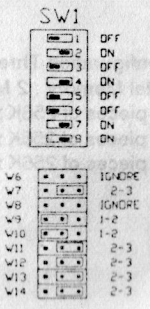
Configuration Five
Total Memory : 2 Megabyte
*2 pieces of 1M x 9 SIMMs



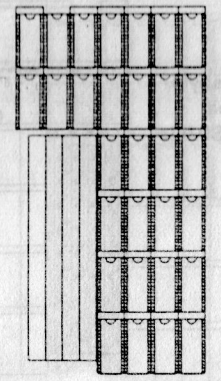


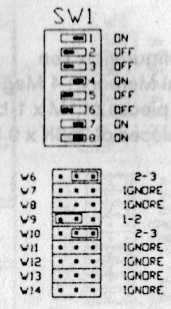
Configuration Six
Total Memory : 3 Megabyte
*8 pieces of 256K x 4-bit and
4 pieces of 256K x 1-bit
*2 pieces of 1M x 9 SIMMs



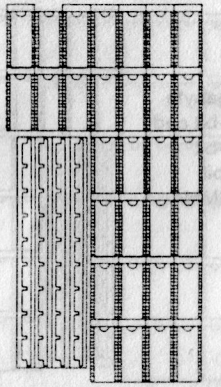


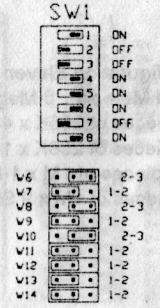
Configuration Seven
Total Memory : 3 Megabyte
*8 pieces of 256K x 4-bit and
4 pieces of 256K x 1-bit
*18 pieces of 1M x 1-bit



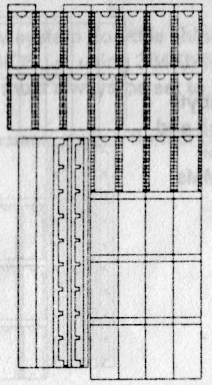


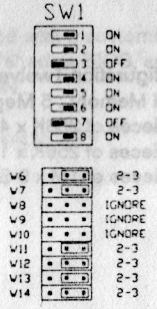
Configuration Eight
Total Memory : 4 Megabyte
*8 pieces of 256K x 4-bit and
4 pieces of 256K x 1-bit
*18 pieces of 1M x 1-bit
*4 pieces of 256K x 9 SIMMs



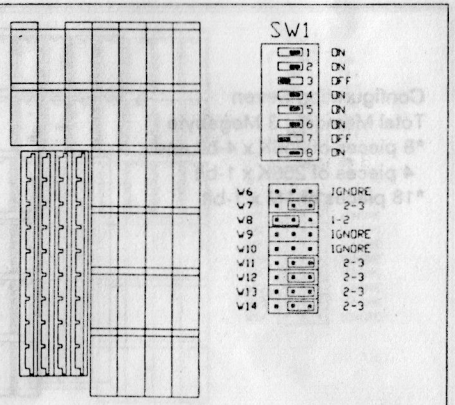


Configuration Nine
Total Memory : 4 Megabyte
*18 pieces of 1M x 1-bit
*2 pieces of 1M x 9 SIMMs

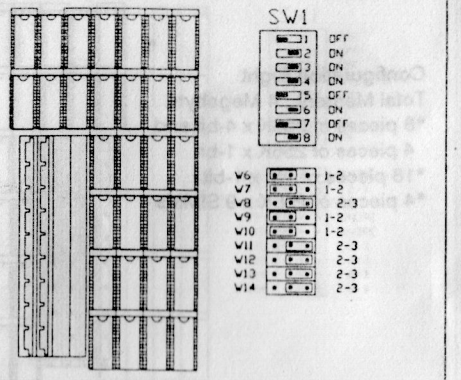




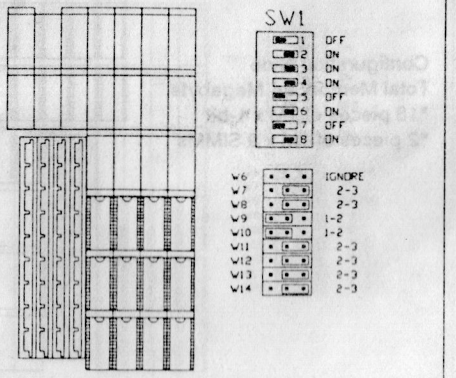
Configuration Ten
Total Memory : 4 Megabyte
*18 pieces of 1M x 1-bit
*4 pieces of 256K x 9 SIMMs



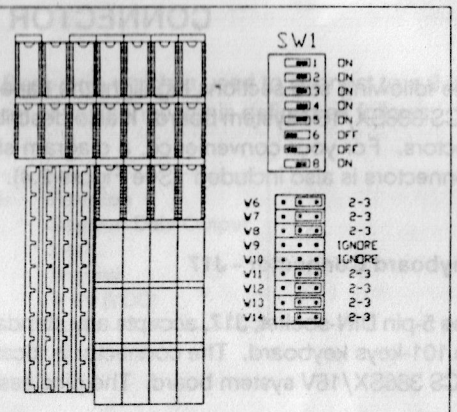
Configuration Eleven
Total Memory : 5 Megabyte
*8 pieces of 256K x 4-bit and
4 pieces of 256K x 1-bit
*18 pieces of 1M x 1-bit
*2 pieces of 1M x 9 SIMMs



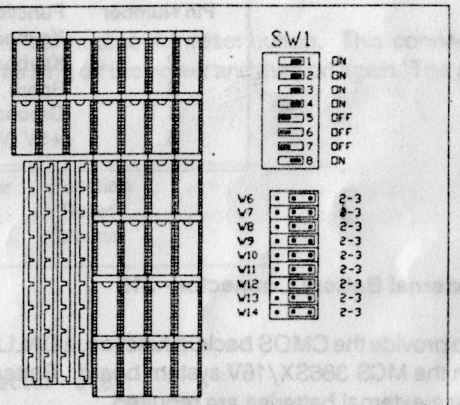
Configuration Twelve
Total Memory : 5 Megabyte
*8 pieces of 256K x 4-bit and
4 pieces of 256K x 1-bit
*4 pieces of 1M x 9 SIMMs



Configuration Thirteen
Total Memory : 6 Megabyte
*18 pieces of 1M x 1-bit
*4 pieces of 1M x 9 SIMMs



Configuration Fourteen
Total Memory : 7 Megabyte
*8 pieces of 256K x 4-bit and
4 pieces of 256K x 1-bit
*18 pieces of 1M x 1-bit
*4 pieces of 1M x 9 SIMMs



Note : As the MCS 386SX/16V system board is shipped with a customised version of the Award BIOS i.e. using 384Kb for shadow BIOS, switch 8 of DIP switch block SW1 must always be set to 'ON'.

If other type of BIOS is used, switch 8 must be set to 'OFF'.

Power Supply Connector - PS 1

PS 1 is a 12-pin connector which connects to the power supply's P8 and P9 connectors. The power supply's P8 connector is connected to pins 1 through 6 and the P9 connector is connected to pins 7 to 12.

The pins assignment of this 12-pin connector is defined as follows:

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

THE SETUP PROCEDURE

What SETUP does?

The CMOS RAM of the clock calendar contains configuration information pertaining to the systems date/time and equipment configuration. This information is entered via a SETUP program which is built into the MCS 386SX/16V ROM BIOS and is maintained by the battery even when the power is turned off. The ROM BIOS contains essential system initialization and self-test code, programming interfaces and the bootstrap program in addition to the SETUP program. It is executed everytime the system is powered-on.

The SETUP program in the ROM BIOS records the following information:

1) Date and Time
2) Number, type and capacity of floppy diskette drive
3) Number, type and capacity of fixed disk drive
4) Amount of memory installed
5) Amount of expansion memory installed
6) Primary display adaptor type

You should run the SETUP program everytime you add, remove or change the system's configuration. If you are using external batteries, you should also run the SETUP program everytime you replace these batteries.

Activating the SETUP Program

The MCS 386SX/16V BIOS contains a built-in SETUP program and does not require any diskette based SETUP program. To activate the SETUP program, enter the following keystroke sequence i.e. <Ctrl>-<Alt>-<Esc> after a hardware reset by either depressing the "POWER" or "Reset" button.

Alternatively, a difference between the systems configuration and the information stored in the BIOS will prompt a request by the computer to enter the <Ctrl>-<Alt>-<Esc> keystroke sequence. The following diagram shows what the SETUP screen looks like.

CONNECTOR PORTS

The following sub-sections highlight the various connector ports available on the MCS 386SX/16V system board. It also describes the pin assignment of these connectors. For your convenience, a diagram showing the header pinouts of these connectors is also included (See Figure 2.4).

Keyboard Connector - J17

The 5-pin DIN-socket, J17, accepts any standard AT-compatible keyboard such as an 101-keys keyboard. The connector is located at the rear right-hand side of the MCS 386SX/16V system board. The pins assignment are defined as follows:

Pin Number	Function
1	Keyboard Clock
2	Keyboard Data
3	Spare
4	Ground
5	+5V (VCC)

External Battery Connector - J15

To provide the CMOS backup function, a DALLAS DS1287 real time clock is installed on the MCS 386SX/16V system board. Battery connector, J15 is also provided in case external batteries are required.

The following table shows the polarity of the battery connector J15. If an external battery pack is used, the battery's positive and negative terminal will be connected to pin #1 and pin #4, respectively.

Pin Number	Function
1	+ 4.5V DC from Battery
2	Not Used
3	Ground
4	Ground

Speaker Connector - J19

J19 (located at the front) is a 4-pin Berg-strip which is used to connect to a 2-inch, 8-ohm speaker. The pins assignment of this connector is defined as follows:

Pin Number	Function
1	Speaker Data Output
2	Key
3	Ground
4	+ 5V (VCC)

Push Button Reset Connector - J16

The reset connector, J16, is used to connect to the reset button. This connector provide a full system reset much like turning off the power and then on again. The pins assignment is shown below:

Pin Number	Function
1	- Reset
2	Ground

Power Indicator & Keylock Connector - J18

J18 is a 5-pin header which provides connection to a front panel power-on indicator LED and security lock. The pins assignment for this connector is as follows:

Pin Number	Function
1	LED Anode (Positive)
2	Key
3	Ground
4	Keylock
5	Ground

AWARD SOFTWARE CMOS SETUP

DATE (MM/DD/YY)	1/ 1/80
TIME (HH:MM:SS)	0:00:00
DISKETTE 1	1.2M
DISKETTE 2	NONE

CYLS. HEADS SECTORS PRECOMP

DISK 1	NONE
DISK 2	NONE
VIDEO	NONE
BASE MEMORY	640
EXTENDED MEMORY	256
ERROR HALT	HALT ON ALL ERRORS
SHADOW RAM	BIOS & VIDEO

UP DOWN ENTER MOVES BETWEEN ITEMS, LEFT, RIGHT SELECTS VALUE
F10 RECORDS CHANGES, F1 EXITS, F2 FOR COLOUR TOGGLE

The SETUP Screen

SETUP Selections

The following sections discusses how to respond to the SETUP prompts.

1) **Entering the Current Date**
Enter the current date into this field and press <Enter>. Enter the date in the following format: MONTH/DAY/YEAR. For example, to enter the date May 6th, 1989, you would type "5/6/89". The "/" must be entered as a separators. The <Backspace> key can be used to correct typing mistakes.

2) **Entering the Current Time**
Type the current time into this field and press <Enter>. Enter the time in the format HOUR:MINUTE:SECONDS. It is not necessary to enter leading zeros in front of numbers or to enter values for the seconds. However you will need to enter ":" to separate the hour from the minute.

3) **Diskette 1**
Diskette 1 refers to the floppy disk drive that you would like to setup as "A" drive. Four types of diskette drive are supported.

a) 1.2MB (5.25 inch AT-Type high-density drive)
b) 360KB (5.25 inch PC-Type standard drive)
c) 720KB (3.5 inch single-sided drive)
d) 1.44MB (3.5 inch double-sided drive)

Selection can be made when the DISKETTE 1 field is highlighted. Use the <Left> or <Right> arrow key to select the type of diskette drive installed.

4) **Diskette 2**
Diskette 2 refers to the floppy disk drive you would like to setup as "B" drive. If you have only one diskette drive, select NONE for this field. Otherwise, follow the procedure outlined previously.

5) **Disk 1**
Selection DISK 1 identifies the Type Number of the first fixed disk drive that has been installed in the system. The system need this information in order to make full use of the available storage capacity in the fixed disk.

Press the <Right Arrow> key to select a higher numbered fixed disk or <Left Arrow> key to select a lower numbered one. Alternatively, simply type in the fixed disk type number followed by <**Enter**>.

6) **Disk 2**
You can use this field to install a second fixed disk in your system. If you have only one fixed disk installed in your system, select NONE for this field, otherwise follow the procedure outlined in the previous section.

7) **Selecting the type of Video Adapter Installed**
This selection specifies the type of Video adapter installed. The following selections are available:

a) MONO (Monochrome adapter)
b) COLOR 40 (Colour Graphics Adapter, power-up in 40-column mode)
c) COLOR 80 (Colour Graphics Adapter, power-up in 80-column mode)
d) EGA/VGA (Enhanced or Video Graphics Adapter)

8) **Base Memory**

Base Memory is the memory usable by DOS, the primary operating system for the MCS 386SX/16V. It is the memory that is addressed from zero to the 1MB boundary. On the MCS 386SX/16V, Base Memory is fixed at 640KB.

9) **Extended Memory**

Extended Memory is the memory beyond the 1MB boundary. It is normally not accessible by DOS except as RAM disks. Protected Mode operating systems such as Unix, OS/2 and Xenix can take advantage of Extended Memory.

As the MCS 386SX/16V comes standard with 1 MB of RAM, 384 KB of Extended Memory will be available if the "Shadow RAM" feature is disabled. If "Shadowing" feature is enabled then the amount of extended memory available is 256 KB.

10) **Error Halt Options**

The system will normally enter a Halt condition when it encounters any error condition during its power-on-self-test (POST). You can override this using the ERROR HALT field. The following are valid selections:

a) HALT ON ALL ERRORS
Default selection, stop when any error is encountered.

b) NO HALT ON ANY ERRORS
Continue even if errors are encountered.

c) NO KEYBOARD ERROR HALT
Continue even if keyboard is bad or not installed. Halt on any other errors.

d) NO DISK ERROR HALT
Continue even if no disk is installed. Halt on any other errors.

e) NO KEYBOARD OR DISK ERROR
Continue even if both keyboard and disk error are present. Halt on any other errors.

11) Shadow RAM

"Shadowing" is a technique in which the BIOS and/or VIDEO programs stored in slow EPROM are transferred to faster system RAM memory. This can appreciably speed up programs which make intensive use of the BIOS and VIDEO facilities. Three options are available for this selection:

a) DISABLE (does not enable shadowing option)
b) BIOS (enables BIOS shadowing only)
c) BIOS & VIDEO (enables both BIOS & VIDEO BIOS ROM shadowing)

On powering-up, the BIOS checks for the presence of either an EGA or VGA display adapter. If neither is found or, if you have a monochrome display adapter installed, you will not be able to shadow the VIDEO BIOS. In this instance, option (c) will achieve the same result as option (b).

Saving the Configuration

After you have entered all the correct settings, press the <F10> function key to record the new values in the system's battery-backed memory. Press the <F5> function key to confirm. The system will then reboot itself with the new configuration setting. This concludes the SETUP procedure.

MCS 386SX/16V HARD DISK TYPE TABLE

Type	Cylinder	Heads	Sec/Trk	W/Precomp	Land-Zone	Capacity	Remarks
1	306	4	17	128	305	10 MB	ST412
2	615	4	17	300	615	21 MB	ST225
3	615	6	17	300	615	31 MB	ST138
4	940	8	17	512	940	64 MB	
5	940	6	17	512	940	48 MB	
6	615	4	17	None	615	21 MB	WD362
7	462	8	17	256	511	31 MB	
8	733	5	17	None	733	31 MB	
9	900	15	17	None	901	115 MB	
10	820	3	17	None	820	21 MB	
11	855	5	17	None	855	36 MB	
12	855	7	17	None	855	51 MB	
13	306	8	17	128	319	21 MB	
14	733	7	17	None	733	44 MB	
15			Reserved				
16	1024	5	17	None	1023	44 MB	HH-1050
17	977	5	17	300	977	42 MB	CP344
18	977	7	17	None	977	58 MB	
19	1024	9	17	None	1023	80 MB	ST4096
20	1024	8	17	None	1023	71 MB	XT1085
21	1024	11	17	None	1023	98 MB	CP3100
22	918	15	17	None	918	120 MB	XT1140
23	1224	15	17	None	1223	160 MB	XT2190
24	1314	7	17	None	1313	80 MB	HH-1090
25	872	7	17	650	871	53 MB	RO3065
26	1024	7	17	None	1023	62 MB	HH-1075
27	989	5	17	None	989	43 MB	CDC 9420x-51
28	697	5	17	None	697	30 MB	CDC 9415x-36
29	925	9	17	None	925	72 MB	CDC 9415x-86
30	809	6	17	None	808	42 MB	Miniscribe 3675
31	830	6	17	None	829	43 MB	Micropolis 1304
32	971	5	17	None	970	42 MB	MR535
33	699	7	17	300	699	42 MB	DK511-5
34	820	6	17	None	820	43 MB	ST251
35	1166	7	17	None	1165	71 MB	V185
36	1412	11	34	None	1411	270 MB	CDC 94186-324
37	1412	15	34	None	1411	369 MB	CDC 94186-442
38	1024	7	35	None	1023	128 MB	HH-2120
39	1224	7	35	None	1223	153 MB	XT4170E
40	1224	15	35	None	1223	329 MB	XT4380E
41	1632	8	52	None	1632	347 MB	XT8380E
42	1632	15	52	None	1632	652 MB	XT8760E
43	305	16	63	None	1223	157 MB	Translation
44	635	16	63	None	1223	327 MB	Translation
45	618	16	63	None	1223	319 MB	Translation
46			Spare				
47			Spare				