

S-286
USER'S MANUAL
2ND EDITION

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APPENDIX A FCC Compliance Statement

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APPENDIX D System Setup And BIOS

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7. CERTIFICATION OF DIAGNOSTIC TESTING

This unit was tested and passed prior to packing.
The results are recorded below.

Clock Speed During Tests: _____ MHZ
ROM BIOS Installed: _____

- _____ () System Board
- _____ () Memory
- _____ () Keyboard
- _____ () Monochrome & Printer Adapter
- () Display Adapter Test
- () Display Attributes
- () Character Set
- () 80 x 25 Display
- _____ () 1.2 Meg Floppy Drive
- () Sequential Access
- () Verify Diskette
- () Random Seek
- () Diskette Change Test
- () Speed Test
- _____ () 2nd Floppy Drive
- () Sequential Access
- () Random Seek
- () Verify Diskette
- () Speed Test

- Hard Disk & Controller
- Write, Read, Compare
On Test Cylinder
- Seek Test
- Head Select
- Error Detection &
Correction

- 80287 Co-processor

Setup Parameters

Setup parameters are stored in battery-maintained memory. This unit was set as follows:

Drive A _____

Drive B _____

Drive C _____

Drive D _____

Base Memory Size _____

Extended Memory _____

Primary Display _____

System checked by _____

2. GENERAL INFORMATION ABOUT YOUR S-286

2-1. Basic Information about your System Board:

The S-286 system board (the motherboard) is the main part of your PC/AT compatible computer. The board is physically 8-1/2 inches wide and 13 inches long, about the same size as the PC/XT motherboard. It is made from fiberglass and epoxy resins and is coated with a permanent corrosion-resistant material. All the components and connectors are mounted on one side. The S-286 uses very large scale integration (VLSI) technology with a four-layer printed circuit board (PCB) and is designed to be fully compatible with the IBM PC/AT. The S-286's CPU (Central Processing Unit) is a full 16 bit microprocessor capable of addressing up to 16 megabytes of physical memory and up to 1024 megabytes of virtual memory. Properly configured, it can process information at CPU speeds of up to 12 megahertz with one wait state. This speed is two times faster than the first PC/AT computers. Within the S-286's small footprint are the principal parts that tell the system how to boot the computer when the power is applied, how to generate sound, how and when to communicate with internal and external devices, and how fast to run. Mounted on the system board are connectors for an external speaker, a keyboard, a power supply, and eight expansion slots, five of which are 16 bit slots. Through these expansion slots, the world outside your computer is accessible via disk drives, hard drives, modems, printers, plotters, and monitors, just to mention some of the more popular peripherals. There is a socket that will accept the 80287 math coprocessor IC for your BIG number crunching applications, and two sockets for ROM (Read Only Memory) ICs where the BIOS (Basic Input/Output System) and other ROM or EPROM (Erasable Programmable Read Only Memory) based applications can be placed. On the system board is one bank of eight DIP (Dual In-line Package) switches that allow your to optimally configure your system.

2-2. Features of the Twinhead S-286:

- 80286-10 high speed CPU (Central Processing Unit).
- 10MHz high speed Chips and Technologies CHIPSet
- 6/8/10/12 MHz, four speed system clock selectable by system board DIP switch or keyboard control.
- Zero/one wait state switch selectable.
- Jumper selectable 5 or 8 MHz clock rate for an 80287 co-processor.
- RAM-free motherboard:
System memory is provided by a small adapter RAM (Random Access Memory) card (a 'RAM only' card) that plugs into the left-most slot on the motherboard. This design permits stable system performance up to a 12 megahertz, 1 wait state CPU speed and also allows an inexpensive upgrade to an equally fast 4 megabyte RAM card. This card comes in two configurations:
 - A. One megabyte system memory RAM 1 card:
selectable as 512K, 640K, or a true 1 megabyte (640K base + 384K extended) using 256 kilobit DRAM chips.
 - B. Four megabyte system memory RAM 4 card:
selectable as two megabytes (640K base + 1408K extended), or as 4 megabytes (640K + 3456K extension) using one megabit DRAM chips.
- Clock/Calendar function with internal or external battery backup.
- Built-in speaker with extra connector for an external speaker.
- Supports XT and AT screw holes so the motherboard is suitable for both XT style and AT style cases.
- Four layer baby-AT size PCB.
- Low motherboard power consumption (approximately 15 watts) permits usage of an XT type power supply (150 watts).

2-3. Environmental Limits:

Ambient Air Temperature:

Power ON : 15 to 32 degrees C
Power OFF: 10 to 43 degrees C

Humidity:

Power ON : 8% to 80%
Power OFF: 20% to 80%

Altitude:

Maximum altitude: 2133 meters (7000 feet)

Noise Level:

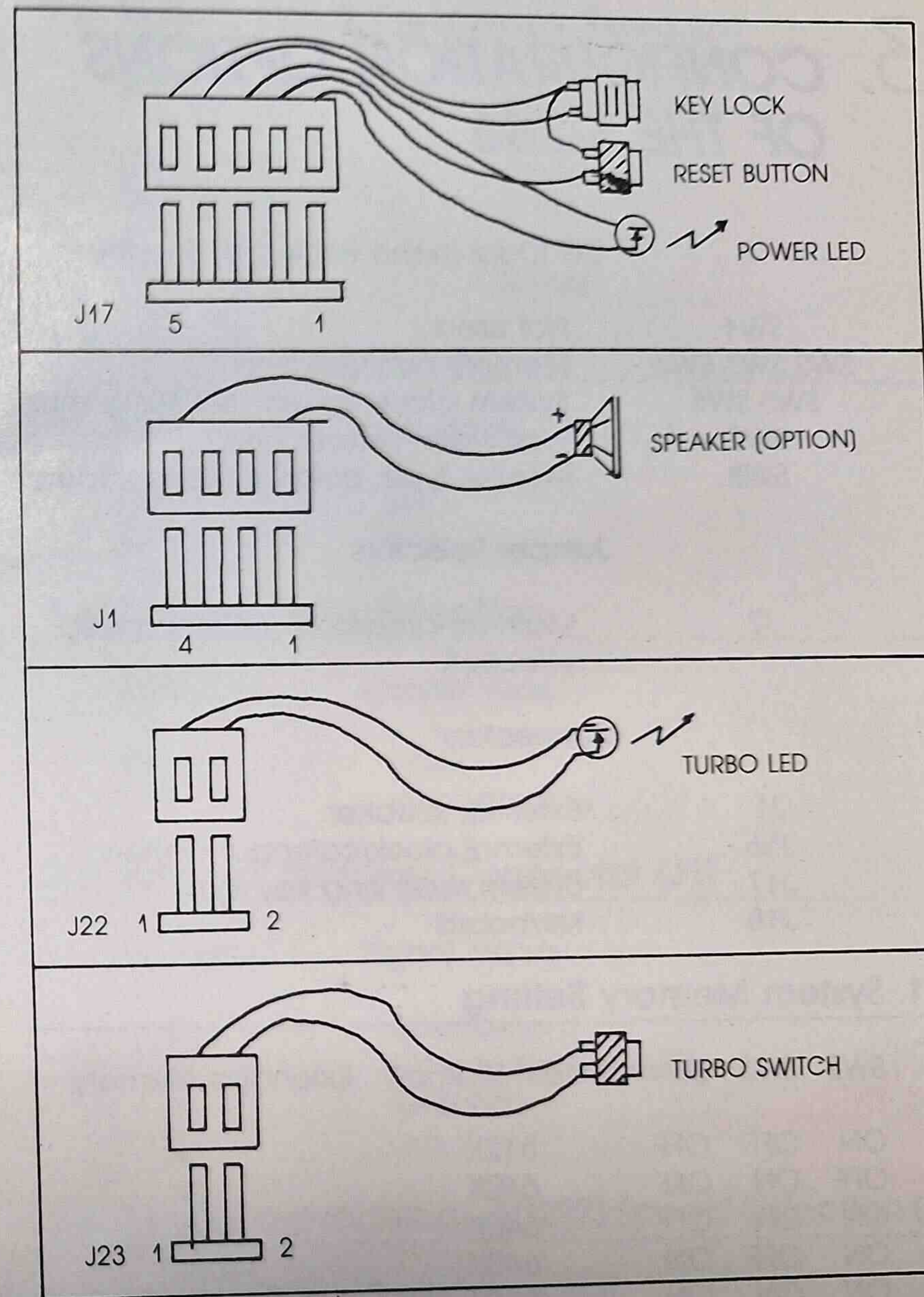
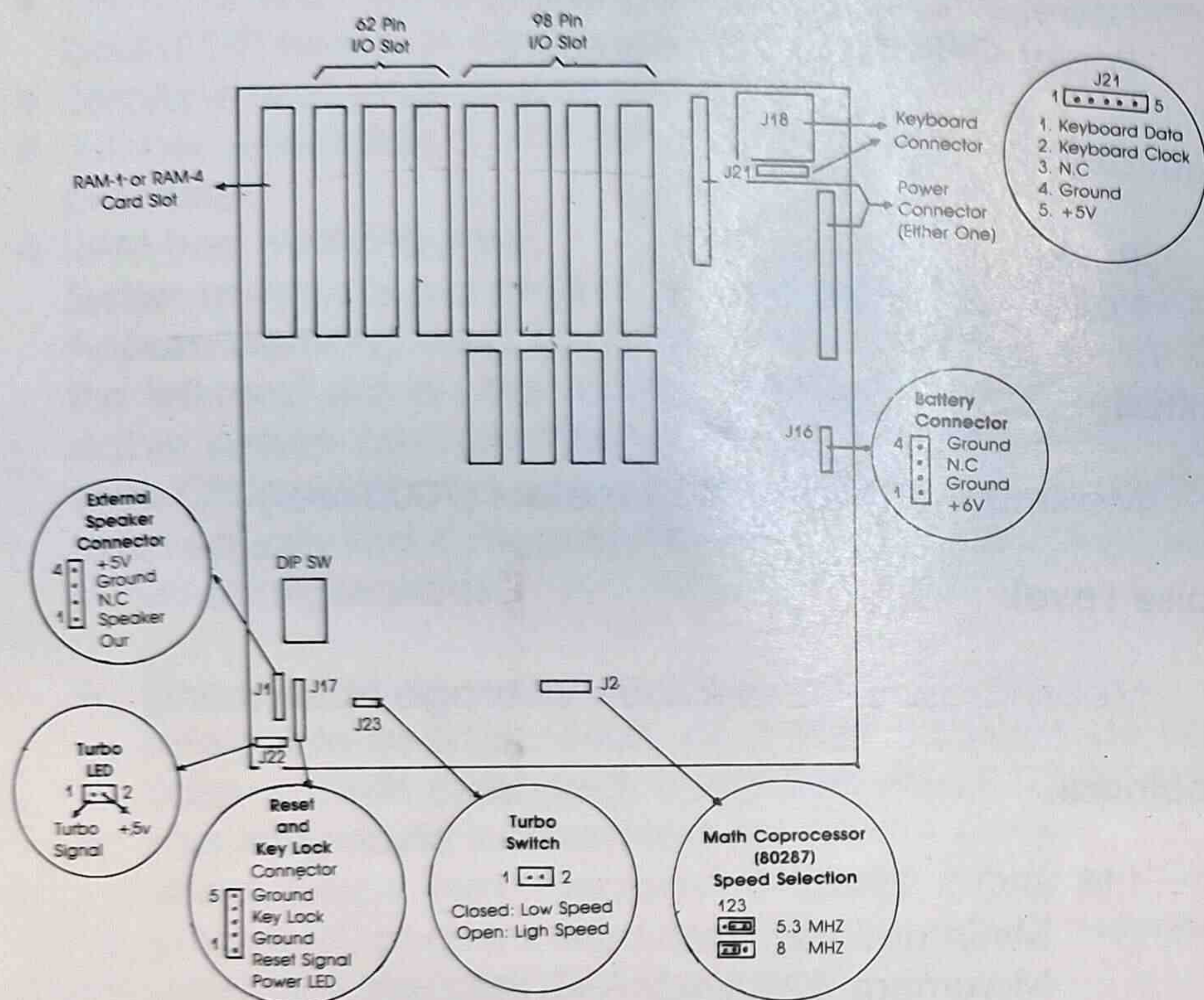
Meets Class 3; 42 decibels average noise rating

Electrical:

115 VAC
Minimum 100 VAC
Maximum 125 VAC

230 VAC
Minimum 200 VAC
Maximum 240 VAC

2-4. Layout of the S-286 System Board



3. CONFIGURATION OPTIONS OF THE S-286

DIP (Dual In-line Package) Switches

SW1	Not used
SW2,SW3,SW4	Memory configuration
SW5,SW6	System clock speed: 6/8/10/12 mhz
SW7	Wait state: zero or one
SW8	Monitor type: color or monochrome

Jumper Selectors

J2	Math co-processor (80287) speed selection
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Connectors

J1	External speaker
J16	External clock/calendar battery
J17	System reset and key lock
J18	Keyboard

3-1. System Memory Setting

SW2	SW3	SW4	System Memory	Extended Memory
ON	OFF	OFF	512K	OK
OFF	ON	OFF	640K	OK
ON	ON	OFF	640K	384K
ON	OFF	ON	640K	1408K
ON	ON	ON	640K	3456K

3-2. System Clock Frequency Selection

SW5	SW6	System Clock Frequency
ON	ON	6 mhz
OFF	ON	8 mhz
ON	OFF	10 mhz
OFF	OFF	12 mhz

3-3. Wait State Selection

SW7	Wait State
ON	zero
OFF	one

3-4. Monitor Type Selection

SW8	Monitor Type
ON	color
OFF	monochrome

3-5. External Speaker Connector (J1)

Pin out	Signal Name
1	Speaker out
2	No connection (NC)
3	Ground
4	+5 V

3-6. Math Co-processor (80287) Speed Selection (J2)

Jumper Pins	Speed Selection
1 - 2	8 mhz
2 - 3	5.3 mhz

3-7. External Battery Connector (J16)

Pin out	Signal Name
1	+6 volts
2	Ground
3	NC
4	Ground

3-8. Reset and Key Lock Connector (J17)

Pin out	Signal Name
1	+5 V
2	Reset Signal
3	Ground
4	Key Lock
5	Ground

3-9. Keyboard Connector (J18)

Pin out	Signal Name
1	Keyboard Data
2	Keyboard Clock
3	NC
4	Ground
5	+5 V

4. TECHNICAL INFORMATION ABOUT THE INPUT/OUTPUT (I/O) CHANNELS

The following information names the signals leaving and entering the expansion slot sockets on the S-286 system board. Refer to section 2.4, the section on the layout of the S-286 for location of the sockets, sides, and pins.

J9, J10, J11, J12, J13, J14, J15 (Side A)

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

A26	SA5	I/O
A27	SA4	I/O
A28	SA3	I/O
A29	SA2	I/O
A30	SA1	I/O
A31	SA0	I/O

J9, J10, J11, J12, J13, J14, J15 (Side B)

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

*J3, J4, J5, J6, J7 (Side A)

I/O Pin	Signal Name	I/O
C1	SBHE	I/O
C2	LA23	I/O
C3	LA22	I/O
C4	LA21	I/O
C5	LA20	I/O
C6	LA19	I/O
C7	LA18	I/O
C8	LA17	I/O
C9	-MEMR	I/O
C10	-MEMW	I/O
C11	SD08	I/O
C12	SD09	I/O
C13	SD10	I/O
C14	SD11	I/O
C15	SD12	I/O
C16	SD13	I/O
C17	SD14	I/O
C18	SD15	I/O

J3, J4, J5, J6, J7 (Side B)

I/O Pins	Signal Name	I/O
D1	-MEM CS16	I
D2	-I/O CS16	I
D3	IRQ10	I
D4	IRQ11	I
D5	IRQ12	I
D6	IRQ15	I
D7	IRQ14	I
D8	-DACK0	O
D9	DRQ0	I
D10	-DACK5	O
D11	DRQ5	I
D12	-DACK6	O
D13	DRQ6	I
D14	-DACK7	O

D15	DRQ7
D16	+5V
D17	-MASTER
D18	GND

Memory expansion slot J8 (Side A)

Pin	Signal Name
A1	MD0
A2	MD1
A3	MD2
A4	MD3
A5	NC
A6	MD4
A7	MD5
A8	MD6
A9	MD7
A10	NC
A11	MD8
A12	MD9
A13	MD10
A14	MD11
A15	NC
A16	MD12
A17	MD13
A18	MD14
A19	MD15
A20	NC
A21	MA0
A22	MA1
A23	MA2
A24	MA3
A25	MA4
A26	NC
A27	MA5
A28	MA6
A29	MA7
A30	MA8
A31	MA9

J8 (Side B)

Pin	Signal Name
B1	GND
B2	MDPIN1
B3	+5V
B4	MDPOUT1
B5	NC
B6	MDPIN0
B7	NC
B8	MDPOUT0
B9	NC
B10	GND
B11	NC
B12	-WR
B13	-RAS0
B14	-RAS1
B15	-RAS2
B16	-RAS3
B17	NC
B18	NC
B19	NC
B20	-CAS0L
B21	-CAS0H
B22	-CAS1L
B23	-CAS1H
B24	-CAS2L
B25	-CAS2H
B26	-CAS3L
B27	-CAS3H
B28	NC
B29	+5V
B30	NC
B31	GND

5. SYSTEM BOARD INSTALLATION

The procedure given below assumes you have purchased one of the standard types of cases that are available at present. This type of case will have standard mounting brackets or pre-punched holes in the bottom of the case and will attach the system board with either brass standoffs and metal screws or nylon self-locking standoffs.

If your case is not pre-punched for the S-286 system board and you plan to use your own mounting system, it is advisable to make at least one of the mounting devices a metal one so that the case, and therefore, electrical ground, will be firmly attached to the system board.

5-1. Cover Removal.

If you have a slide type case, the cover will have to be re-moved. Normally, there are 4 or 5 screws located at the back of the case that must be removed in order to slide the cover off the base of the case. Refer to the manual that came with your case if there is any doubt.

If you have a rear-hinged type case, usually just opening the cover will provide ample room for system board installation.

5-2. Spacer or Standoff Mounting.

PRECAUTION

Please read the precautions in section 6-1 regarding static electricity. They also apply to the S-286 system board.

If your case uses brass standoffs and metal screws, the standoffs should be attached to the bottom of the case first and then the S-286 system board can be placed over the standoffs and the metal screws placed through the board and tightened into the standoffs.

If your case uses dual ended self-locking nylon standoffs which poke through holes in the case bottom, then mounting can be done by either attaching the nylon standoffs to the case first and then attaching the S-286 or vice versa.

If your case uses single ended self-locking nylon standoffs which have a button on the bottom that slides into a slot on the case bottom, then the nylon standoffs should be attached to the S-286 system board first and then the whole unit mounted into the case.

5-3. Final Adjustment.

In all the cases above regarding mounting the S-286 system board, try to fix the board so that when an expansion card is inserted fully into a system board slot, the hold-down bracket on the expansion card fits as closely as possible to the slotted openings at the back of the case. This provides for good case integrity for electrical grounding and prevents excessive radiated emissions.

5-4. S-286 System Board Settings and Connections.

Now that the S-286 is securely mounted, it's time to make the final settings and connections to complete the installation and make the system ready for the rest of your peripheral cards. After you have read the paragraphs below, refer back to section 3, Configuration Options, for the exact setting values, location of connections, and jumper values.

5-4-1. DIP Switch Settings

The DIP switch bank located in the lower left corner of the system board gives you control over:

1. System clock speed
2. Wait states
3. Memory size
4. Monitor type

How fast you set the system clock and which wait state you chose will depend on the quality and type of your peripherals. Some video and hard disk expansion cards will not work at the higher CPU speeds. The best advice is to ask your vendor which cards will work at the CPU speed and wait state setting you wish to use. Refer to switches 5 and 6 for CPU speed and switch 7 for wait state setting.

The amount of memory you choose will depend on your application and your pocketbook. If the pocketbook is not too much of a consideration, get as much memory as possible. You can always use extended memory for a virtual disk or one of the new concurrent programs that let you store many programs in memory and then switch between them in a flash.

Another consideration regarding RAM will depend on how fast you have chosen to run the computer, i.e., system clock and wait state setting. Check ahead to section 6-3-2 and see what access time your RAM will have to be in order to run at your chosen speed and wait state. Refer to switches 2, 3 and 4 for memory configuration.

There are only two monitor types which use the DIP switch on the system board: color or monochrome. There is a third choice, the EGA (Enhanced Graphics Adapter) monitor, that can be set by running the setup program that comes with the system board. This program performs the same functions as those found on the AT Diagnostic Disk, but does them much quicker. If you chose the EGA display, the settings of the DIP switch are not important. The display you chose determines what monitor type the system expects to display when the system is first powered. Refer to switch 8 or the setup program for monitor setting.

5-4-2. Jumper Settings

The only jumper setting at present depends on your choice of speed for the math co-processor IC, the 80287. If you don't use the math chip, the jumper doesn't matter. If you have a math IC, be sure to set the jumper for the correct speed to match the speed of the 80287. The jumper block, J2, is located in the center of the board, near the edge toward the front of the computer.

5-4-3. Connections

One of the important connections in this and most computer systems is the keyboard connector. Until a flawless vocal interface is developed, the keyboard will be the main way for human beings to input data. The connector is located in the upper right corner and is a DIN (Deutsche Industrie Normen) jack, labelled J18.

The case you chose may be one of the types that has a front panel with a key lock, a reset push button, and one or more LEDs (Light Emitting Diode) on its face. If so, then you will want to connect the lock and reset button because the lock will provide you will added security and the reset button will let you reboot the computer should you get into a situation where it is normally impossible to exit. The five pin in-line connector, J17, is located in the lower left corner of the board, next to the built-in speaker.

And speaking of speakers, if you want to install your own, the external speaker connector, J1, is also located next to the built-in speaker, in the lower left corner of the board.

When this section is finished, please read the next section before installing any of your expansion cards. The information is of a general nature and includes some helpful hints that may help avoid a difficult situation. Thank you.

6. GENERAL INFORMATION ABOUT EXPANSION CARD INSTALLATION

6-1 Precautions about Expansion Card Installation

PRECAUTIONS

Precaution #1 is about static electricity (the spark that jumps from your finger as you reach for a door knob after walking on a carpeted floor). It is a major killer of integrated circuit components (ICs or 'chips'). That little spark represents between 1,000 to 10,000 volts of static discharge which can easily damage an electronic device which was only built to withstand between 5 to 20 volts. So, you must be careful when handling adapter cards. One good method to use when installing or removing these electronic devices is to take your bare finger and touch a grounded metal part BEFORE handling an item that has ICs on it. Any unpainted, shiny, metallic part on your computer case is a good place to touch. Installed adapter card hold-down brackets or most power supply cases are places that fit this example. After the card is in your hands, try not to touch any of the electronic components, and, if you walk to another location, remember to touch a grounded, bare metal part BEFORE installing or putting down the card.

Precaution #2 is about the safety of your hands when removing and installing adapter cards. The back sides of these cards, the sides that have no components on them, have many sharp points sticking out of the card. Grasping a card tightly during these times can result in pokes and tears in your hands and fingers. The best solution when removal or installation is difficult is to gently ROCK the card in a front to back motion during the process.

Generally, adapter cards are not slot dependent, which means you can install the card in any slot in your computer and it will work OK. However, some cards require cables that connect to other devices in the computer, like floppy drives and hard drives, so it is wise to install those types of cards near the device where the card will connect. Also, if you have chosen to use our specially designed RAM card system, the 'RAM only' card must be placed in the left-most slot.

6-1-1. Expansion Card Configuration Information

Many cards contain means of communicating with an external device such as a modem, printer, plotter, or a mouse. These communicating areas are called ports and each port has a specific location in memory, called an address, that is reserved for only its use. If two cards in the same computer system try to communicate using the same port or memory address, a conflict will occur which will usually cause a failure of communication. This is like the situation where two people try to go through the same door at the same time. Some cards have this port memory address 'hard wired', meaning it is not changeable unless an IC is changed. Other cards use DIP switches or jumper shorting blocks that permit changing the port memory address. The main point is to be sure that no two ports use the same address. Therefore, when installing adapter cards, notice which memory addresses the ports on the card use and check that they do not conflict with other addresses which already exist in the computer system. The manual that comes with the card will have this information.

The below chart shows some of the ports that are used in DOS (Disk Operating System):

Port Name	Application
LPT1 (PRN)	Parallel printer #1
LPT2	Parallel printer #2
LPT3	Parallel printer #3
COM1 (AUX)	Serial device #1
COM2	Serial device #2

These are also the most common ones that will require adjustment when installing a new adapter.

6-1-2. Expansion Card Installation/Removal Procedure

Simply stated, installation is to:

1. Turn the power off on the computer and all devices connected to the computer.
2. Observe static electricity precautions.
3. Locate an empty slot on the motherboard.
4. Remove the back plate covering the empty case slot.
5. Locate the adapter card over the empty motherboard slot. Be sure all DIP switches and jumpers are set.
6. Line up the card with the plastic guide located at the front of the case.
7. Press the card into place. Rock the card gently if necessary.
8. Fix the card to the case by installing a screw through the card hold-down bracket.

In most cases, cards that require cables that attach to other internally mounted devices, like floppy drives or disk drives, should have the cables attached first. Cables that connect through the hold-down bracket to externally mounted devices, such as printers or modems, should be attached after the card is installed. A simple rule to follow is: If it will be difficult to connect a cable after the card is installed, do it before installation. Otherwise, connect all cables later as the card will install easier without additional things connected to it.

Removal is to:

1. Turn the power off on the computer and all devices connected to the computer.
2. Observe static electricity precautions.
3. Remove the screw holding the card hold-down bracket fixed to the case.
4. Grasp the card gently, but firmly and pull the card from the slot socket using a slight rocking motion if necessary.

6-2. Integrated Circuits Installation

This section will most often apply to users that are adding or changing the RAM ICs in their computer. The information is use-ful, however, in all IC addition or replacement.

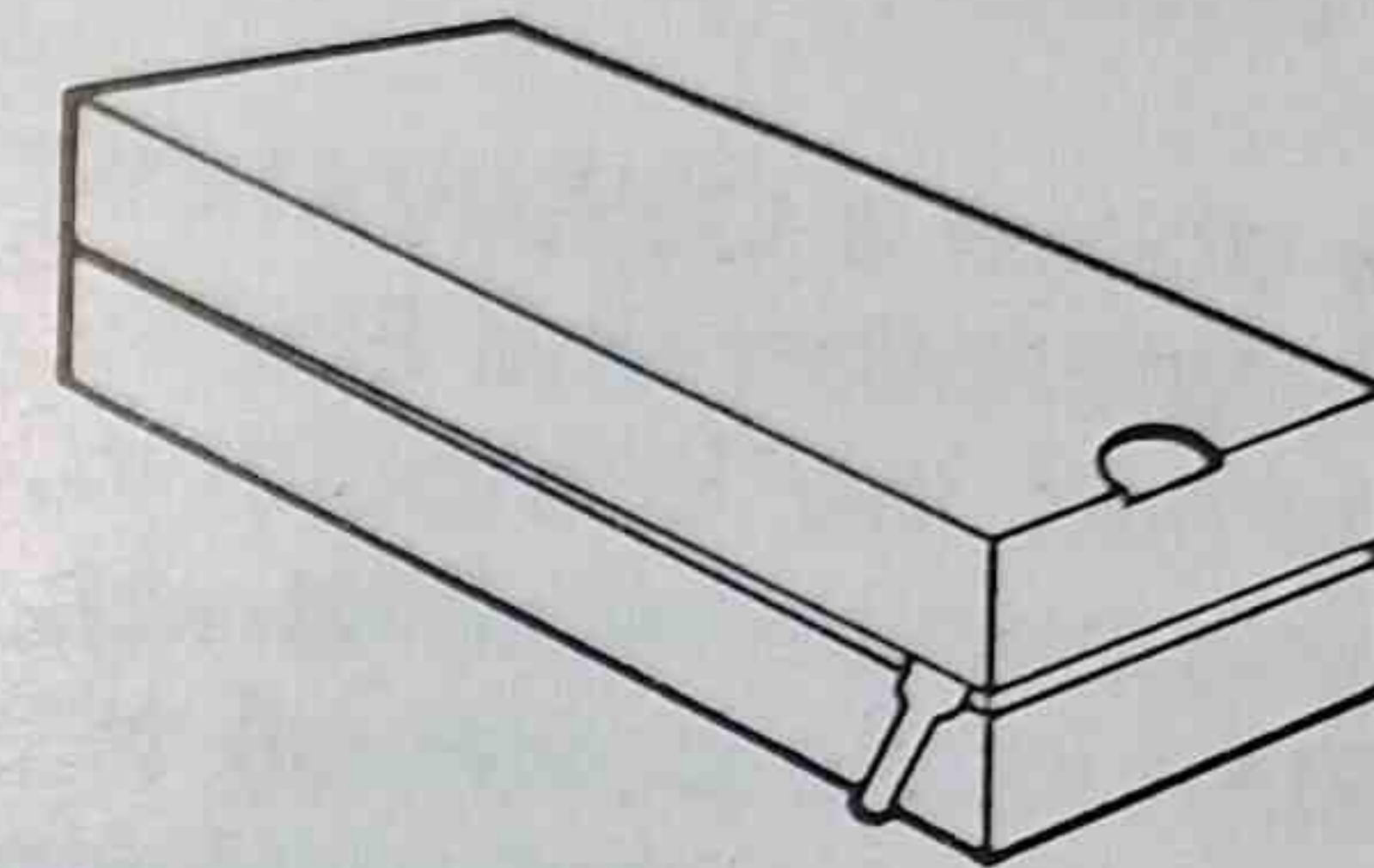
Other than improper design, ICs can work properly if:

1. They have not been destroyed by static electricity.
2. They have been correctly inserted into their sockets.

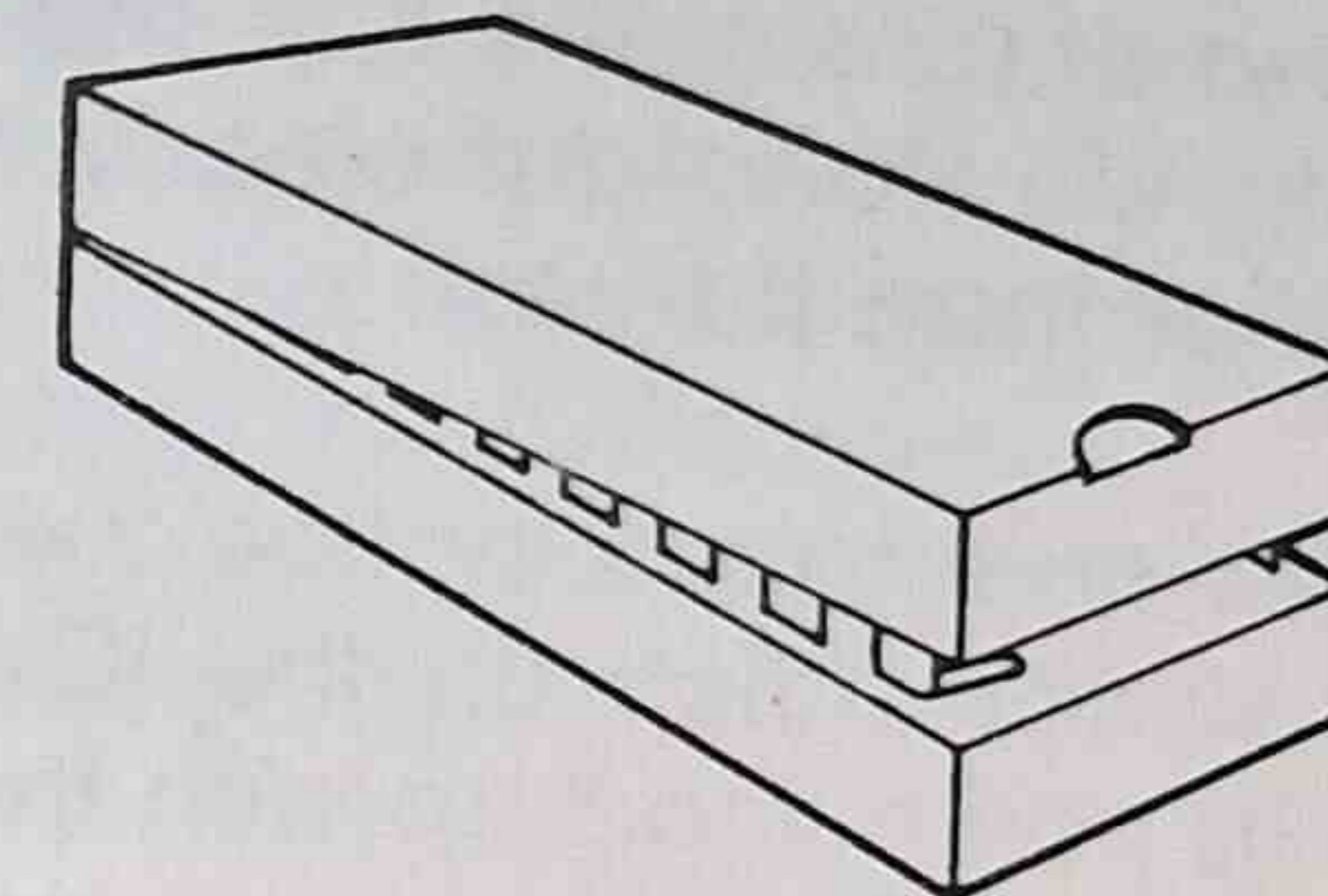
The first is very difficult to detect since no apparent damage has been caused. Hence, the precautions that have been mentioned before. The second is the primary reason for computer failure when ICs have been changed or added.

Insertion failure is caused in five ways:

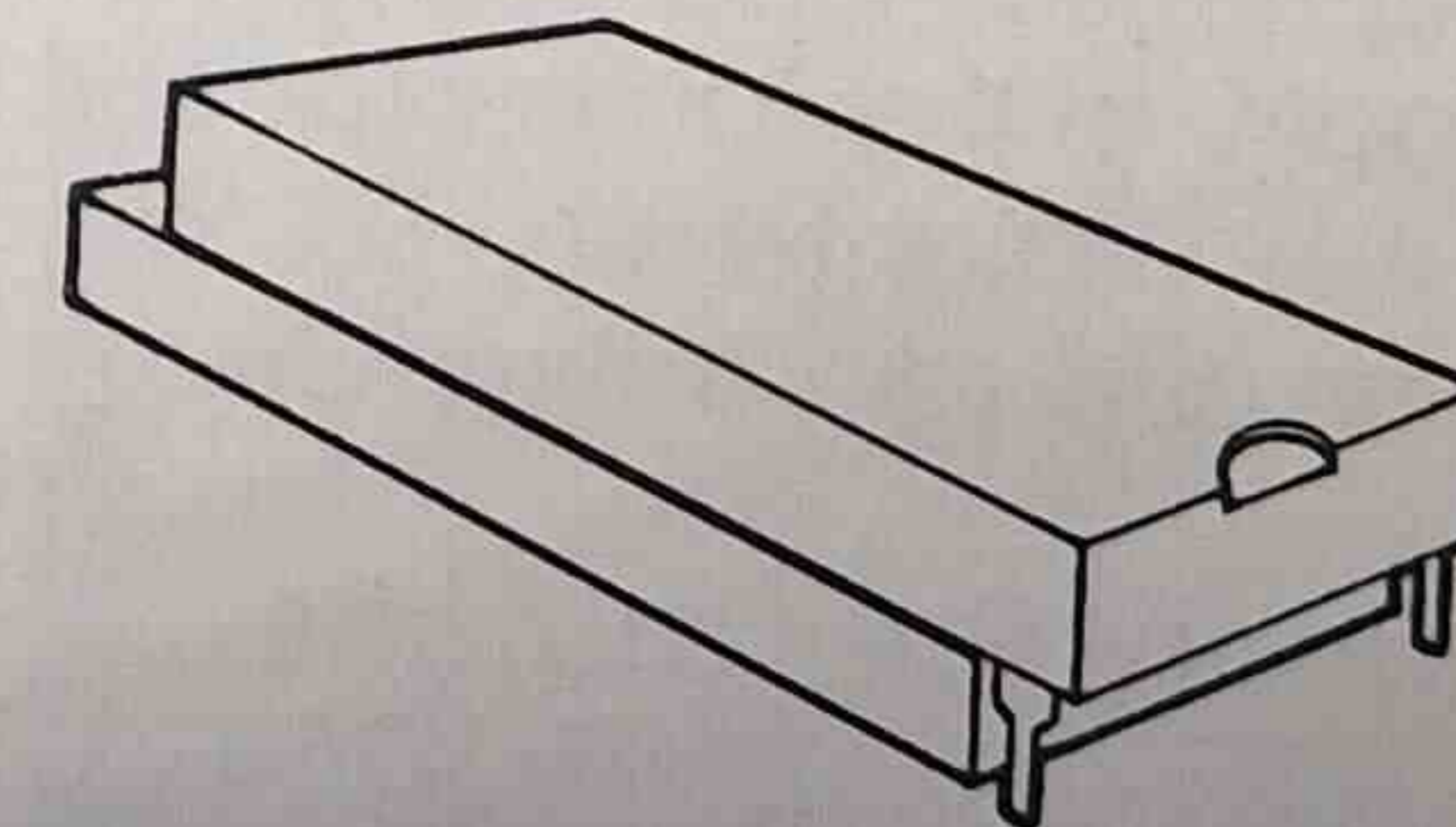
1. A pin of the IC is bent away from the IC and so is outside the socket.



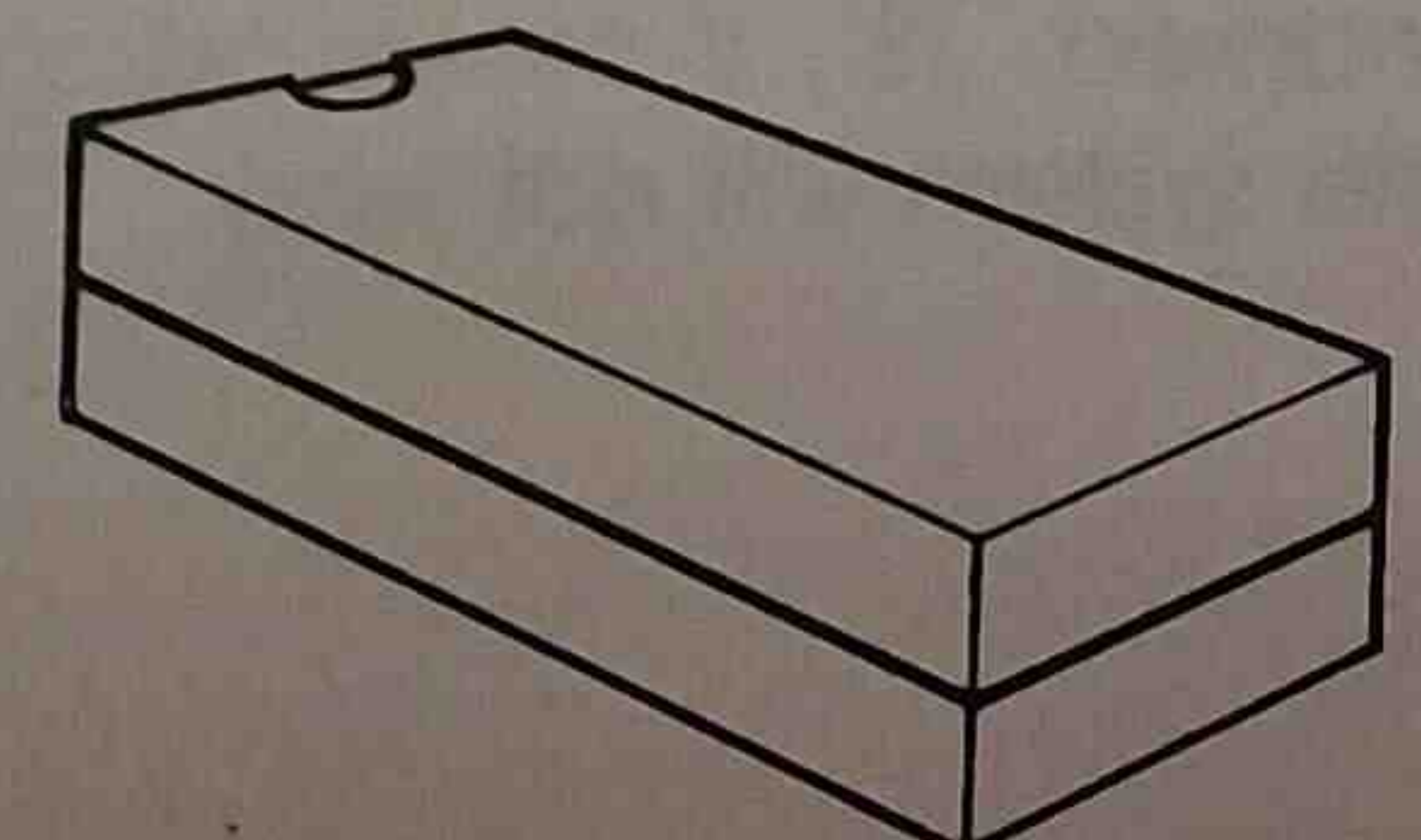
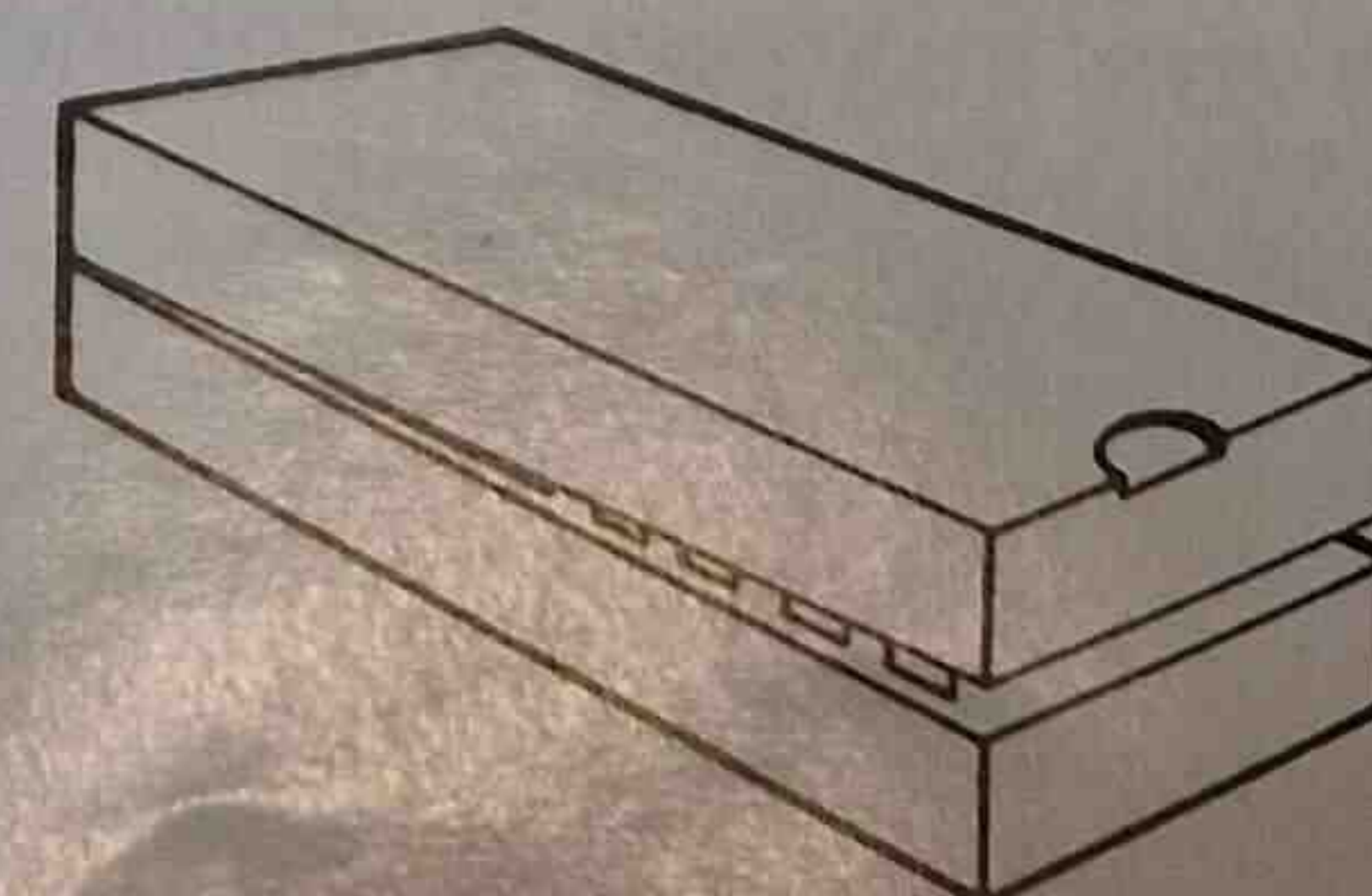
2. A pin of the IC bent under the IC and so is outside the socket.



3. Pins of the IC are offset with respect to the socket with 2 or more pins outside the socket.



4. The IC is not fully inserted into its socket.
5. The IC is inserted with improper orientation with the IC end notch opposite the socket end notch (backwards).



The first four cases usually cause only a failure of the system. The last case sometimes causes the IC to self-destruct in a small puff of smoke due to the power and ground pins being reversed.

The cure for all of the above is OBSERVATION. Examine your work carefully after IC installation and BEFORE turning on the power. If you have turned the computer on and nothing happened or something happened that was not supposed to happen, IMMEDIATELY turn the power off and look CLOSELY at the IC or ICs that you have installed. A small reading or magnifying glass will often help. Remove the board from the computer, if possible, and hold it horizontally at eye level and look down the rows of pins of the ICs. The pin out of line with the rest of the pins will stand out clearly. An IC not fully inserted will stand higher than the rest.

In the case of improper orientation, notice the notch on one end of the IC and a similar notch on the IC socket. The IC must be inserted with its notch lined up with the notch on the socket.

In the case of ICs with bent pins, the IC can be removed, the pin carefully straightened, and the IC reinserted. If the same pin gets bent again, at the same place, it will probably break the next time it is straightened. So, be VERY careful when straightening pins and reinserting ICs.

6-3. Expansion Memory Precautions

PRECAUTION #1

If you have chosen the Twinhead's RAM 1 or RAM 4 adapter, for your system, it must be installed ONLY in the left-most expansion slot of the motherboard. The socket for this slot is marked 'J8'. If these adapters are installed in another slot the system will not work.

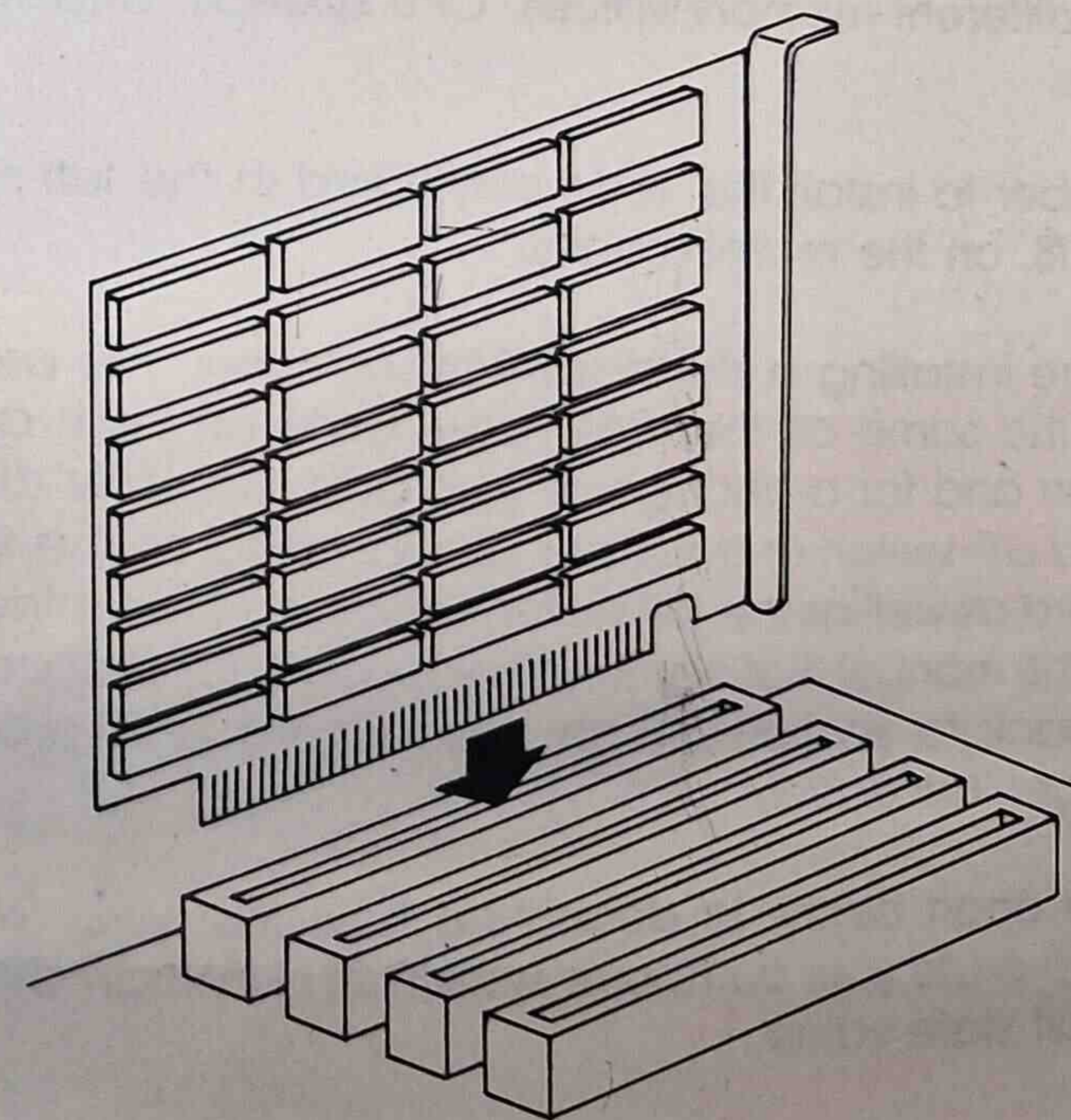
PRECAUTION #2

If you have chosen a standard RAM adapter for your system, it can be installed in any available slot EXCEPT the left-most slot, J8.

6-3-1. Expansion Memory Installation Hints

The RAM-free motherboard design permits easy and simple RAM installation, change, and upgrade for your computer system. It's a matter of:

1. Turning off all power in the computer system.
2. Removing the existing RAM card or preparing a slot for the new RAM card.
3. Performing the changes to the RAM card.
4. Installing the RAM card.
5. Setting DIP switches on the motherboard, if needed.
6. Re-powering the system.



The Twinhead 'RAM only' card has four columns of nine sockets per column for a total of 36 sockets. Each column is called a 'bank' and all banks should contain the same type and access speed of RAM. The banks are labelled 0 to 3 on the card and the configuration you choose will determine if all the banks are used. The minimum configuration requires two banks to be filled. Bank '0' must be filled first, followed by bank '1' and so forth. Banks of RAM must always be added two at a time so the card will only have two conditions; half full and totally full. The manual with the card will tell you how to configure it for the type of RAM you have.

When you have finished installing all the RAM, check carefully for improperly installed ICs. Refer back to the previous section, section 6-3, if you have some doubts about what to look for.

The motherboard DIP switch, labelled 'DSW' on the board, is located in the lower left corner near the built-in speaker. Refer to section 2.3 for which switches to set and how to set them for the different memory values, CPU speeds, and wait state settings.

Remember to install the 'RAM only' card in the left-most slot, socket J8, on the motherboard.

If you are installing a standard RAM adapter, the procedure will be the same as the 'RAM only' card for both a new installation and for a change or upgrade. The only difference will be a DIP switch or a jumper block setting on the standard RAM card as well as the DIP switch setting on the motherboard. Check the manual that came with your card for proper settings. Refer back to section 3.2 for precautions and procedures for proper installation.

Use the chart below to determine how fast your RAM must be to operate your computer system at a certain CPU speed and wait state value.

6-3-2. Slowest Permissible RAM Access Times

versus
CPU Speeds and Wait States

CPU speed	Wait states	RAM access time
8 mhz	1	150 ns
8 mhz	0	120 ns
10 mhz	1	120 ns
10 mhz	0	100 ns
12 mhz	1	100 ns
12 mhz	0	80 ns

7. CHECKLIST FOR STARTING A MINIMUM SYSTEM

The following items are suggested in order to have a functioning basic computer system:

- AT-type keyboard
- Case
- Diagnostics and Setup Diskette
- Diskette drive
- Diskette drive adapter + cables
- Power cord
- Power supply
- RAM card + RAM
- S-286 system board
- Set of tools (screwdriver, pliers, wrench)
- System diskette (DOS or other)
- Two System Keys
- User's guide
- Video monitor + cables + power cord
- Video adapter

Check these items off to be sure you are able to start up your system without any missing equipment.

Good luck with your new system!

APPENDIX A FCC Compliance Statement

This board generates and uses energy of about the same frequency as radio and TV broadcasts. Installed incorrectly it may interfere with reception of radio and TV broadcasts.

The board has been verified to be within energy emission limits for Class B computing devices as defined in the FCC Rules, Part 15, Subpart J. Installed correctly, it probably will not interfere with your radio or TV. However, we do not guarantee the absence of interference.

If you suspect this board is causing interference, turn your computer on and off while your radio or TV is showing interference. If the interference disappears when you turn the computer off and reappears when you turn the computer on, something in the computer is causing interference.

The following suggestions might reduce interference:

- Change the direction of the radio or TV antenna.
- Move the computer or the radio or TV. For example, if the computer is to the right of the TV, move it to the left of the TV. Or, move the computer farther away from the radio or TV.
- Plug the computer into a different outlet. Use an outlet on a different circuit than the radio or TV.
- Ensure that all expansion slots (on the back or side of the computer) are covered. Also, ensure that all board retainer brackets are tightly attached to the PC.

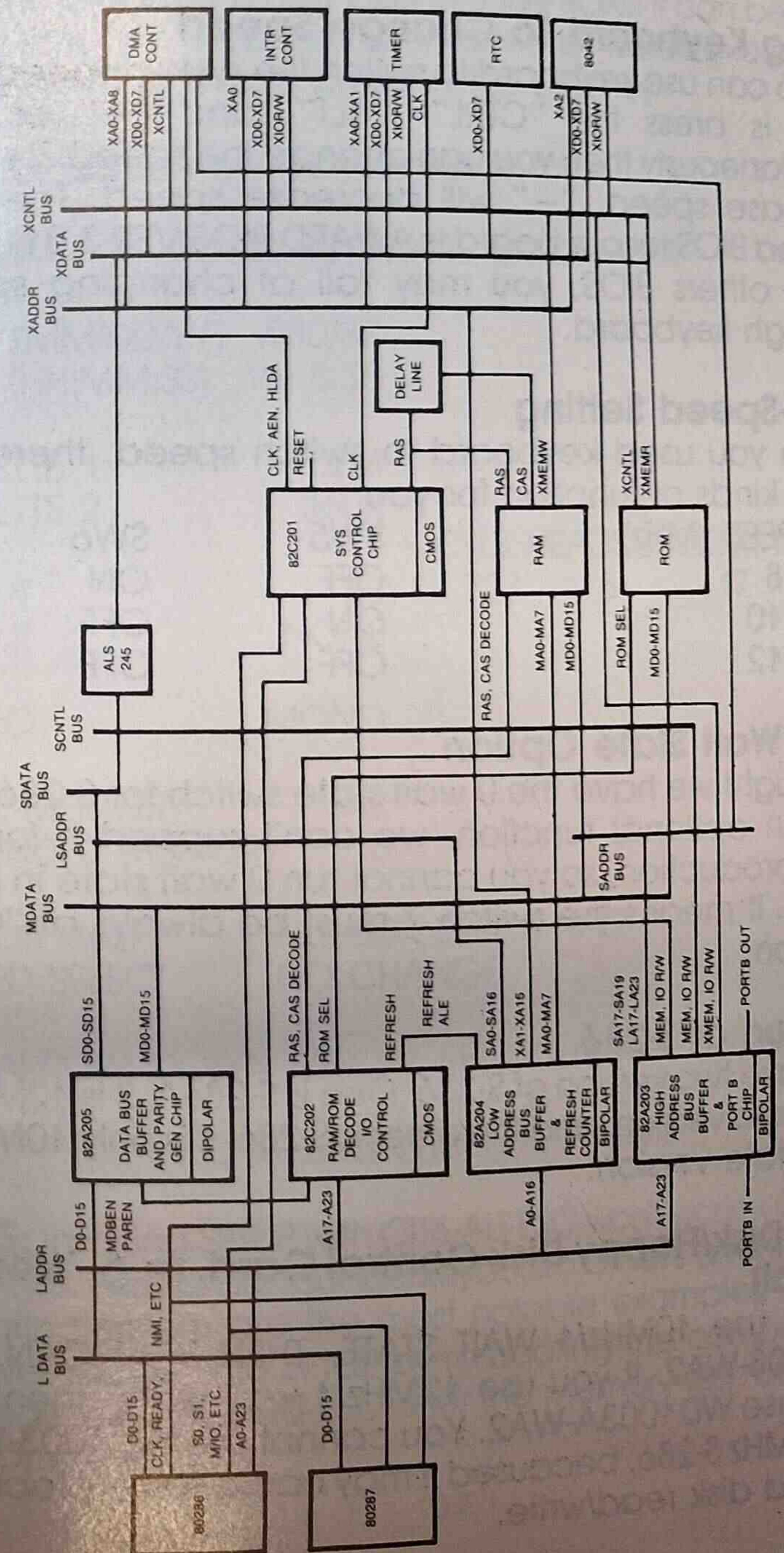
If these suggestions don't help, consult your computer dealer or an experienced radio/TV technician for more suggestions. You might find the following booklet helpful: "How to Identify and Resolve Radio-TV Interference Problems"

You can order the booklet from the U.S. Government Printing Office, Washington, DC 20402. Ask for stock number 004-000-00345-4.

*The use of a non-shielded interface cable with the referenced device is prohibited.

APPENDIX B

S-286 BLOCK DIAGRAM



APPENDIX C SPEED SETTING

1. Using Keyboard To Change Speed

S-286 can use keyboard to switch the system speed. The way is press the "CTRL", "ALT", and "-" or "+" simultaneously then you can change the speed. "+" will increase speed, "-" will decrease speed. The suggested BIOS for our board is AWARD BIOS VER 3.01. If you used others BIOS, you may fail at changing speed through keyboard.

2. High-Speed Setting

When you used keyboard to switch speed, there are three kinds of function for you.

SPEED (MHz)	SW5	SW6
6/8	OFF	ON
6/10	ON	OFF
6/12	OFF	OFF

3. Zero Wait State Option

Although we have the 0 wait state switch for S-286, but it is an optional function, we don't support it for our massproduction, so you cannot run 0 wait state in most cases. It means the switch 7 must be always at "OFF" position.

4. Version of S-286

We have two version of S-286. One is S-286A, it is 12MHz/1 wait state version, and the other is S-286, it is only 10MHz/1 wait state version.

5. Hard Disk/Floppy Disk Control Card. (e.g. Western Digital)

If you use 10MHz/1 WAIT STATE, THEN YOU CAN USE WD1003-WA2. If you use 12MHz/1 wait state, then you must use WD1003A-WA2. You cannot use WD1003-WA2 for 12MHz S-286, because it may cause some problems in hard disk read/write.

APPENDIX D SYSTEM SETUP AND BIOS

1.0 General Information

The SETUP program is now built into the ROM. It can be invoked any time the keyboard is enabled by holding down the CTRL and ALT keys and pressing the ESC key.

The SETUP screen will look similar to this:

AWARD SOFTWARE CMOS SETUP

DATE (MM/DD/YY) 4/10/87
TIME (HH:MM:SS) 11: 8:38

DISKETTE 1 1.2M
DISKETTE 2 360K

DISK 1 22
DISK 2 NONE

VIDEO MONO

BASE MEMORY 512
EXTENDED MEMORY 0

ERROR HALT NO DISK ERROR HALT
SPEED SELECT NO CHANGE

UP ARROW, DOWN ARROW, RETURN moves between lines,
LEFT ARROW, RIGHT ARROW selects values
F10 records changes, F1 exits

NOTES: invoking SETUP with CTRL-ALT-ESC won't work with all applications. Foreign language keyboard drivers and the VENIX operating system are the most notable examples. You can however still get into SETUP by re-booting the computer and holding down CTRL-ALT-ESC after the memory test, but before the computer boots.

The options you can set with 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. ERROR HALT
11. SPEED SELECT
12. DISK 1 STEP RATE
13. DISK 2 STEP RATE

The last three items, 11-13, are optional, and might not appear on your SETUP screen.

2.0 Moving Between Options

Use the UP ARROW, DOWN ARROW and RETURN keys to move between options. The field shown in reverse video is the current fields, which is the one the user may change.

3.0 Setting the Options

OPTION 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. It is not necessary to put leading zeros in front of numbers; however, you will need to type the "/" to separate the MONTH/DATE/YEAR. You may use the backspace key to correct any mistakes you make while typing in the date.

OPTION 2: TIME

Type the current time into this position and press RETURN. Type the time in the format HOUR:MINUTE:SECONDS. The HOUR

should be on a 24-hour clock; so far 1 o'clock p.m., type in 13:00:00. It is not necessary to put leading zeros in front of numbers; however you will need to type the ":" to separate the HOUR:MINUTE:SECONDS. You may use the backspace key to correct any mistakes you make while typing in the time.

OPTION 3: DISKETTE 1

There are five possible selections for "A" drive:

1. No floppy drive (NONE)
2. 5 1/4" standard drive (360K)
3. 5 1/4" high-density drive (1.2M)
4. 3 1/2" standard drive (720K)
5. 3 1/2" high-density drive (1.4M)

The values in parentheses are the abbreviations which the SETUP screen displays for each drive type.

Pressing the LEFT ARROW key changes the value displayed to the next one in the above list.

Pressing the RIGHT ARROW key changes to the previous selection in the above list.

OPTION 4: DISKETTE 2

Same as described for Option 3.

OPTION 5: DISK 1

Press the RIGHT ARROW key to select a higher numbered fixed disk type. Press the LEFT ARROW key to select a lower numbered fixed disk type. You may also type the disk type in directly using the numeric keys.

If you have no fixed disk, you should select "NONE". "NONE" can be using the arrow keys to rotate the selections until the word "NONE" appears in the field, or you can type in "0".

the cylinders, heads, sectors and write precomp fields are only there for information. You cannot edit these fields.

OPTION 6: DISK 2

Same as described for Option 5.

OPTION 7: VIDEO

There are four possible setting for the primary adapter type:

1. Enhanced Graphics Adapter or special video adapter (EGA)
2. Color Adapter, power up in 40 column mode (40 Color)
3. Color Adapter, power up in 80 column mode (80 Color)
4. Monochrome adapter (MONO)

The values in parentheses are the abbreviations which appear on the SETUP screen.

Pressing the LEFT ARROW key changes the value displayed to the next one in the above list.

Pressing the RIGHT ARROW key changes to the previous selection in the above list.

OPTION 8: BASE MEMORY

This value should be set to the amount of normal contiguous memory your system has.

To set this value, type in the amount of memory, in kilobytes, using the numeric keys on your keyboard. Most computers will have values of 256, 512 or 640.

At power up time, the computer determines how much memory is present by testing to see what is there. If the value you enter is different from the value the computer found, it will ask you to confirm that you have entered the correct value. Press the Y key if you are sure you have the correct number. Press the N key if you want to restore the previous value.

OPTION 9: AMOUNT OF EXTENDED MEMORY

This value should be set to the amount of memory your com-

puter has above the 1 megabyte boundary.

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

At power up time, the computer determines how much memory is present by testing to see what is there. If the value you enter is different from the value the computer found, it will ask you to confirm that you have entered the correct value. Press the Y key if you are sure you have the correct number. Press the N key if you want to restore the previous value.

OPTION 10: ERROR HALT

This setting allows you to control whether the computer will stop if it finds an error during power up. An error message will still be displayed, but the machine will not display "TYPE F1 to Continue."

For most situation, if the computer detects an error, it should stop so as to prevent possible loss of data (such as if a fixed disk is malfunctioning or memory is not behaving reliably). For some special applications, however, the computer should not halt.

For example, systems tied to local area networks do not need disk drivers, and should not halt if the system fails to detect any disk drives. Also, computers that are running as the center of a multi-user system or as a file server may not need a keyboard, and should not stop operation if no keyboard is present.

The options available are:

1. Halt on all errors.
2. Don't halt on any errors.
3. Don't halt on keyboard errors, but halt on all others.
4. Don't halt on disk errors, but halt on all others.
5. Don't halt on keyboard or disk errors, but halt on all others.

To select the option you want, press the LEFT ARROW key if you want to change the current selection to a higher numbered selection from the list above. Press the RIGHT ARROW key to move to a lower numbered selection. Continue pressing the ARROW key until the selection you want is showing on the screen.

OPTION 11: SPEED SELECT (OPTIONAL)

This option may not appear on your screen. It should only appear on computers that are capable of changing speeds.

This setting allows you to control what speed your computer will be running at before it begins booting its system software.

There are three possible settings:

1. Do not change speeds (NO CHANGE)
2. Low Speed (LOW)
3. High Speed (HIGH)

The values in parentheses are the abbreviations which appear on the screen.

To select the speed you want, press the LEFT ARROW key to move to a higher numbered selection on the above list. Press the RIGHT ARROW key to move to a lower numbered selection. Continue pressing the ARROW key until the selection you want is showing.

Not all computers have multiple speed capability, so setting this on your computer may not have any effect. If your computer does not switch speeds, then this should be set to NO CHANGE.

OPTION 12: DISK 1 STEP RATE (OPTIONAL) and OPTION 13: DISK 2 STEP RATE (OPTIONAL)

These options also might not appear on your screen. Most manufacturers do not use this, because it may have undesirable consequences.

Some new, advanced fixed disk controllers and fixed disk driver are capable of these operating faster than previous models would allow. If you have one of these advanced controllers, such as the Western Digital WD1003-WA2, and a disk that can benefit from a faster step rate, you can use this option to speed up the performance of your disk drive.

There are three options available:

1. Normal speed stepping (NORMAL)
2. Fast stepping (FAST)
3. Very Fast stepping (VERY FAST)

If the user sets this option to the FAST or VERY FAST option, he will be asked to confirm that he is sure his drive and controller are capable of handling these options.

WARNING: Do not set this value to anything except NORMAL unless you are certain your disk controller and disk can handle the higher speeds. If your controller and disk cannot handle the higher speeds, it could have the opposite effect and slow your drive down, and possibly cause unreliable operation or loss of data.

4.0 DEFAULT SETTINGS

If CMOS has not been set, SETUP will default to:

Date	1/1/80
Time	00:00:00
Diskette 1	None
Diskette 2	None
Disk 1	None
Disk 2	None
Video	EGA
Base Memory	Amount found by POST
Extended Memory	Amount found by POST

Error Halt Halt on all errors
 Speed Select No change

Disk 1 Step rate normal
 Disk 2 Step rate normal

S-286 BIOS

1) S-286 BIOS supports the 101 key keyboard, and all the new video functions that support it. It will call INT 15H, function 4FH immediately after getting the scan code from the keyboard controller. In order to determine if there is an enhanced keyboard attached, the BIOS assumes that the keyboard will pages lists all codes generated by entire an 84 key or 101 key keyboard:

Keyboard: 84 key (standard)

KEY	NORMAL	SHIFTED	CTRL	ALT
F1	3b	0 54	0 5e	0 68
F2	3c	0 55	0 5f	0 69
F3	3d	0 56	0 60	0 6a
F4	3e	0 57	0 61	0 6b
F5	3f	0 58	0 62	0 6c
F6	40	0 59	0 63	0 6b
F7	41	0 5a	0 64	0 6e
F8	42	0 5b	0 65	0 6f
F9	43	0 5c	0 66	0 70
F10	44	0 5d	0 67	0 71
'	29	60 29	7e ff	ff 29 f0
1	2	31 2	21 ff	ff 78 0
2	3	32 3	40 3	0 79 0
3	4	33 4	23 ff	ff 7a 0
4	5	34 5	24 ff	ff 7b 0
5	6	35 6	25 ff	ff 7c 0
6	7	36 7	5e 7	1e 7d 0
7	8	37 8	26 ff	ff 7e 0
8	9	38 9	2a ff	ff 7f 0
9	a	39 a	28 ff	ff 80 0
0	b	30 b	29 ff	ff 81 0
-	c	2d c	5f c	1f 82 0
=	d	3d d	2b ff	ff 83 0
/	2b	5c 2b	7c 2b	1c 2b f0
Backspace	e	8 e	8 e	7f e f0
Tab	f	9 f	0 94	0 a5 0
q	10	71 10	51 10	11 10 0
w	11	77 11	57 11	17 11 0
e	12	65 12	45 12	5 12 0
r	13	72 13	52 13	12 13 0
t	14	74 14	54 14	14 14 0
y	15	79 15	59 15	19 15 0
u	16	75 16	55 16	15 16 0
i	17	69 17	49 17	9 17 0
o	18	6f 18	4f 18	f 18 0
p	19	70 19	50 19	10 19 0
&	1a	5b 1a	7b 1a	1b 1a f0
e	1b	5d 1b	7d 1b	1d 1b f0

a	1e	61	1e	41	1e	1	1e	0
s	1f	73	1f	53	1f	13	1f	0
d	20	64	20	44	20	4	20	0
f	21	66	21	46	21	6	21	0
g	22	67	22	47	22	7	22	0
h	23	68	23	48	23	8	23	0
j	24	6a	24	4a	24	a	24	0
k	26	6b	25	4b	25	b	25	0
l	26	6c	26	4c	26	c	26	0
;	27	3b	27	3a	ff	ff	27	f0
'	28	27	28	22	ff	ff	28	f0
Return	1c	d	1c	d	1c	a	1c	f0
z	2c	7a	2c	5a	2c	la	2c	0
x	2d	78	2d	58	2d	18	2d	0
c	2e	63	2e	43	2e	3	2e	0
v	2f	76	2f	56	2f	16	2f	0
b	30	62	30	42	30	2	30	0
n	31	6e	31	4e	31	e	31	0
m	32	6d	32	4d	32	d	32	n
,	33	2c	33	3c	ff	ff	33	f0
.	34	2e	34	3e	ff	ff	34	f0
/	35	2f	35	3f	ff	ff	35	f0
Space	39	20	39	20	39	20	39	20
ESC	1	1b	1	1b	1	1b	1	f0
SysReq	ff	ff	ff	ff	ff	ff	ff	ff
Keypad Home	47	0	47	37	77	0	0	7
Keypad UpArrow	48	0	48	38	8d	0	0	8
Keypad PgUp	49	0	49	39	84	0	0	9
Keypad *	37	2a	ff	ff	72	0	37	f0
Keypad LeftArrow	4b	0	4b	34	73	0	0	4
Keypad 5	4c	f0	4c	35	8f	0	0	5
Keypad								
RightArrow	4d	0	4d	36	74	0	0	6
Keypad -	4a	2d	4a	2d	8e	0	4a	f0
Keypad End	4f	0	4f	31	75	0	0	1
Keypad Down Arrow								
Arrow	50	0	50	32	91	0	0	2
Keypad PgDn	51	0	51	33	76	0	0	3
Keypad +	4e	2b	4e	2b	90	0	4e	f0
Keypad Ins	52	0	52	30	92	0	ff	ff
Keypad Del	53	0	53	2e	93	0	ff	ff

Keyboard: 101/102 key

KEY	NORMAL		SHIFTED		CTRL		ALT	
	1	1b	1	1b	1	1b	1	1b
ESC	3b	0	54	0	5e	0	68	0
F1	3c	0	55	0	5f	0	69	0
F2	3d	0	56	0	60	0	6a	0
F3	3e	0	57	0	61	0	6b	0
F4	3f	0	58	0	62	0	6x	0
F5	40	0	59	0	63	0	6d	0
F6	41	0	5a	0	64	0	6e	0
F7	42	0	5b	0	65	0	6f	0
F8	43	0	5c	0	66	0	70	0
F9	44	0	5d	0	67	0	71	0
F10	85	0	87	0	89	0	8b	0
F11	86	0	88	0	8a	0	8c	0
F12	29	60	29	7e	ff	ff	29	ff
1	2	31	2	21	ff	ff	78	ff
2	3	32	3	40	3	0	79	0
3	4	33	4	23	ff	ff	7a	ff
4	5	34	5	24	ff	ff	7b	ff
5	6	35	6	25	ff	ff	7c	ff
6	7	36	7	5e	7	1e	7d	1e
7	8	37	8	26	ff	ff	73	ff
8	9	38	9	2a	ff	ff	7f	ff
9	a	39	a	28	ff	ff	80	ff
0	b	30	b	29	ff	ff	81	ff
-	c	2d	c	5f	c	1f	82	ff
=	d	3d	d	2b	ff	ff	83	ff
Backspace	e	8	e	8	e	7f	e	7f
Tab	f	9	f	0	94	0	a5	0
q	10	71	10	51	10	11	10	11
w	11	77	11	57	11	17	11	17
e	12	65	12	45	12	5	12	5
r	13	72	13	52	13	12	13	12
t	14	74	14	54	14	14	14	14
y	15	79	15	59	15	19	15	19
u	16	75	16	55	16	15	16	15
i	17	69	17	49	17	9	17	9
o	18	6f	18	4f	18	f	18	f
p	19	70	19	50	19	10	19	10

(1a	5b	1a	7b	1a	1b	1a	1b
)	1b	5d	1b	7d	1b	1d	1b	1d
/	2b	5c	2b	7c	2b	1c	2b	1c
a	1e	61	1e	41	1e	1	1e	1
s	1f	73	1f	53	1f	13	1f	13
d	20	64	20	44	20	4	20	4
f	21	66	21	46	21	6	21	6
g	22	67	22	47	22	7	22	7
h	23	68	23	48	23	8	23	8
j	24	6a	24	4a	24	a	24	a
k	25	6b	25	4b	25	b	25	b
l	26	6c	26	4c	26	c	26	c
;	27	3b	27	3a	ff	ff	27	ff
'	28	27	28	22	ff	ff	28	ff
Return	1c	d	1c	d	1c	a	1c	a
z	2c	7a	2c	5a	2c	1a	2c	1a
x	2d	78	2d	58	2d	18	2d	18
c	2e	63	2e	43	2e	3	2e	3
v	2f	76	2f	56	2f	16	2f	16
b	30	62	30	42	30	2	30	2
n	31	6e	31	4d	31	e	31	e
m	32	6d	32	43	32	d	32	d
.	33	2c	33	3c	ff	ff	33	ff
,	34	2e	34	3e	ff	ff	34	ff
/	35	2f	35	3f	ff	ff	35	ff
Space	39	20	39	20	39	20	39	20
Insert	52	e0	52	e0	92	e0	a2	e0
Home	47	e0	47	e0	77	e0	97	e0
PageUp	49	e0	49	e0	84	e0	99	e0
Delete	53	e0	53	e0	93	e0	a3	e0
End	4f	e0	4f	e0	75	e0	9f	e0
PageDown	51	e0	51	e0	76	e0	a1	e0
UpArrow	48	e0	48	e0	8d	e0	98	e0
LeftArrow	4b	e0	4b	e0	73	e0	9b	e0
DownArrow	50	e0	50	e0	91	e0	a0	e0
RightArrow	4d	e0	4d	e0	74	e0	9d	e0
Keypad /	e0	2f	e0	2f	95	0	a4	0
Keypad *	37	2a	37	2a	96	0	37	0
Keypad -	4a	2d	4a	2d	8e	0	4a	0
Keypad Home	47	0	47	37	77	0	0	0

Keypad UpArrow	48	0	48	38	8d	0	0	0
Keypad PgUp	49	0	49	39	84	0	0	0
Keypad +	4e	2b	4e	2b	90	0	4e	0
Keypad LeftArrow	4b	0	4b	34	73	0	0	0
Keypad 5	4c	f0	4c	35	8f	0	0	0
Keypad RightArrow	4d	0	4d	36	74	0	0	0
Keypad End	4f	0	4f	31	75	0	0	0
Keypad DownArrow	50	0	50	32	91	0	0	0
Keypad PgDn	51	0	51	33	76	0	0	0
Keypad Enter	4e	d	4e	d	e0	a	a	a
Keypad Ins	52	0	52	30	92	0	0	0
Keypad Del	53	0	53	2e	93	0	0	0

In addition INT 16H has three new function calls (ah = 10h, 11h, 12h) which are the 101 key keyboard equivalents of calls 0, 1, and 2.

2) S-286 BIOS will now support 3 12" floppy drives, using DRIVER.SYS supplied with DOS 3.2. This corrects a problem in other BIOS which did not turn on the motor to the drive for a sufficient period of time prior to formatting a track.

3) S-286 BIOS corrects a problem in the fixed disk handling. In other BIOS, if there were two or more consecutive seek operations on the fixed disk, it was possible that some of the later seeks would not be performed. This only affected seek tests, and did not cause any other problems.

4) Depending on the architecture of the machine, the machine may hang during the external ROM detection in the POST. This has been corrected in S-286 BIOS.

5) The speed switching in S-286 BIOS uses CTRL-ALT 1 or CTRL-ALT - to switch to low speed, and CTRL-ALT 2 or CTRL-ALT +, to switch to high speed. In addition, switching to low speed will cause a single beep, while switching to high speed will cause two beeps. The cursor is not changed by the switching operation. The speed switching is accomplished by changing bits 2 and 3 of the keyboard controller output port (pin 23 and 24), so that either bits will set the speed.

6) The fixed disk table has been extended to the following entries:

TYPE CYLINDERS HEADS WRITE PRE-COMP LANDING ZONE SPECIFIC DISK

1	306	4	128	305
2	615	4	300	615
3	615	6	300	615
4	940	8	512	940
5	940	6	512	940
6	615	4	0	615
7	462	8	256	511
8	733	5	0	733
9	900	15	0	901

			0	820
	820	3	0	855
10	855	5	0	855
11	855	7	128	319
12	306	8	0	733
13	733	7		
14		RESERVED		
15			0	663
16	612	4	300	997
17	997	5	0	997
18	997	7	512	1023
19	1024	7	300	732
20	733	5	300	732
21	733	7	300	733
22	733	5	0	336
23	306	4		
24		RESERVED		
25	1024	9	0	1023 Segment 4096
26	1224	7	0	1223 Maxtor 2085
27	1224	11	0	1223 Maxtor 2140
28	1224	15	0	1223 Maxtor 2190
29	1024	8	0	1023 Maxtor 1085
30	1024	11	0	1023 Maxtor 1105
31	918	11	0	1023 Maxtor 1170
32	925	9	0	926 CDC 9415
33	1024	10	0	1023 Generic 10hd
34	1024	12	0	1023 Generic 12hd
35	1024	13	0	1023 Generic 13hd
36	1024	14	0	1023 Generic 14hd
37	1024	2	0	1023 Generic 2hd
38	1024	16	0	1023 Generic 16hd
39	918	15	0	1023 Maxtor 1140
40	820	6	0	820 Seagate 251

7) The fixed disk routines have been extended to access drives with greater than 1024 cylinders (Maxtor 2190). The interface has change to:

ah = function
 al = number of sectors
 dl = drive number (0-1 for diskette, 80-81h for hard disk)
 dh = head number-bit 0-5
 bits 6-7 are the extended high cylinder (cyls > 1024)

ch=cylinder number-low 8 bits
 cl=sector number-bits 0-5
 bits 6-7 are high 2 cylinder bits
 es:bx= transfer address

where dh has been extended to include 2 bits for the high cylinder count.

Not to take advantage of the increased drive table and cylinder access, we suggest that you use the SPEEDSTOR software available from Storage Dimension, 981 University Ave., Los Gatos, Ca. 95030 (408) 395-5882.

B) Added INT 15H, function COH into the BIOS. This function returns a pointer to a configuration area which contains the following:

```
CONFIG__TABLE: DW      8           ;Size of table
                DB      OFCH       ;AT BIOS Model
                DB      1           ;System type
                DB      0           ;BIOS revision
                DB      01110000B   ;info byte
                DB      0           ;reversed
                DB      0
                DB      0
                DB      0
                DB      'Award Software Inc.-1987'
```

9) During the POST, the BIOS will access both floppy drives (if they exist), in order to reset the disk change lines (if they exist).

10) Added three routines to be used for CPU speed independence: WAIT_REFRESH, WAIT_FOR_PORT, WAIT_FOR__MEN. All timing loops of any importance have been removed throughout the BIOS with calls to these routines. These routines use one of three different methods of timing:

- a) Fast refresh clock-refresh clock < 60 microseconds
- b) slow refresh clock-refresh clock > 30 Us and < 5 ms
- c) CPU timings

To change which method of timing is used, and the timing parameters, use MODHEX. For further information on MODHEX and its capabilities, refer to the MODHEX manual. If the ROM is set for refresh timing, and the refresh clock is not appropriate, an error message will be displayed, "REFRESH TIMING ERROR"

11) Rewrote PRNT__SCAN to add new features: (1) Quick abort if printer not ready or out of paper. (2) Nesting of Interrupts prevented. (3) Last lines is taken from 40:84h.

12) Floppy driver massively rewritten, mainly to make driver compatible with BMhz IBM BIOS. Also, commentary expanded. This new INT 13H handler will run correctly with 3.5" disk drives. SETUP allows setting the drives for 360K, 720K, 1.2M AND 1.44M.

13) Fixed disk task file is no longer stored at 0:442h, to prevent multi-tasking conflict with floppy.

14) Fixed disk code allows more than 32 sectors per track.

15) Last Line of video screen is stored in 40:84 for use by INT 5h.

16) increased parallel strobe delay for faster processors.

17) Do two INs to get printer status to give the line time to stop floating. This appears to be necessary with certain parallel ports.

18) Do CLI before EOI in INT 8 to stop stack buildup because of INT 1CH routines taking too long.

19) INT 1Ah Returns AH=0, Carry flag clear or set for all functions. Functions 2 and 3 now manage the daylight savings time bit. Functions 2 and 4 return AL=0 if error. Stack usage reduced.

20) CMOS SETUP utility is now located in the ROM. It can be invoked using CTRL+ALT+ESC. It is also possible to make

a far call F000 :

EB2A which will also run SETUP. On return, the carry flag will be set if the user did not change CMOS (the date and time, can be changed without clearing the carry flag). It is the callers responsibility to reboot the machine to take advantage of the new CMOS changes. For more information on SETUP, refer to the SETUP manual.

21) BIOS contains module invoker. This allows the installation of additional modules into the BIOS, without massive work.

22) Default mode on power up is 80x25 instead of 40x25.

23) BIOS can be set to operate:

- a) without keyboard
- b) without disks
- c) without disks and keyboard
- d) without anything (runs until it dies).

The default can be entered into the BIOS, but this can be overridden using the SETUP utility.

24) Processor speed can be set (on switchable machines), for entry into the POST, and for booting. The speed after booting can be overridden using the SETUP utility.

25) This BIOS will only operate on 80286 based machines. It will halt if run on a 80386 processor.

26) Additional checksums have been incorporated into the BIOS for security. MODHEX must be used to create hex file. CHGHEX will no longer work correctly.

27) Added INT 16H, function 3 - Set Typematic Rate. Too call,

Input: ah=03h
al=05h
bl=typematic rate (0-1FH)-value checked
bh=repeat delay (0-3H)-value checked
Output: none

This function set the AT keyboard typematic rate (how many characters will be sent per second by pressing a key), and repeat delay (how long after a key is pressed will it start sending additional characters).

Typematic Rate (make codesseconds)

Bit	Rate	Bit	Rate	Bit	Rate
00000	30	00001	26.7	00010	24
00011	21.8	00100	20	00101	18.5
00110	17.1	00111	16	01000	15
01001	13.3	01010	12	01011	10.9
01100	10	01101	9.2	01110	8.6
01111	8	10000	7.5	10001	6.7
10010	6	10011	5.5	10100	5
10101	4.5	10110	4.3	10111	4
11000	3.7	11001	3.3	11010	3
11011	2.7	11100	2.5	11101	2.3
11110	2.1	11111	2		

Repeat Delay (milliseconds)

Bit	Delay	Bit	Delay	Bit	Delay	Bit	Delay
00	250	01	500	10	750	11	1000

28) Fixed problem with QuickBASIC by preserving BX in INT 15H function 84H, subfunction 0. Also changed other function returns to be more compatible.

29) Modified INT 13H (fixed disk) to get step rate from CMOS. this is not useful on all systems. Use with caution.

30) INT 70H Alarm function does not turn alarm function off.

31) Modified video to print nulls if there is no external video table defined for chars above 80H. Changed SET_MODE (function 0) to default to mode 0 or 2 if an invalid CGA mode is tried. Fixed bug in function 8 that caused snow on screen.

32) Fixed keyboard handler to accept extended Insert key when Num Lock is on.

33) Changed SETSPEED routine so that polarity of speed change bit(s) can be modified by MODHEX.

34) Added support for Seagate 4051 as drive 24 with following entry:

TYPE	CYLINDERS	HEADS	WRITE PRE-COMP	LANDING ZONE	SPECIFIC	DISK
24	977	5	None	976	Seagate	4051

In addition types 41-47 have been zeroed out. These types can be modified using the MODHEX program.

35) The SETSPEED function is now callable externally. To invoke, do a far call to F000:E826H, where bit7 = 1 to beep the speaker, and a 0 if the speaker should stay silent. The remaining seven bits (0-6) are defined by the SETSPEED routine installed by the user. The default routine assumes a 7FH for high speed, and 0 for low speed. Other routines may support the other bits for multiple speeds, or wait states.

36) All external option ROMs are now checksummed prior to being called. Also, floppy boot record is checked for validity prior to its being invoked.

37) Code has been restructured to place more routine in the orged area starting at F000:E000. To accomplish this, several of the source files have been consolidated into ATORGS.ASM. A new make file is supplied that is appropriate for this release.

38) Keyboard interrupts are enable immediately after keyboard reset to allow SETUP to be invoked as early as possible.

39) Bytes F000:FFE0 - F000:FFEF are defined to be customization bytes, and are reserved for use by MODHEX.

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