486 System Board

User's Guide

May 1992

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Contents

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1. 486 System Board Introduction

Thank you for purchasing this 486 system board. The manufacturer is confident that this product will provide all the performance and reliability you expect from a high quality 486 system board.

This first chapter of the manual introduces some of the technology behind the 486 system board and describes the board's features and peripheral connections. A brief overview of the contents of the rest of the manual is given in section 1.1 below.

This 486 system board uses advanced design techniques and the most recent technology to provide you with high performance and flexibility. The 80486 microprocessor used on this board is the most powerful personal computer microprocessor available today. This system board takes full advantage of the 80486's capabilities to provide you with the processing speed you need for even the most demanding applications.

This manual describes how to modify various settings on your system board to meet your personal requirements as well as, in certain cases, how to upgrade your system board. If you are unsure of how to configure the board yourself, you are advised to consult an authorized dealer. Note that in some cases, altering the system board yourself may void the product warranty.

This system board can be used with a 486DX microprocessor to build a 486DX-50MHz or 486DX-33MHz computer system, with a 486DX2 to build a 486DX2-66MHz or 486DX2-50MHz system, or with a 486SX to build a 486SX-25MHz or 486SX-20MHz system. The board may also be used to build a 487SX-20/25 system. (The 487SX, sold as a numeric coprocessor for the 486SX, is actually capable of functioning as an independent CPU itself.) If necessary, a Weitek 4167 math coprocessor may

be installed on the system board. Instructions on installing a math coprocessor are given in Chapter 2.

The system board has a four-layer construction and dimensions one-third smaller than the standard baby AT board size. The six mounting holes on the board are designed primarily for use with baby AT size desktop and tower cases but will fit most other cases as well.

This 486 system board supports up to 32MB of RAM (Random Access Memory) installed on-board. Various combinations of 256KB, 1MB, or 4MB 80ns DRAM modules may be installed in the two memory banks on the system board. Complete details on memory installation are given in Chapter 3.

The system board is compatible with all standard operating systems, including MS-DOS versions 3.0 and up, DR DOS 5.0, UNIX/XENIX, NetWare, and OS/2.

1.1 Organization of this Manual

This manual provides both basic explanations of your system board's features and instructions on how to complete installation of a 486-based personal computer system using this system board. It is recommended that you read the manual through thoroughly before beginning to set up and install your system board. The remainder of the manual is organized as follows:

Chapter 2 describes how to set up your system board prior to installing the board in the system unit case. You should read Chapter 2 before beginning to install anything.

Chapter 3 describes the size and configuration of your system's on-board memory and external cache memory and gives instructions for installing the memory devices on the system board.

Once you finish the steps described in chapters 2 and 3, your system will be ready to install in a system case. *Chapter 4* provides instructions for installing the system board in a system unit case along with a number of typical peripheral components.

Chapter 5 provides technical information on various aspects of the system board for the reference of advanced users. This information includes the AT bus definition for the system and the pin definitions for the chip set used on the board. The *Appendix* of the manual will give you a basic idea of how to operate the Basic Input/Output System (BIOS) setup program installed on this system board.

If you are beginning with an uninstalled system board, you will need to follow the instructions in chapters 2, 3, and 4, in that order, to complete installation of your system board and all related components. When these steps have all been completed, you will need to adjust the BIOS set-up using the software utility described in the Appendix. Finally, you will need to install a software operating system (such as DOS) before your personal computer system will be ready for use.

1.2 486 CPUs

The 486DX microprocessor is a highly integrated (one million transistors on-chip) 32-bit architecture central processing unit (CPU) with on-chip memory management and an on-chip floating point unit and cache memory unit.

The 486DX includes all of the features of the popular 386 microprocessor, with a number of enhancements, such as an on-chip 8 Kbyte, 4-way set associative cache memory with write-through design, RISC design

technology for reduced instruction cycle time, and a burst bus feature for fast cache fills. The 486DX also integrates the functions of a math coprocessor on-chip. The combination of these features results in performance better than twice that of a 386 microprocessor.

The 486SX microprocessor is 100% compatible with the 486DX microprocessor and includes all of the 486DX's features except for the on-chip floating point coprocessor.

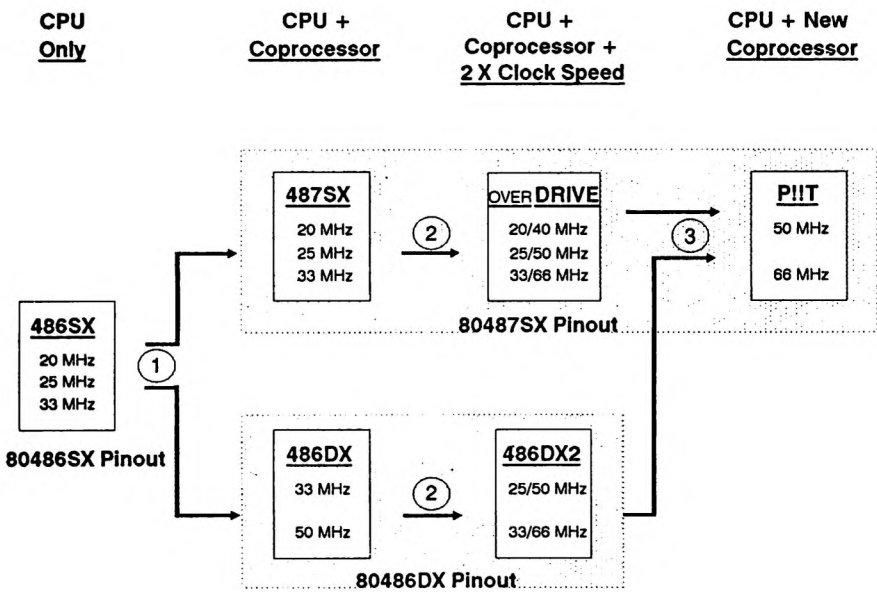
1.3 CPU Upgrades

Among the major advantages of this 486 system board is the flexibility it offers to the end-user. This system board can be used to build a personal computer system based on any one of the three 486 microprocessors currently available, and it is also designed for use with several microprocessors expected to be added to the 486 line in the near future. With the continuing growth of the 486 family of microprocessors, the user may eventually wish to upgrade the CPU installed on the system board. The chart on the next page displays the relationships between the various CPUs in the 486 line that are currently available or soon expected to become available.

As shown in the upgrade chart, the 486SX CPU offers 486-level performance without an on-chip math coprocessor. At the next upgrade level, both the 487SX and the 486DX integrate a math coprocessor on-chip along with the 486 CPU. The next upgrade step is to a 486DX2 CPU or a OVERDRIVE CPU; these CPUs operate at twice the clock speed of the 486DX and 487SX, resulting in approximately a seventy percent increase in system performance speed. The final upgrade shown in the chart is from the 486DX2 CPU or OVERDRIVE CPU to the P!!T CPU. This last CPU will include a more advanced math coprocessor providing a thirty percent increase in processing speed for integer calculations and a one to two hundred percent increase in floating point processing speed over the 486DX2 and OVERDRIVE CPUs.

This system board is designed for use with any of the CPUs listed in the chart. When installing a particular CPU on the system board, be certain to configure the board for use with that CPU by adjusting the CPU selection jumpers described in section 2.1 below.

CPU Upgrade Chart



1. **Math Coprocessor Upgrade.**

2. **70% System Performance Speed Upgrade.**

3. **30% increase in integer calculation processing speed and a 100-200% increase in floating point processing speed.**

1.4 The Cache Memory

The incorporation of high speed CPUs into computer systems can give rise to a significant discrepancy between CPU processing speed and memory access speed: main memory access times may be so slow relative to CPU cycle time that overall machine performance is severely impaired, and the system is simply unable to take full advantage of the high speed processing capabilities of an advanced CPU. Cache memories were first conceived as a solution to this problem. The cache design helps to reduce average memory access time, making the system appear to have a large amount of very fast memory.

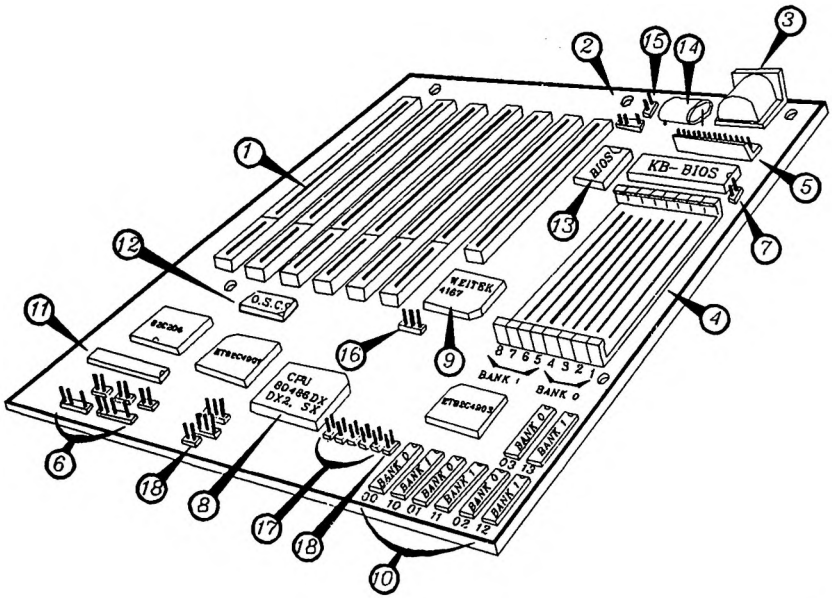
A cache memory is a small, high-speed buffer memory placed logically between the CPU and main memory and used to store frequently used data or routines for CPU access. Cache memories are based on the twin principles of spatial and temporal locality, which refer, respectively, to the highly sequential and loop-oriented character of most computer programs. Since programs generally proceed in a sequential, loop-oriented way, information that the CPU may need to reference in the near future is likely to be located logically close in main memory to information currently being referenced by the CPU, and it is likely to be referenced repeatedly as the program is executed. These facts about computer programs make the following strategy sound promising: each time the CPU accesses certain information in the main memory, information in several locations logically close to that information can be fetched along with it, stored in a very fast buffer memory, and kept there for an extended period of time (i.e., until it is replaced by other information). This makes it likely that as a particular program is executed, a high percentage of the instructions or data needed by the CPU will eventually end up being stored in the buffer memory, where it can be accessed by the CPU far more rapidly than information stored in the slower main system memory. And this is, in fact, basically how a cache memory works.

The cache memory subsystem on your system board, then, works roughly as follows. Whenever the CPU reads from a particular location in the main memory, the information from that location and several neighboring locations, known as "lines" or "blocks," is copied into the cache memory. The data itself is stored in the data Random Access Memory, or *data RAM*, while the addresses in the main memory of the information copied into the data RAM are stored in the *tag RAM* for comparison with addresses referenced by the CPU in the future. From that point on, each time the CPU accesses the memory, the cache controller will compare the address generated by the CPU with the contents of the tag register to see if the information requested is already in the cache memory. If it is, a cache "hit" occurs, and the CPU memory access is serviced by the high speed cache memory. If the information requested by the CPU is not already stored in the cache memory, a cache "miss" occurs. The CPU then performs a *cache update cycle*, in which the information requested is retrieved from main memory to service the CPU and concurrently copied into the cache memory for future use. In this way, eventually a very high average percentage of the information needed by the CPU (over 90%) can be accessed directly from the cache RAM.

The 486 CPU on this system board includes an 8KB internal cache, while the external cache on the board itself may be 64KB or 256KB in size. The high speed of the SRAM (Static Random Access Memory) chips used in the cache memory (compared to the Dynamic Random Access Memory chips, or DRAMs, used in the main memory) helps your system take full advantage of the 486 CPU's rapid processing speed, thus reducing the wait state of the system to nearly zero.

1.5 486 System Board Layout

The major components on your 486 system board and their locations are depicted in the diagram on the next page. Brief descriptions of the expansion slots, chip set, and BIOS are given in this section. Descriptions of the



1. 8-bit and 16-bit expansion slots.
2. External-battery connector.
3. Keyboard connector.
4. Memory banks 0 and 1.
5. Power supply connector.
6. Case feature connectors.
7. Software turbo enable jumper (JP 1).
8. 80486DX/80486DX2/80486SX central processing unit (CPU).
9. Weitek 4167 math coprocessor socket.
10. Data SRAMs.
11. Tag SRAM.
12. Oscillator.
13. ROM BIOS.
14. On-board battery.
15. On-board battery enable jumper (JP 7).
16. 486DX-50MHz system selection jumper (JP 50).
17. CPU selection jumpers (Jumpers JX1 - JX5).
18. Cache size selection jumpers (JP 2, 3, 4 and 5).

jumper switches, system case features, keyboard connector, power supply connector and memory components on the board appear in chapters 2 and 3.

Expansion Slots

This 486 system board has six 16-bit AT expansion slots and one 8-bit XT slot. The 8-bit and 16-bit slots will fit all AT-compatible expansion cards designed to run at 8MHz.

The 8-bit slot is used for expansion cards that do not require a 16-bit path, such as certain I/O cards and other cards designed for XT-compatible computers. This slot is located to the right of the 16-bit slots and is shorter than the others.

The 16-bit slots are used by add-on cards such as hard disk controllers, network cards, and many others. These slots have two sections, one long and one short. The long sections may be used to install 8-bit cards, if necessary.

When installing an expansion card, remove the slot cover corresponding to the slot you are using, insert the card firmly into the slot, and fasten the card to your computer chassis with the screw that originally held the slot cover in place. Check that the rows of connectors inside the slots are clean before installing an expansion card.

Chip Set

The control logic and other components of this 486 system board are contained in an ETEQ ET82C4901/ET82C4903 chip set. Technical information on the chip set used on the system board is included in Chapter 5 of this manual for the reference of advanced users. For most users, a detailed understanding of the chip set's functions is not necessary in

order to build and operate a computer system based on this system board.

ROM BIOS

A standard design feature of PC/AT-compatible system boards is a basic software program permanently stored in a ROM (Read Only Memory) chip on the board. This software is referred to as the *BIOS*, or Basic Input/Output System. The major functions of the BIOS are to check the hardware in your system each time it is powered on (this operation is known as the *POST*, or Power-On Self Test) and to act as an interface between the CPU and the other components and peripherals in the system. Information on the BIOS installed on this system board and the BIOS setup utility used to configure your computer system is given in the Appendix of this manual.

On Board Battery

An on-board battery is installed on this system board. The battery is used to power the CMOS RAM in which system configuration information is stored while the system power is off.

System Case Features

There are eight connectors on the system board that are used to connect the board to controls located on the front panel of your system unit. They are the keyboard connector, the speaker connector, the external battery connector, the keylock connector, the hardware reset switch connector, the hardware turbo switch connector, the turbo LED connector, and the power connector. Brief explanations of the functions of each of the connectors and instructions on how to connect these controls to the system board are given in Chapter 2.

1.6 System Specifications

The following is a brief summary of this 486 system board's features:

- Intel 80486DX-50/33MHz, 80486DX2-66/50MHz or 80486SX-25/20MHz PC/AT compatible system
- AT Bus Speed:
  - 486SX-20: 10 MHz
  - 486SX-25: 6.25 MHz
  - 486DX2-50: 6.25 MHz
  - 486DX2-66: 8.25 MHz
  - 486DX-33: 8.25 MHz
  - 486DX-50: 8.33 MHz
- ETEQ chip set
- 27512 x 1 EPROM
- Dimensions: 8.6 x 9.8 inches (Two-thirds standard "baby" AT board size)
- Up to 32 MB on-board system memory using 256KB, 1MB, or 4MB 80ns SIMMs
- On-board memory configuration: 1, 2, 4, 5, 8, 16 or 32 MB
- Supports 64KB or 256KB cache memory (8K x 8 or 32K x 8 SRAMs)
- Slots: six 16-bit AT slots, one 8-bit XT slot
- Shadow RAM and 256KB memory remapping
- Two blocks of non-cacheable memory
- Fast Reset and GateA20 to optimize operations under OS/2
- Hidden refresh and AT refresh option
- Software/hardware turbo speed toggle

- 4-layer PCB
- Flexible design: one board for 486DX/486DX2/486SX/487SX CPUs running at 20/25/33/50/66MHz

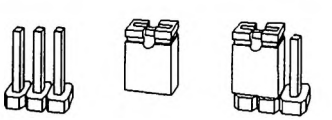
2. System Board Setup

Before you begin installing your system board in a system unit case and connecting peripheral devices to the system, there are several preliminary steps you must take. First, there are several jumper switches on the board that must be adjusted for use with your particular system. Next, you will need to install the memory devices on the system board. Last, there are a number of connectors on the board that you must attach to the system case (depending on the type of system case you are using, connectors may be attached before or after installing the board in the case). This chapter will tell you how to adjust the jumpers on the board and attach the various connectors. Installation of the memory devices is discussed in Chapter 3.

If your system board has already been installed by the dealer, you will still want to refer to this chapter in case you plan to make any changes or upgrades to your system.

2.1 Jumper Switches

Jumper switches are used to select between various operating modes. A jumper switch consists of two or three gold pins projecting up from the system board. Placing the plastic *jumper cap* over two pins connects those pins and makes a particular selection. Using the cap to cover two pins in this way is commonly referred to as *shorting* those pins. If the cap is not placed on any pins at all, this is referred to as leaving the pins *open*.

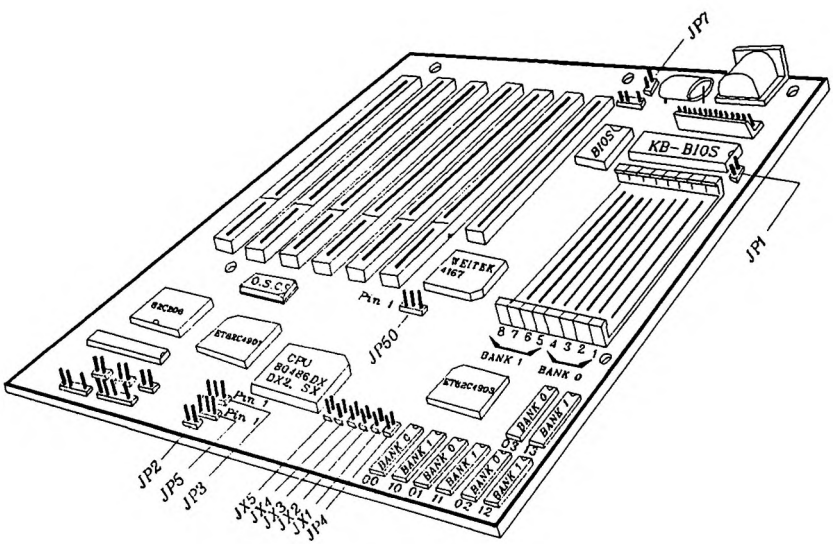


3-pin Jumper

2-pin Jumper

There are twelve user-configurable jumper switches on this 486 system board. One set of five jumpers - Jumpers JX1 through JX5 - is used to configure the system board for the type of CPU that will be used with the system. Another set of four jumpers - Jumpers 2, 3, 4 and 5 - is used to set up the system board for the size of the cache memory that you plan to install. The remaining three jumpers are Jumpers 1, 7, and 50. Jumper 1 is used to activate the software turbo enable function, while Jumper 7 is used to activate the on-board battery, if desired. Jumper 50 is used to set up the system board for a 486DX-50MHz computer system.

This section will discuss the functions and settings for all of the user-configurable jumpers on the system board. Consult the diagram below to find the location of the various jumpers on the system board.

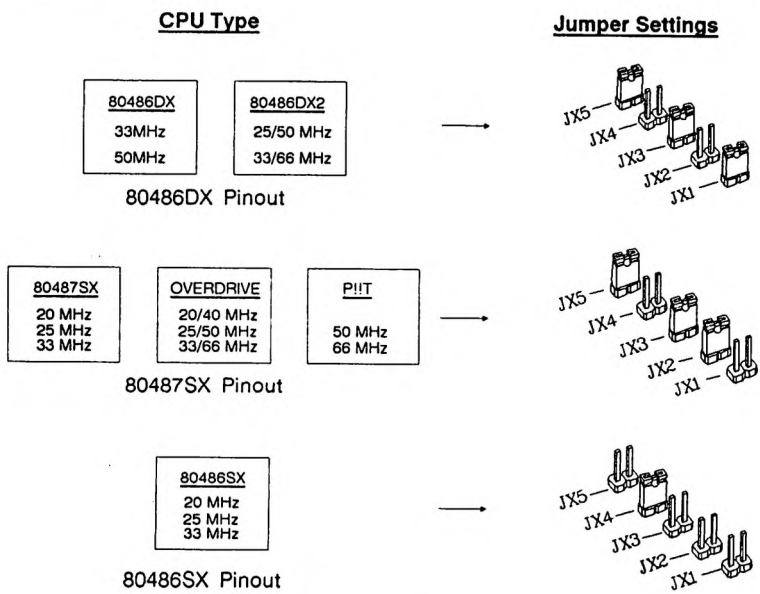


486 System Board Jumper Switches

CPU Selection Jumpers

The first set of jumpers you will need to configure are the CPU selection jumpers. If you orient the system board so that the expansion slots are at the rear left as you face the board, the CPU selection jumpers will be located just to the right of the CPU, near the front center of the board. The CPU selection jumpers are a row of five jumper switches, labeled JX1 through JX5. Jumper JX1 is the first of these five jumpers, counting from the right.

The CPU selection jumpers are used to set up the board for the type of CPU you are using - either a 486DX, a 486SX, a 487SX, or another advanced CPU from the 486 family. Each of the five jumpers has just two pins. Depending on the type of CPU you have selected, you will need either to short these two pins by covering them with the jumper cap, or else to remove the cap and leave the pins open. Configure Jumpers JX1 through JX5 for the type of CPU you have selected according to the settings shown below:



Cache Size Selection Jumpers

The cache size selection jumper switches are Jumpers 2, 3, 4 and 5. These jumpers are used to configure your system board properly for the size of the external cache memory you intend to install. Either a 64KB or a 256KB cache memory may be installed on this system board. Details regarding the installation and type of SRAM devices to be used in the cache memory are given in Chapter 3. This section will discuss the configuration of the jumper switches on the system board only.

Assuming that you still have the system board oriented as described in the last section, Jumpers 2, 5 and 3 will be located adjacent to each other near the front center of the board. Jumper 4 is located just to the right of Jumper JX1 (the first CPU selection jumper).

Before you begin to adjust these jumpers, you need to make note of three things. First, you need to decide the size of the cache memory you will be installing on the system board. Next, you should observe that of the four jumpers you will be adjusting, Jumpers 3 and 5 are three-pin jumpers, while Jumpers 2 and 4 have only two pins. This means that to configure Jumpers 3 and 5 you will need to use the jumper cap to connect two of the three pins; to adjust Jumpers 2 and 4, on the other hand, you will simply need to either short the pins with the jumper cap or remove the cap and leave the pins open. Last, for Jumpers 3 and 5 you need to identify which of the three pins is Pin 1. As should be marked clearly on the board itself, Pin 1 for each of these jumpers is the pin at the right-hand side.

Once you have made note of the size of the cache memory you will install and the type and location of Jumpers 2, 3, 4 and 5, you will be ready to adjust the jumper settings. These jumpers should be configured for the cache memory size you will be using according to the settings shown in Table 2.1:

Cache Memory Size	Jumper Switch Settings			
	JP2	JP3	JP4	JP5
64KB	Open	1-2	Open	1-2
256KB	Short	2-3	Short	2-3

Table 2.1: Cache Memory Size Jumper Switch Settings

On-board Battery Enable Jumper

Jumper 7, the on-board battery enable jumper, is used to activate the on-board battery. The battery is the power source for the real time clock and the CMOS RAM in which system configuration information is stored when the system power is off. There is an on-board battery and an external-battery connector installed on the system board. The external-battery connector is meant to be used only for backing up the on-board battery or for replacing it when it fails (typical battery life for the on-board battery is two to three years).

Jumper 7 is a two-pin jumper located at the rear of the system board, immediately to the left of the on-board battery. To activate the on-board battery, *short* Jumper 7 by connecting the two pins together using the plastic jumper cap provided. To deactivate the on-board battery and enable the external battery, leave Jumper 7 open.

Software Turbo Enable Jumper

Jumper 1, the software turbo enable.jumper, is used to activate the system board's software turbo mode enable feature. Turbo mode is a high speed operating mode; non-turbo mode is a slower processing speed that may be necessary for older-generation software originally designed for slower machines.

Jumper 1 is a two-pin jumper located behind the memory banks to the right of the keyboard BIOS. To activate the software turbo mode enable,

short Jumper 1 by connecting the two pins together using the plastic jumper cap provided. To deactivate the software turbo mode enable, leave Jumper 1 *open*.

If the software turbo mode enable is activated, you can toggle your system's turbo mode on and off from your keyboard, as follows: To toggle the turbo mode *on*, hold down the <CTRL> and <Alt> keys simultaneously and press the + (plus) key. To toggle the turbo mode *off*, hold down the <CTRL> and <Alt> keys and press the - (minus) key.

A hardware turbo switch connector is also provided on the system board. This means that there are three possible ways to set up your system board to toggle the turbo mode on and off. You may choose to connect the hardware turbo switch only, leaving Jumper 1 open; in this case turbo mode is toggled on and off by using the hardware switch only. Or you may choose to activate the software turbo enable using Jumper 1 and leave the hardware turbo switch unconnected; in this case, the turbo mode is toggled on and off by means of the software turbo enable command only. Last, you may both connect the hardware turbo switch *and* activate the software turbo enable; in this case either the hardware switch *or* the software command may be used to toggle the turbo mode *off*, but *both* the software command *and* the hardware switch must be set to *on* in order to toggle the turbo mode *on*.

Naturally, you may also choose to leave the hardware switch unconnected and Jumper 1 open, in which case your system will run in turbo mode continuously. Generally speaking, you will want to run the system in turbo mode continuously unless you experience compatibility problems with certain older software applications.

486DX-50MHz System Selection Jumper

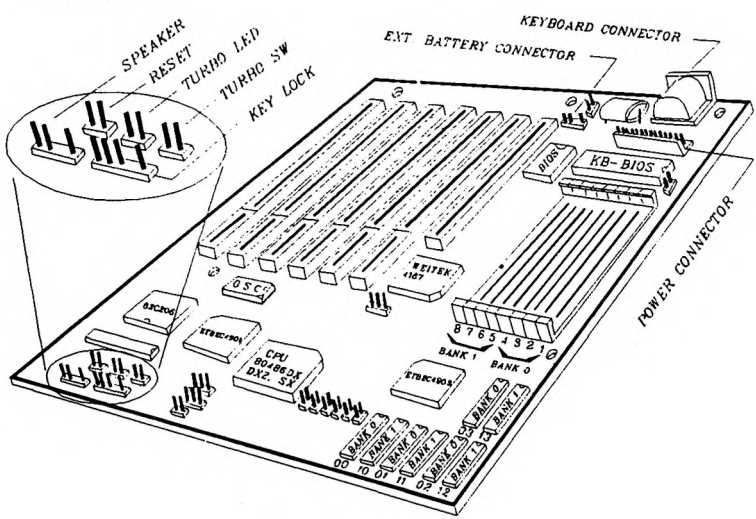
The last user-adjustable jumper on the system board is Jumper 50, the 486DX-50MHz system selection jumper. Jumper 50 is used to set up the

board for a 486DX-50MHz system. It is very important that Jumper 50 be adjusted correctly for the type of system you install, otherwise the system will not run properly, regardless of whether it is a 20, 25, 33, or 50MHz system.

Jumper 50 is a three-pin jumper located in front of the math coprocessor socket. Pin 1 of this jumper is the pin on the left. For 486DX-33, 486DX2-50/66, or 486SX-20/25/33MHz systems, the jumper cap on Jumper 50 must be used to connect Pins *2 and 3*. For a 486DX-50MHz system, Pins *1 and 2* of Jumper 50 must be selected.

2.2 Connectors

Connectors are used to connect the system board to other parts of the system, including the power supply, the keyboard, and the various controls on the front panel of the system case. Like jumper switches, connectors usually consist of several gold pins protruding upwards from the system board. When attaching connecting wires to the connectors you should remember that some of them must be aligned in a specific way in order to function properly.

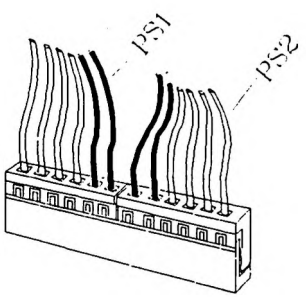


There are eight connectors this system board. They are the keyboard connector (KB1), the speaker connector (SPK), the battery connectors (BATT), the keylock connector (KEYLC), the hardware reset switch connector (RST), the hardware turbo switch connector (TBSW), the turbo LED connector (TBLED), and the power connector (PW1). Each of the connectors is discussed individually below.

Power Supply Connector

The power supply connector is located on the right-hand side of the system board, behind the memory banks. When installing the board, the power supply connector is usually the last connector to be attached before moving on to install the system peripherals. Before connecting the power supply, check that it is not connected to a power source.

Most power supplies have two six-wire connectors that must be attached to the system board. Two of the wires on each connector are black. When attaching these two connectors to the power supply connector, align them so that the two black wires on each connector are in the *middle*, as shown below.



The pin definitions for the power connector are shown in Table 2.2.

Pin	Connector PS-1	Connector PS-2
1	Power Good	Ground
2	+5V DC	Ground
3	+12V DC	-5V DC
4	-12V DC	+5V DC
5	Ground	+5V DC
6	Ground	+5V DC

Table 2.2: Power Connector Pin Definitions

Keyboard Connector

The keyboard connector is located at the rear of the system board on the right-hand side. Usually the keyboard is the last part of the system attached to the system board, after the board has been installed in its case and the case has been fastened shut.

Keyboard connector pin assignments are shown in Table 2.3.

Pin	Definition
1	Keyboard clock
2	Keyboard data
3	(none)
4	Ground
5	+5V DC

Table 2.3: Keyboard Connector Pin Definitions

Speaker Connector

The speaker connector is located at the front left of the board. An external speaker mounted inside the case may be attached to the system board via this connector. The POST and many software applications make use of the speaker. Typical speaker specifications are 8 Ohm, 0.2 Watt, and 1.5 inches in size.

Speaker connector pin assignments are shown in Table 2.4.

Pin	Definition
1	Speaker signal
2	No connection
3	GND
4	+5 V DC

Table 2.4: Speaker Connector Pin Definitions

Keyboard Lock Connector

The keyboard lock connector is a four-pin connector located at the front left of the system board, to the right of the speaker connector. When this connector is attached to the keylock on the front panel of the system case, the lock can be used to disable the keyboard, preventing other users from using the keyboard to communicate with your computer. It is important to orient the cable correctly when connecting the keylock to the system board. As should be clearly labeled on the board itself, Pin 1 of the keyboard lock connector is the first of the four pins, counting from the left.

Pin definitions for the keyboard lock connector are shown in Table 2.5.

Pin	Definition
1	+5 V DC
2	No connection
3	Ground
4	Keylock
5	Ground

Table 2.5: Keyboard Lock Connector Pin Definitions

System Reset Switch Connector

The system reset switch connector is a two-pin connector located at the front left of the system board, behind the speaker connector. This connector should be attached to the Reset switch on the front panel of the system case. The Reset switch may then be used to reset the computer, causing it to perform a cold restart from the power-on self test without turning off the power.

Pin definitions for the reset switch connector are given in Table 2.6.

Pin	Definition
1	System reset
2	GND

Table 2.6: Reset Switch Connector Pin Definitions

Turbo LED Connector

The turbo LED connector, located at the front left of the system board next to the reset connector, attaches to a turbo LED on the front panel of the system case. If connected, the turbo LED will light whenever the system is running in turbo (high speed) mode. Note that when attaching the turbo LED wire to the turbo connector, it is important to orient the wire correctly. The "+" terminal of the connector is the right-hand pin.

Hardware Turbo Switch Connector

The hardware turbo switch connector, located at the front left of the system board next to the turbo LED connector, is used to connect the board to a hardware turbo switch on the front panel of the system unit. If connected, the hardware turbo switch can be used to toggle the turbo (high speed) mode on and off. Refer to the discussion of the software turbo enable jumper in section 2.1 above for more information on the functions of the hardware turbo switch.

External Battery Power Connector

The external battery connector is a four-pin connector located at the rear of the board between the power connector and the expansion slots. This connector may be used to attach an external 4.5V to 6V battery to back up or replace the on-board battery. When attaching the external battery, it is very important that the connecting wire be oriented correctly.

Pin definitions for the external battery power connector are given in Table 2.7.

Pin	Definition
1	+ 4.5 - 6 V DC
2	No connection
3	Ground
4	Ground

Table 2.7: Battery Connector Pin Definitions

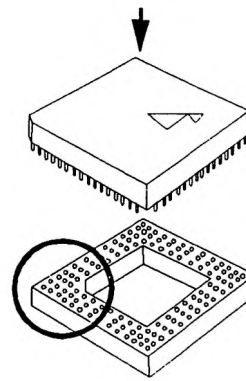
2.3 Installing a Numeric Coprocessor

Installing a math coprocessor can increase system speed dramatically for certain calculation-intensive applications.

The math coprocessor socket on this system board is found near the center of the board, to the right of the expansion slots. The coprocessor socket on this 486 board will fit the Weitek 4167 math coprocessor.

When installing a coprocessor, you will need to take care that the pins are aligned correctly with the holes of the socket. The corner of the socket into which Pin 1 of the coprocessor is to be inserted is marked by a notch on the hollow center square of the socket. If you examine the coprocessor, you will notice that one corner of the coprocessor chip is marked by a similar notch. Position the coprocessor so that the Pin 1 corner of the

chip is oriented in the same direction as the Pin 1 corner of the socket, align the pins on the chip carefully with the holes of the socket, and insert the chip gently but firmly into the socket.



Installing a Math Coprocessor

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3. Installing the Memory

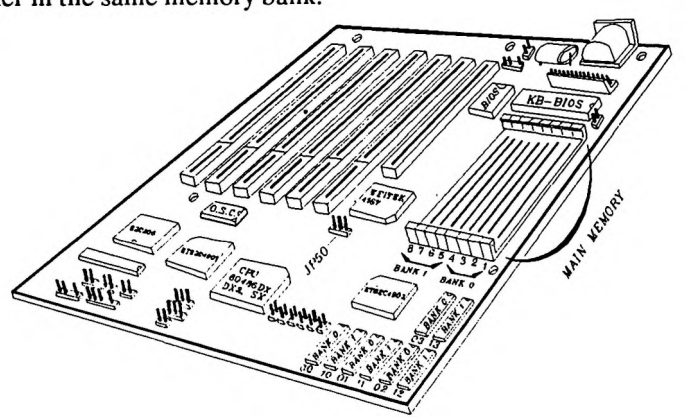
This 486 system board can operate with from 1MB to 32MB of system memory installed on-board. There is also an external cache memory on the system board that may be installed as either 64KB or 256KB in size.

This chapter describes the types of memory devices that should be used with the system board and explains how to install the memory. If your system board has already been installed for you, you will not need to read this section unless you will be adding more memory to the system.

Note that when installing memory devices on your system board you should always take care to follow anti-static electricity precautions. These precautions are explained in detail in Chapter 4.

3.1 Main Memory

The on-board memory is divided into two banks, Banks 0 and 1. Each bank has 4 slots, each of which will hold one SIMM (Single In-line Memory Module). Either 256KB, 1MB, or 4MB modules may be used with this system board, but modules of different sizes may not be installed together in the same memory bank.



A memory bank must be completely filled in order to operate properly, so the minimum amount of memory that may be installed on the board is 1MB, i.e., four 256KB SIMMs installed in Bank 0. (Bank 0 must be filled before Bank 1.)

Memory Configuration

Besides the minimum memory size of 1MB, there are eight other recommended configurations for installing SIMMs in the memory banks, allowing you to select one of nine different memory sizes for use with your system board. If you are using a mixture of 256KB, 1MB, or 4MB SIMMs, it is recommended that the larger-capacity devices be installed in Bank 0, as this will tend to enhance overall system speed. The maximum amount of on-board memory that may be installed is four4MB SIMMs in each of the two memory banks, for a total of 32MB.

The recommended memory configurations and the total memory size that results from each configuration are shown in Table 3.1 below.

Bank 0	Bank 1	Total Memory	Interleave
256K	(Empty)	1M	None
256K	256K	2M	2-way
1M	(Empty)	4M	None
1M	256K	5M	None
1M	1M	8M	2-way
4M	(Empty)	16M	None
4M	256K	17M	None
4M	1M	20M	None
4M	4M	32M	2-way

Table 3.1: Recommended System Memory Configurations

Installing SIMMs

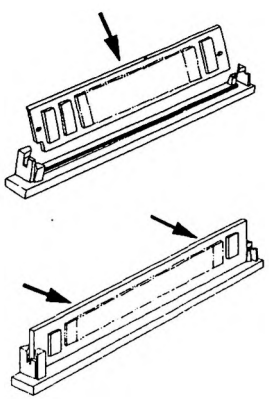
The memory banks must be filled in sequence, i.e., first Bank 0 and then Bank 1. Different size SIMM modules may be installed in the two banks, but within each bank all of the modules used must be the same size.

To install SIMM modules, follow these directions:

1. If you are adding more SIMMs to a system board that has already been installed on your computer, begin by turning off the computer and all peripheral devices, unplugging the power cord from the back of the computer, and opening up the system unit case.

2. Orient the system board so that the expansion slots are at the rear left of the board. The memory banks should now be at the right of the board.

3. Orient the first SIMM so that the chips on top of the module point towards the right. Insert the module into the first slot (slot 1) of the memory bank at a 75-degree angle to the system board. After the edge connector on the module is inserted completely into the socket, gently push the module forward against the retaining clips on each end of the socket until it snaps into place.

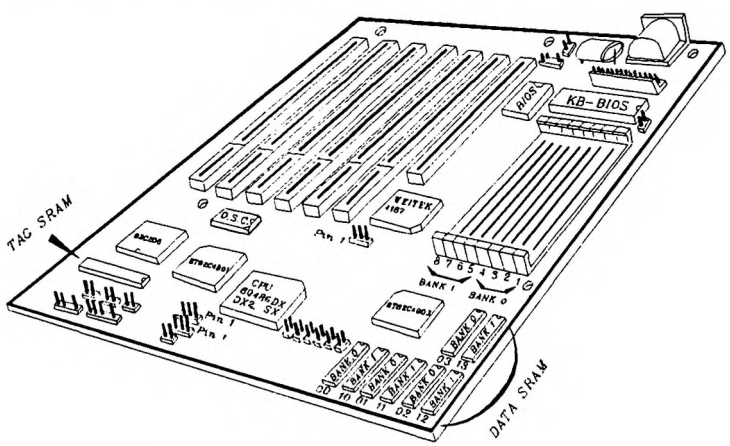


4. Repeat step 3 for each SIMM until all four sockets of Bank 0 (or Bank 0 and Bank 1) are filled.

3.2 External Cache Memory

The concepts behind the design of a cache memory were introduced in Chapter 1. Because of the high-speed CPU used on this system board, the system requires a cache memory in order to function properly. The cache memory on this system board may be 64KB or 256KB in size. Roughly speaking, installing a larger cache memory on the system board will allow the system to store a larger amount of information in the cache's high speed SRAMs, resulting in a higher cache "hit" rate and increasing your machine's overall net processing speed.

The cache memory sockets for your 486 system board are found in two locations on the board. At the front right-hand side of the board are eight sockets for installing 8K×8-bit or 32K×8-bit data SRAMs. At the front left-hand side of the board, just behind the case feature connectors, is one socket used for installing an 8K×8-bit or 32K×8-bit tag SRAM. (Data SRAMs are the devices used to store the information held in the cache memory. The tag SRAM is used to store the high-addresses of the information that has been placed into the data SRAMs.)



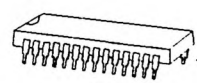
In order for the cache memory to operate properly, you must have the correct memory devices installed. A description of the SRAM devices suggested for use with this system board is included at the end of this section.

Installing the Cache Memory Devices

To install a 64KB cache memory, you will need to install an 8K x 8-bit SRAM in each of the eight data SRAM sockets and the tag SRAM socket. To install a 256KB cache memory, install a 32K x 8-bit SRAM in each of the eight data SRAM sockets and the tag SRAM socket.

The procedure for installing individual SRAM chips is as follows:

1. First, orient the chip correctly with the socket into which it will be inserted. There is a U-shaped notch at one end of each SRAM chip. This notch should be aligned with the corresponding notch on the chip socket.



2. Carefully align the pins of the chip with the holes of the socket and gently seat the chip part of the way into the socket. Check to see that the chip is level, that all of the pins are seated properly, and that there are no bent or misaligned pins. If this is not the case, gently pull the chip out from the socket, straighten the pins if necessary, and begin again.

3. Once all of the pins are properly aligned, gently push the chip the rest of the way into the socket.

Repeat this procedure until all of the data and tag SRAMs are installed in their sockets. Note that when handling and installing these devices, you should take care to follow the anti-static electricity precautions described in Chapter 4.

Setting the Cache Memory Size

When you first install the cache memory on your system board and each time you upgrade or modify it, you will need to adjust the cache memory size setting for the system. The cache memory size for the system is set by means of Jumpers 2, 3, 4 and 5. Complete information on adjusting these jumpers is given in section 2.1 above; if you have any questions, you should consult that section. Table 3.2 (which is an exact duplicate of Table 2.1) displays a summary of the jumper settings for each of the two possible cache memory sizes:

Cache Memory Size	Jumper Switch Settings			
	JP2	JP3	JP4	JP5
64KB	Open	1-2	Open	1-2
256KB	Short	2-3	Short	2-3

Table 3.2: Cache Memory Size Jumper Switch Settings

Recommended Cache Memory Devices

When installing the cache memory you must be sure to use the proper type of memory devices. This section describes the type of SRAM devices recommended by the manufacturer for use with this system board. This 486 system board may be used to build either a 486DX-50/33/25MHz, 486DX2-66/50MHz or a 486SX-25/20MHz computer system, so the recommended memory devices are introduced separately for each of these types of systems.

For the tag SRAM to be used on the board, the manufacturer strongly recommends that devices manufactured by Toshiba Semiconductor or Micron Semiconductor be used.

486DX-50MHz systems:

Cache Size	Device Type
64KB Cache	8K x 8-bit 20ns data SRAMs and tag SRAM
256KB Cache	32K x 8-bit 20ns data SRAMs and tag SRAM

486DX-33, 486DX2-66 and 486SX-33MHz systems:

Cache Size	Device Type
64KB Cache	8K x 8-bit 25ns data SRAMs 8K x 8-bit 20ns tag SRAMs
256KB Cache	32K x 8-bit 25ns data SRAMs 32K x 8-bit 20ns tag SRAMs

486DX-25, 486DX2-50 and 486SX-25/20MHz systems:

Cache Size	Device Type
64KB Cache	8K x 8-bit 30ns data SRAMs 8K x 8-bit 25ns tag SRAMs
256KB Cache	32K x 8-bit 30ns data SRAMs 32K x 8-bit 25ns tag SRAMs

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4. System Installation Guide

Once you have set up the system board and installed the main memory according to the instructions given in Chapters 2 and 3 above, you will be ready to install the board in a system unit case. This chapter provides general instructions on how to install the system board in a standard case along with the peripherals needed to complete a typical personal computer system.

If your board is already installed in a case, you will not need to perform the steps outlined in this chapter. If you will be modifying or upgrading the set-up of your board, however, it is recommended that you at least review the section of this chapter dealing with static electricity prevention measures.

4.1 Static Electricity

Static electricity can build up in your body due to the type of clothing you are wearing, the carpet in the room in which you are working, or various items that you may touch. Static electricity accumulates most easily when you are working in a very dry indoor environment.

When working with delicate electronic components such as those found on your system board, you need to take precautions to prevent them from being damaged by static electricity. Static electricity can have a serious, adverse impact on the performance and lifespan of certain electronic components, such as integrated circuits. In extreme cases, damage due to static electricity can render ICs inoperable.

Whenever installing or upgrading various parts of a computer system, then, you should take care to prevent a discharge of static electricity from your body or clothes to the components in the system. Fortunately, it is easy to prevent such discharges while you are working: each time you are

going to pick up or begin installing a component, first touch a grounded object, such as the unpainted rear panel of your system unit or a water faucet or other grounded fixture in your work area. Any static electricity in your body will then be discharged through that object.

Another precaution you should take when working with your computer system is to keep the connectors of the components of the system dry and clean. Usually the only special precaution you need to take in this regard is to avoid touching any of the connectors directly with your fingers; a residue of oil from your fingers can cause corrosion on the connectors.

4.2 Components

In addition to setting up the system board and installing the memory, you will need to install a number of peripheral components and connect the board to various devices on the system case in order to complete a computer system based on the board. Some of these devices were referred to in Chapter 2 above, where the system board connectors were described. A list of devices commonly used to build a computer system based upon this type of system board appears below. Aside from the last two items - the monitor and keyboard - all of these components are usually installed inside the system case.

- A *system case* similar to the IBM Baby AT in size or one with compatible mounting holes.
- A standard 200W *power supply* (usually provided with the system case).
- A 4.5 to 6V *battery*, used to power the CMOS RAM in which the BIOS set-up configuration is stored while the system power is off.
- A *speaker* (usually provided with the system case).
- A *hard disk/floppy disk drive controller card.*
- A monochrome, EGA, or VGA *video card.*

- One or two 5.25-inch and/or 3.5-inch *floppy disk drives*.
- A *hard disk drive*.
- Flat ribbon *cables* to connect the hard/floppy disk drive controller and the drives.
- A *serial/parallel interface card* to allow peripheral devices such as a printer to communicate with the system.
- A color or monochrome *monitor*.
- A *keyboard*.

4.3 Installing the Board in a Case

There are six mounting holes on this system board, at least some of which should line up with the mounting holes on the case you have selected. The case should include screws or other mounting hardware for fastening the system board to the case. With some cases, the system board will need to be fastened down to the chassis inside the case with screws. Other cases may have a metal or plastic drawer-type holder into which the system board is to be slid. In general, the manufacturer recommends using a case in which the system board is fastened down with a number of screws, as this design helps to ground the board thoroughly and divides the weight of the cards installed in the expansion slots more evenly across the board.

4.4 Controls and Connectors

Once the system board is secured to the case, you will need to attach various connectors on the board to the controls on the front panel of the system case. Most system cases will have several controls and indicators built onto the front panel of the case, as well as a speaker mounted inside the front panel. The various connectors provided on this system board for controls of this type are described in Chapter 2 above. Follow the instructions given there to attach the speaker connector, the keylock connector, the hardware reset switch connector, the hardware turbo switch connec-

tor, and the turbo LED connector to the wires provided for them on the case.

Once you have finished connecting these controls and indicators to the case, you may wish to tie the connecting wires together to make access to this area of the system board more convenient.

Power Connector

Once you have completed attaching controls and indicators to the system board, you will need to connect the board to the power supply via the power connector. The location of the power connector and the proper orientation of the connector wires is described in Chapter 2 above.

4.5 Case-Mounted Peripherals

The next step in installing your computer system will be to install the various peripheral devices that go inside the system unit case, such as floppy and hard disk drives, the disk drive controller card, serial/parallel interface cards, etc. Consult the literature provided with those products and/or the manual that came with your system case for further instructions on installing these devices.

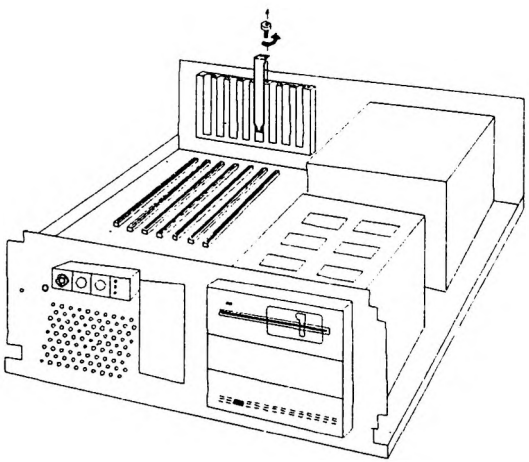
Adapter Card Installation

You may wish to install additional add-on or adapter cards. The procedure for installing add-on or adapter cards is essentially the same for all types of cards.

1. First check that the power for the system and all peripheral devices is turned off. Unplug all power cords from the back of the system unit.

2. If you have already installed the system board in its case, loosen the screws on the rear panel of the system unit case that hold the cover in place and slide the cover forward so that you have access to the system board.

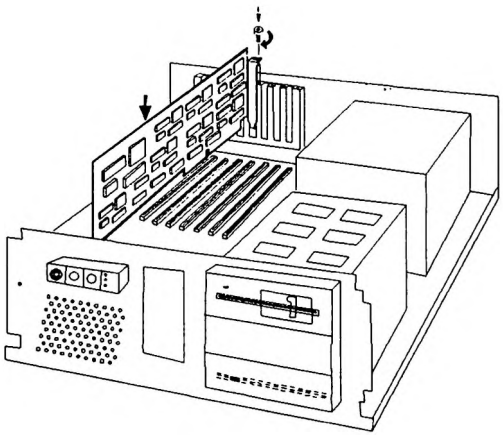
3. Select an unused expansion slot and remove the slot cover corresponding to that slot from the rear panel of the system case. Save the screw holding the slot cover in place.



4. Insert the adapter card firmly into the expansion slot and use the screw removed in step 3 to fasten it to the rear panel of the case.

5. Replace the cover of the system unit case and fasten it in place with the screws removed in step 1.

For further instructions on installing adapter cards and other devices, consult the manuals provided with those products.



Installing an adapter card

4.6 Starting Up the System

Once the system board is mounted in its case and you have completed installation of the peripheral devices inside the case, slide the cover of the case into place and secure it to the rear panel of the case using the screws provided. Next, connect your keyboard to the keyboard connector on the rear panel and your monitor to the output from the video card, also on the rear panel.

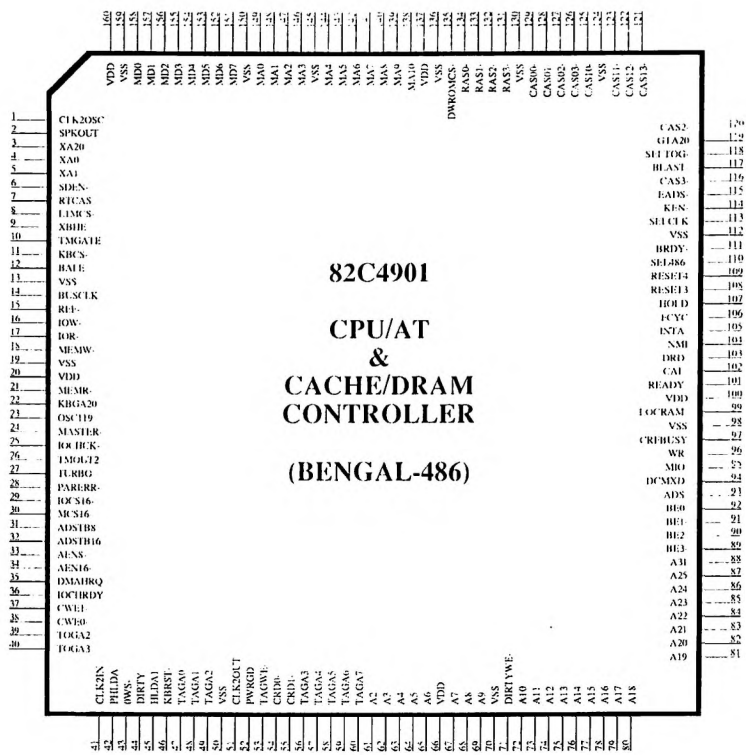
Your computer is now ready to be powered on. Once the computer is powered on, you will need to adjust the settings in the BIOS setup utility to match the set-up of your system. (Descriptions of the BIOS setup utility are given in Appendix of this manual.) Finally, you will need to install and boot an operating system, such as DOS, before your computer can be used. For further instructions, consult your operating system manual.

5. Technical Information

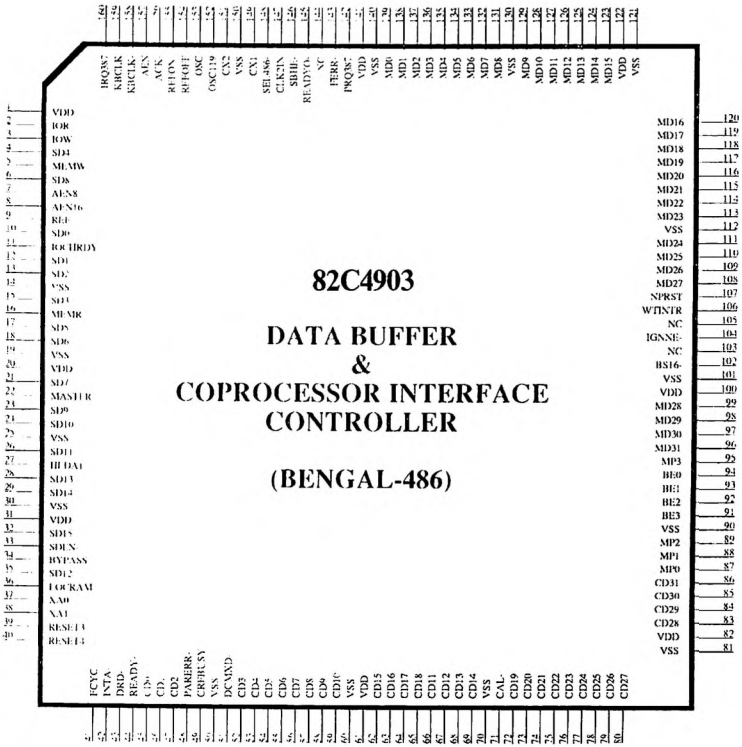
This chapter presents certain technical information for the reference of advanced users. This information includes the AT bus definition for the system board and information regarding the chip set used on the board.

Chip Set Information

Pin definitions for ETEQ ET82C4901/ET82C4903 ship set are shown below.



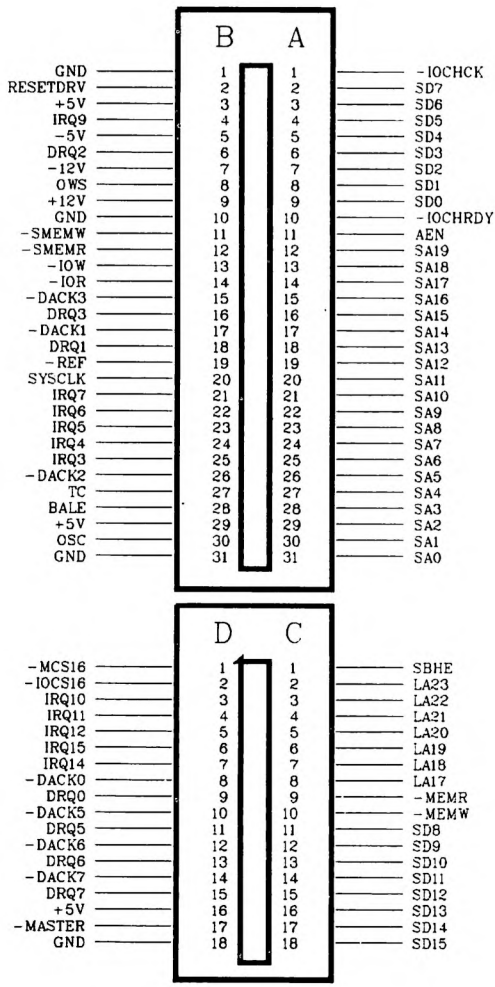
(Top View)


82C4903
DATA BUFFER
&
COPROCESSOR INTERFACE
CONTROLLER
(BENGAL-486)

(Top View)

AT Bus Definition

The AT Bus definition for this system board is shown in the following diagram.



(Top View)

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Appendix: BIOS Setup Program

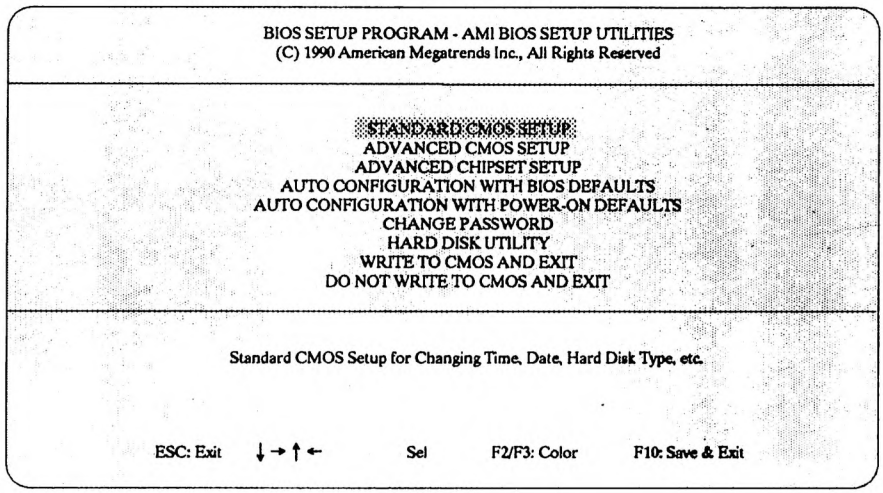

Figure 1: BIOS setup utility main menu.

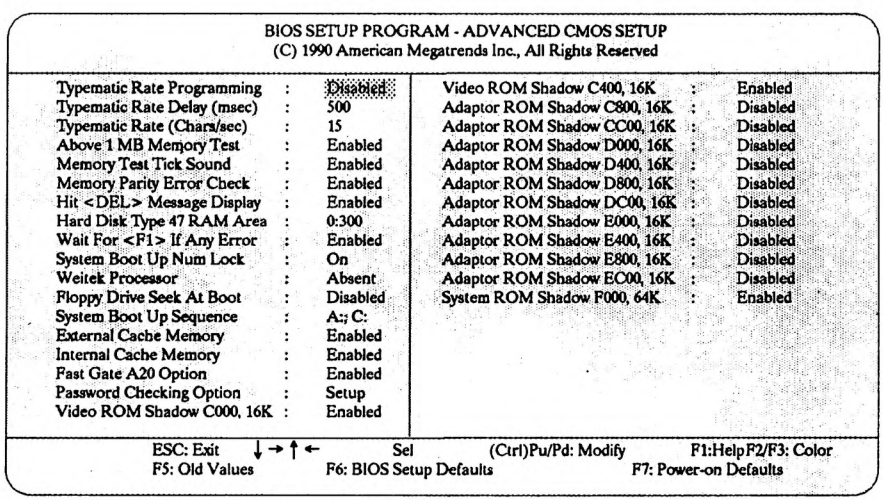

Figure 2: Advanced CMOS Setup display.

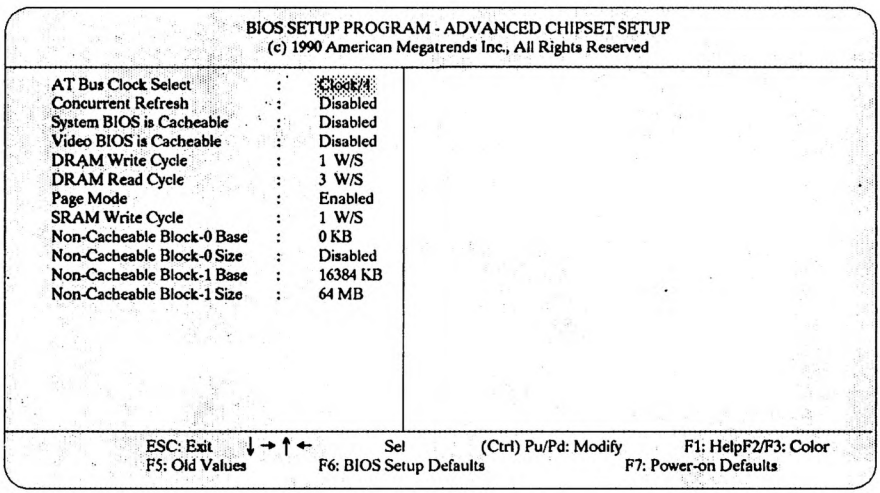

Figure 3: Advanced Chipset Setup display.

The BIOS setup utility displays pictured above will give you a basic idea of how to operate the AMI BIOS setup program included with this system board. To enter the setup program, simply respond to the prompt that is displayed each time you boot your computer.

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