PTM-1632C

16MHz 80286 Mainboard
User's Manual

PTM-1632C

16MHz 80286 Mainboard User's Manual

Edition 1.02

Warning

Reconfiguring

To ensure the reliability of the computer, NEVER reconfigure the board while the power is ON.

If you wish to reconfigure the board at any time, ensure that the power is turned OFF before changing any hardware settings, such as DIP switches or jumpers.

Note

- When you see an error message on the screen after turning the power on, leave the system switched on for one to two hours to charge the battery. You can then enter the system configuration.
- Leave your system switched on for 10 to 15 hours to completely charge the battery.
- If you leave the system switched off for more than one month, repeat the steps above.
- Be sure jumper JP7 is shorted when you install your system. Otherwise, you have to set up your configuration whenever you turn on your computer.

Checklist

Your PTM-1632C mainboard package contains the following:

- One PTM-1632C Mainboard
- One User's Manual
- One EMS Driver Diskette

Contents

Introduction

The PTM-1632C mainboard is compatible with the PC/AT. This means that virtually all the software that is available for the PC/AT can also be run on a system you build around the PTM-1632C mainboard.

Moreover, the same keyboard commands used on a PC/AT can also be used on the PTM-1632C mainboard. For example, the same <Ctrl> <Alt> <Del> combination of keystrokes used for the software reset on the PC/AT may also be used on your PTM-1632C-based system.

For this reason, the PTM-1632C mainboard is the ideal choice for a person seeking affordable AT-style power.

The clear, well-illustrated instructions in this manual ensure that even if you are a newcomer to the computer world, you will have your system installed and running with a minimum of effort.

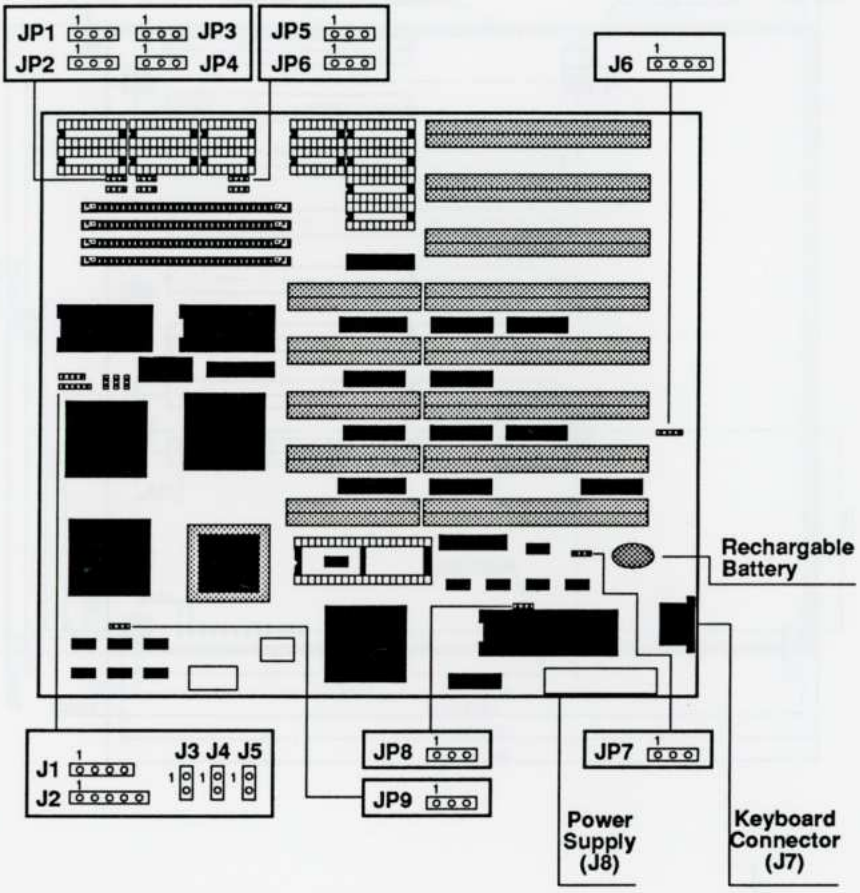
Features

The PTM-1632C includes the following features:

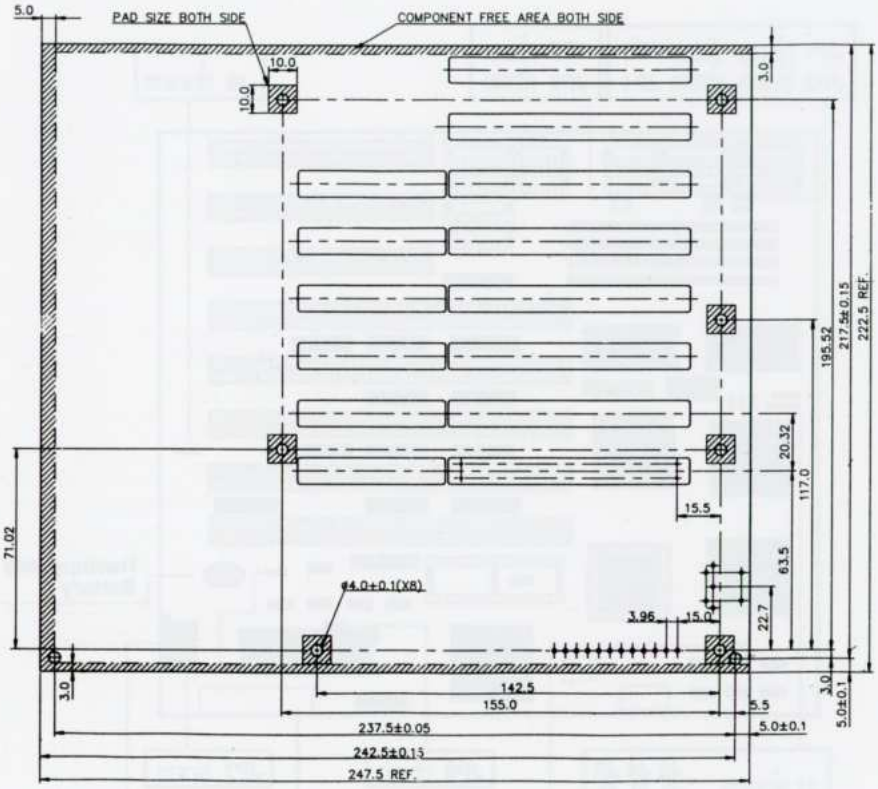
- Intel 80286-16 microprocessor with 80287 coprocessors optional
- Use of CHIP's PC/AT-compatible chip set.
- Switchable between 8MHz Normal mode and 16MHz Turbo mode by either a software switch or a hardware switch
- Onboard battery backup for CMOS configuration table and a real-time clock
- RAM subsystem of 512KB, 640KB, 1MB, 1.5MB, 2MB, 3MB, 4MB and 5M
- Eight expansion slots — five 16 bit slots and three 8 bit slots
- Sixteen-level interrupt
- Seven channel DMA for disk and special I/O
- 64KB legal BIOS (ADL certified)
- Four-layer mainboard
- LIM 4.0 EMS support
- Shadow RAM support
- Choice of either 44256 DIP or 256K/1M SIMM DRAM modules
- Page/Interleaved DRAM access support

Board Layout

Below is a layout of the PTM-1632C showing the jumpers and some of the connectors. The figure on the next page gives the dimensions of the board.



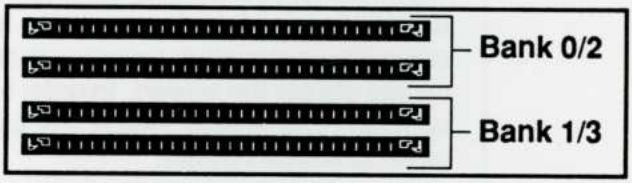
Dimensions of PTM-1632C

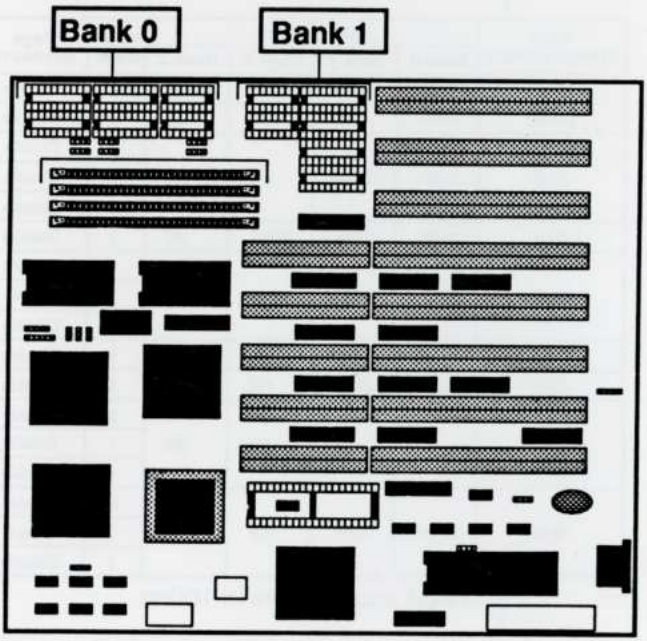


In this section reference will be made to jumper settings used to configure the various functions of the PTM-1632C mainboard. Refer to the Board Layout section for locations of all jumpers.

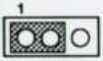
RAM Installation

Jumpers JP1- JP6 are used to set the RAM size you want on the mainboard. The DIP and SIMM DRAM banks can contain from 512KB, 640KB, 1MB, 1.5MB, 2MB, 3MB, 4MB to 5MB by means of setting jumpers JP1 - P6. Refer to the illustration below for the location of jumpers JP1 - JP6 and the RAM banks.





The following shows the configuration for total on-board system memory.

Description	JP1 - JP6 Settings
Using one bank or two banks (banks 0 & 1) with either DIP or SIMM DRAMs as onboard memory →	
Using three or four banks of DIP (banks 0, 1) and SIMM (banks 2, 3) DRAMs as onboard memory →	

Before setting up RAM configuration in BIOS, you must refer to the following table to set the wait state and the page-interleave mode.

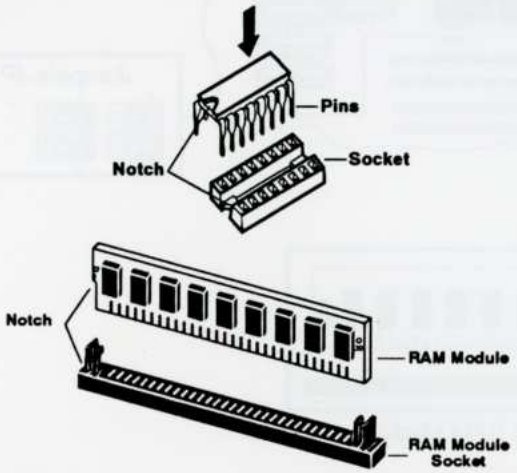
Particularly, you cannot set both 0 wait state and disabled page-interleave mode in Turbo mode; otherwise your system cannot operate normally, even cannot display the screen. In order to set both modes normally, you should switch the button from Turbo mode to **Normal mode**.

Total System Memory	DRAM Type				Wait-State	Page Interleave	Reference
	Bank 0	Bank 1	Bank 2	Bank 3			
512K	256K	0K	0K	0K	1	Disable	Page 8
640K	256K	64K	0K	0K	1	Disable	Page 9
1MB	256K	256K	0K	0K	0	Enable	Page 10
					1	Enable	
					1	Disable	
1.5MB	256K	256K	256K	0K	1	Disable	Page 11
2MB	256K	256K	256K	256K	0	Enable	Page 12
					1	Enable	
					1	Disable	
2MB	1M	0K	0K	0K	1	Disable	Page 12
3MB	256K	256K	1M	0K	1	Disable	Page 13
4MB	1M	1M	0K	0K	0	Enable	Page 14
					1	Enable	
					1	Disable	
5MB	256K	256K	1M	1M	0	Enable	Page 15
					1	Enable	
					1	Disable	

RAM access time is 100ns.

Chip or RAM Module Insertion

Remember that when inserting chips or RAM modules, you must make sure the notched or dotted end of the chip or RAM module is lined up with the notched end of the socket. Gently push the chip into the socket, and be careful not to bend the pins.



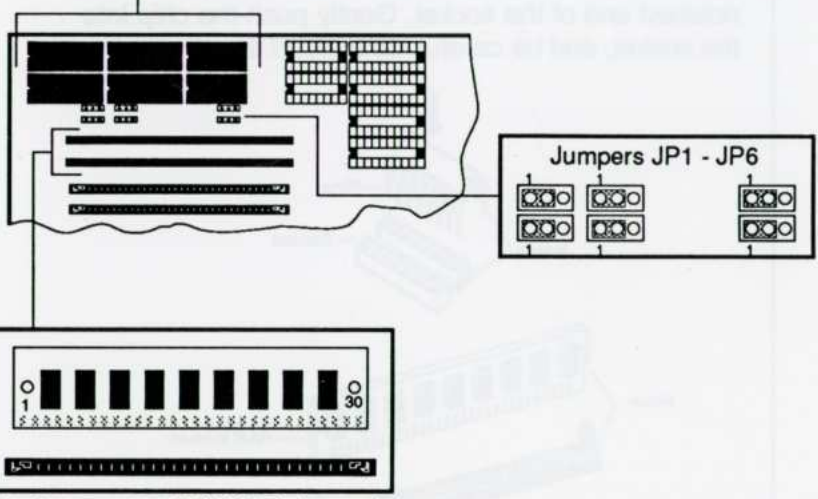
Jumper

A jumper is a kind of switch which uses a plastic cap with a metal interior to connect (short) two pins. If a jumper needs to be left open, you should save the cap for future use by covering one pin only of the jumper. This has no effect on the function of the board while it keeps the cap handy. The illustration below shows the side and top views of a three-pin jumper in which pins two and three are shorted.

To select the proper jumper setting for the RAM size that you want, refer to the figures on the following pages.

512KB Total Onboard System Memory

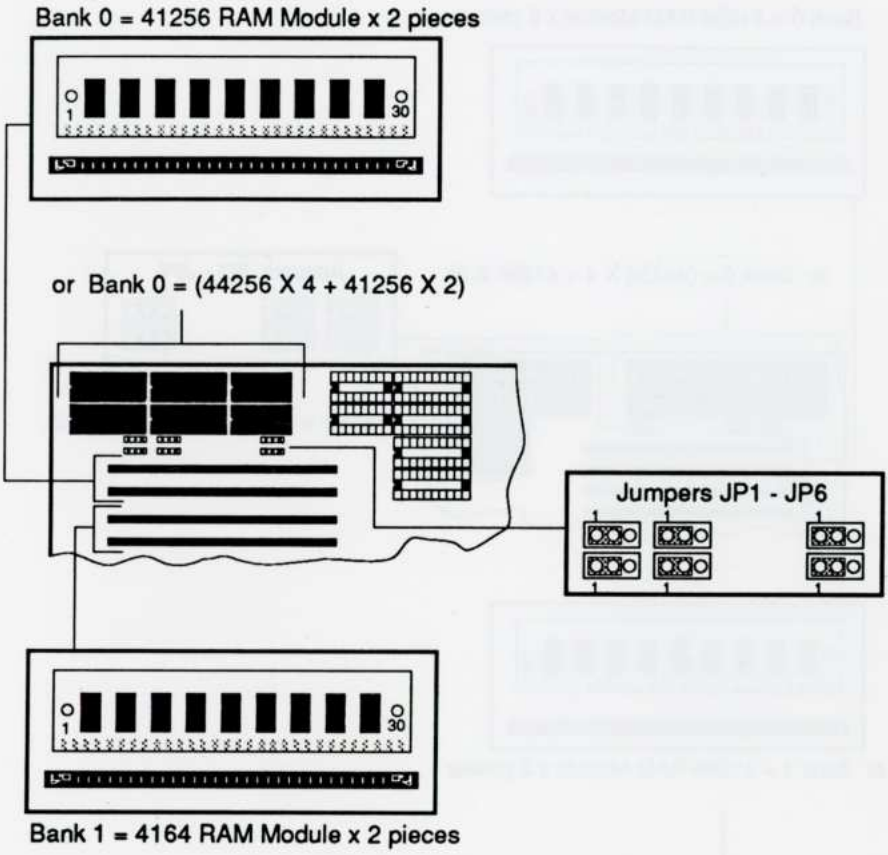
Bank 0 = (44256 X 4 + 41256 X 2)



or Bank 0 = 41256 RAM Module x 2 pieces

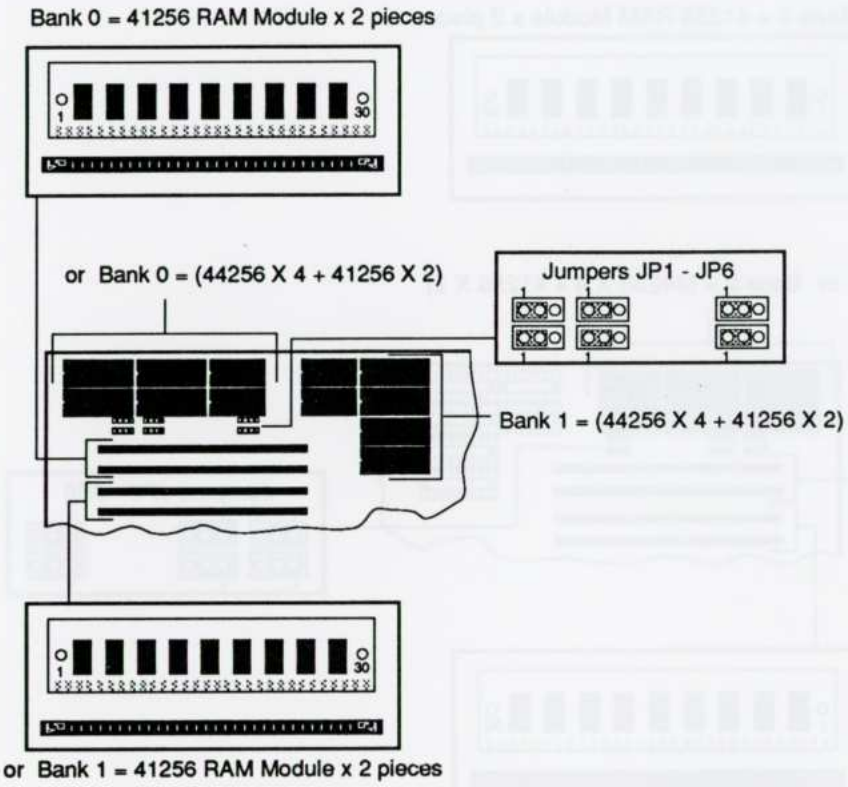
You may use either bank as bank 0.

640KB Total Onboard System Memory



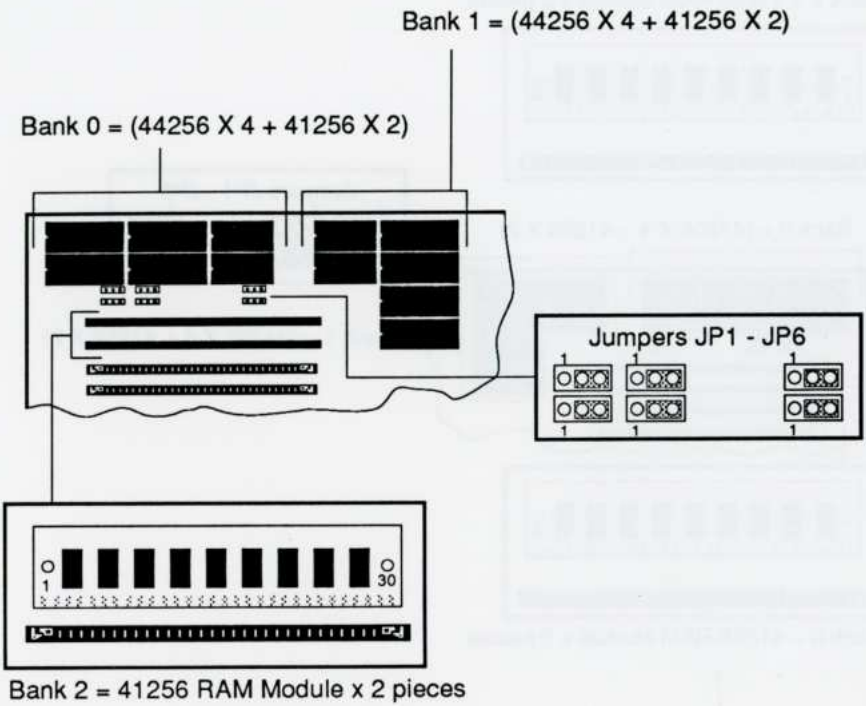
You may use either bank as bank 0.

1MB Total Onboard System Memory



Any bank 0 may be used with any bank 1.

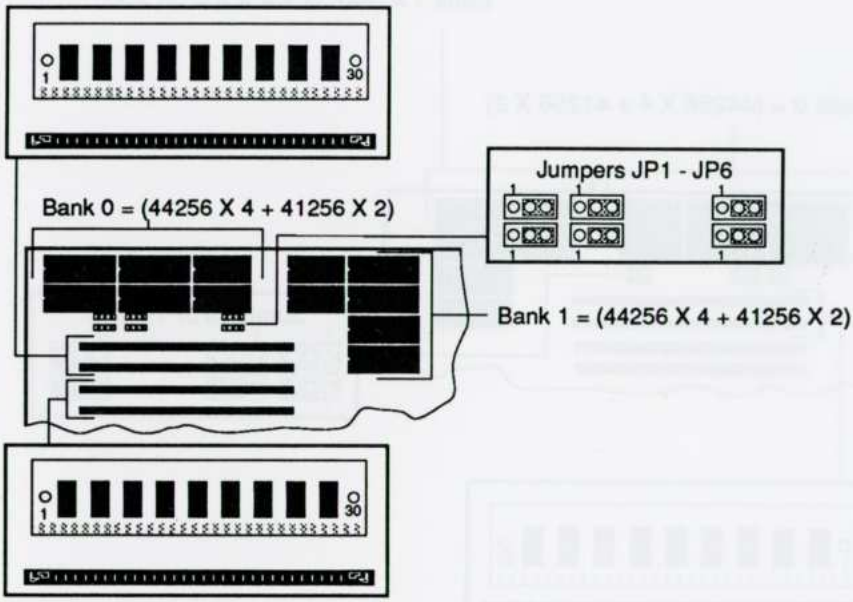
1.5MB Total Onboard System Memory



Bank 2 = 41256 RAM Module x 2 pieces

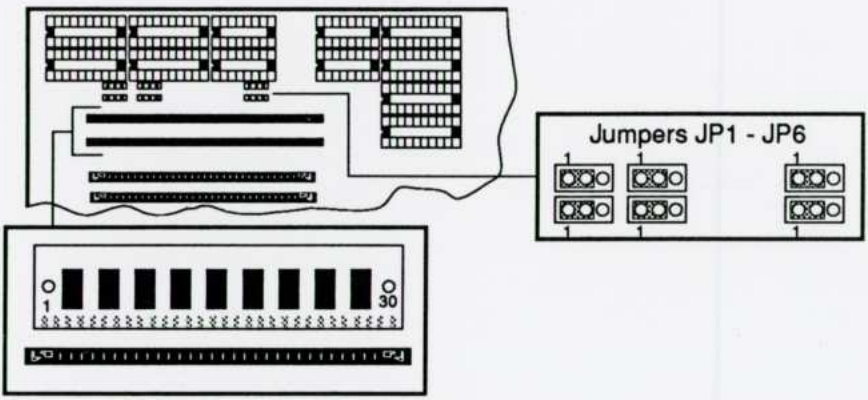
2MB Total Onboard System Memory — A

Bank 2 = 41256 RAM Module x 2 pieces



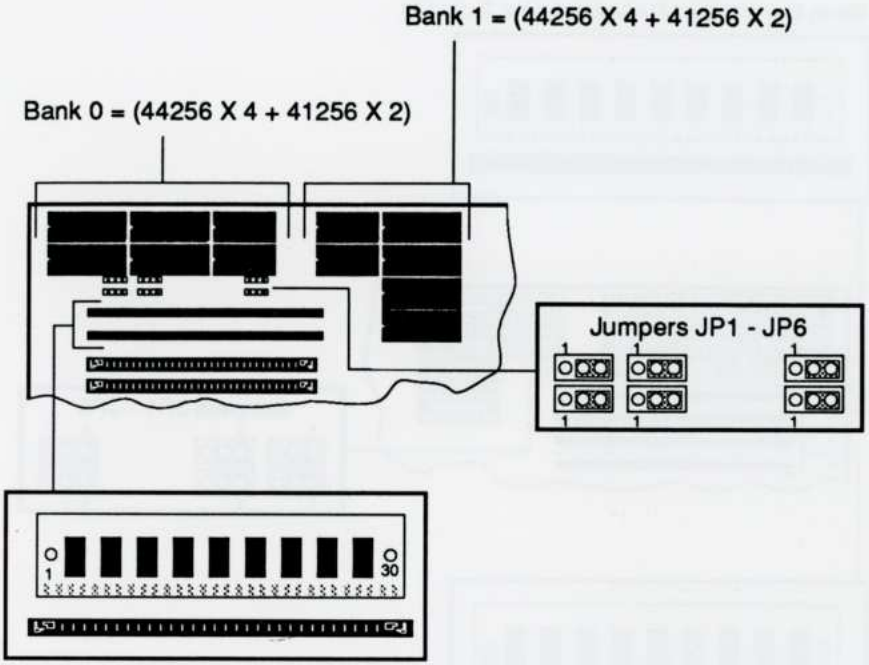
Bank 3 = 41256 RAM Module x 2 pieces

2MB Total Onboard System Memory — B



Bank 0 = 411000 RAM Module x 2 pieces

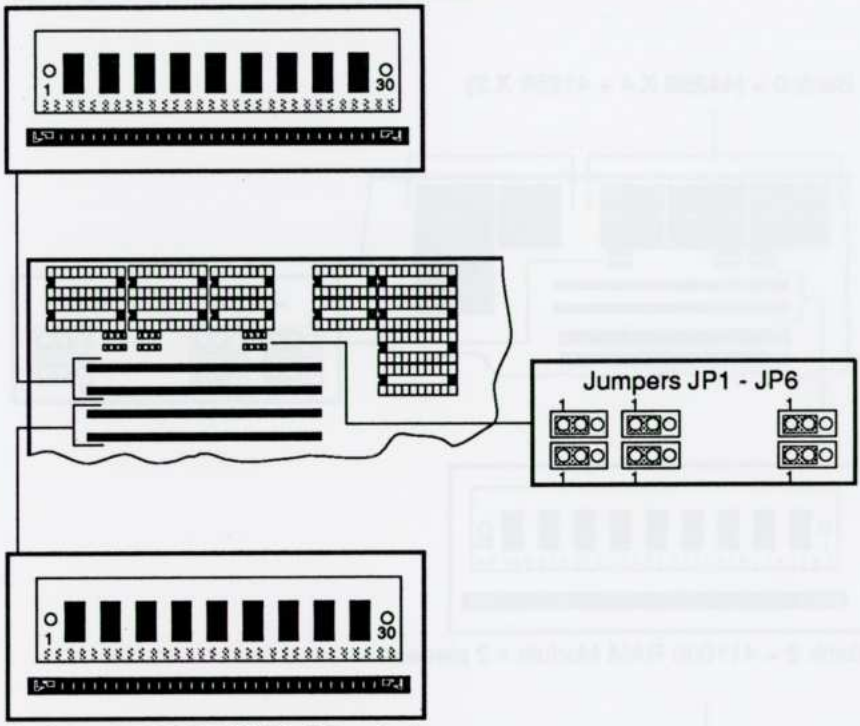
3MB Total Onboard System Memory



Bank 2 = 411000 RAM Module x 2 pieces

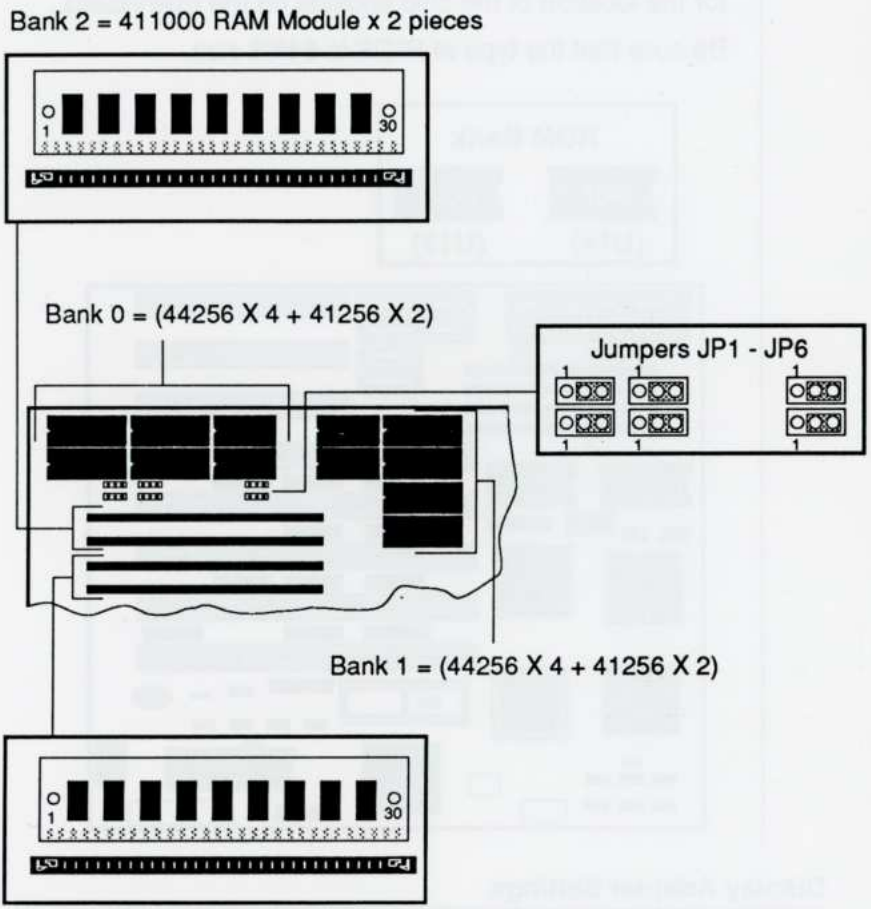
4MB Total Onboard System Memory

Bank 0 = 411000 RAM Module x 2 pieces



Bank 1 = 411000 RAM Module x 2 pieces

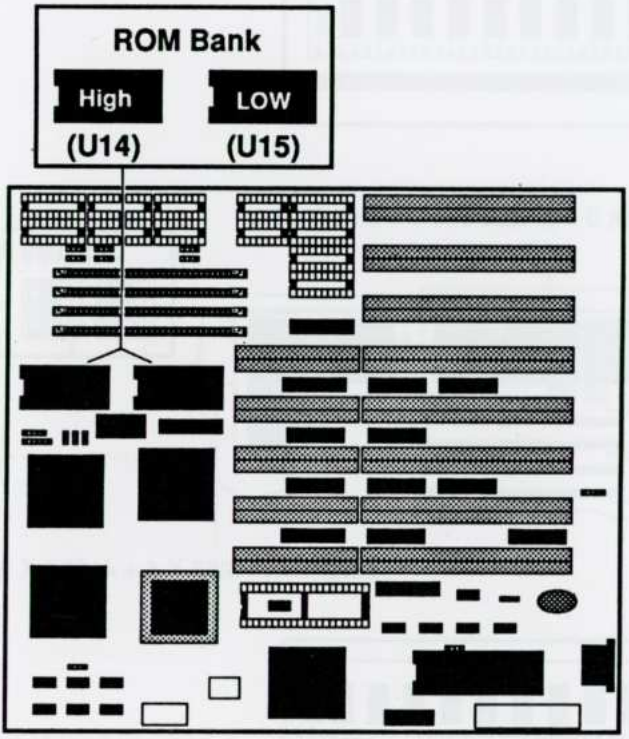
5MB Total Onboard System Memory



ROM Installation

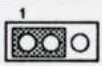
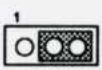
To install the ROM chips, refer to the illustration below for the location of the chip sockets on the mainboard.

Be sure that the type of BIOS is 64KB size.



Display Adapter Settings

Jumper JP8 is used to select the display adapter. To configure the mainboard for the kind of display adapter you want, set jumper JP8 according to the table below.

Jumper JP8	Video Selection
	Monochrome
	Color

Shadow RAM enable

For efficient execution of BIOS, it is preferable to run BIOS code through RAM rather than through the slower EPROMs. The PTM-1632C can support shadow RAM for BIOS and video.

To enable shadow RAM, follow the steps below:

- Hold down the <Esc> keys to enter the setup menu as you turn the power on.
- Select item 6 to enter CHIP setup
- Select item 1 to enable BIOS or video shadow RAM (Refer to the BIOS manual for details.)

NOTE: You can enter the setup menu by pressing <Esc> when the power switched, or you may reset the system to enter setup menu, too.

EMS Driver Setup

The PTM-1632C mainboard supports LIM 4.0 EMS. To set up the EMS driver, follow the steps below:

- Hold down the <Esc> key to enter the BIOS setup program. Choose item 4 to enter the CHIP setup menu. From this menu, you may enable EMS and select EMS size. (Refer to the BIOS manual for details.)

NOTE: If you only have one megabyte onboard memory, you must disable the shadow RAM function first in order to use 384K of extended memory as expanded memory.

- Insert the EMS driver diskette into drive A and enter a:.
- Enter this command:

```
INSTALL
```

You will see the following screen.

```
This program installs the NEAT EMS driver on your hard disk.
(Press Esc key to quit: any other key to continue installaton)
```

- The next screen will be as below if you continue setup.

```
Enter the path name for the location of NEMM.SYS:
C:\NEMS
(Press Esc key to quit: any other key to continue installation)
```

Indicate the path name where NEMM.SYS is to be located. If you want the program to create a directory with the default name (NEMS) on your hard drive, press the Enter key. Otherwise, type in the path and directory name of your choice.

- A screen like the following will appear if you continue setup:

```
        DTK NEAT EMS hardware configuration setup.
        Select the option you want for each item

PAGE REGISTER I/O : 0          0: 208H/209H
BASE ADDRESS                   1: 218H/219H
                               2: 258H/259H
FRAME START ADDRESS:4          3: 268H/269H
                               4: 2A8H/2A9H
                               5: 2B8H/2B9H
                               6: 2E8H/2E9H
F1:accept,Esc, ↑ ↓
```

Indicate two parameters for EMS — page register I/O base address and frame start address.
You will get a warning if you give an incorrect response. For example, if you give D000H as your frame start address, and shadow RAM in the same area, the message on the next page will appear.

```
        DTK NEAT EMS hardware configuration setup.
        Select the option you want for each item

PAGE REGISTER I/O : 0                0: C000H, C400H, C800H, CC00H
BASE ADDRESS                         1: C400H, C800H, CC00H, D000H
                                     2: C800H, CC00H, D000H, D400H
FRAME START ADDRESS:4                3: CC00H, D000H, D400H, D800H
                                     4: D000H, D400H, D800H, DC00H
                                     5: D400H, D800H, DC00H, E000H
                                     6: D800H, DC00H, E000H, E400H
                                     7: DC00H, E000H, E400H, E800H
F1:accept,Esc, ↑ ↓                   8: E000H, E400H, E800H, EC00H

Cannot use as frame! This address is allocated for
Shadow RAM or ROM enable!
```

- If the installation is complete, the following will appear:

```
The installation is complete. Remove the diskette and
press Ctrl+Alt+Del to restart the system.
```

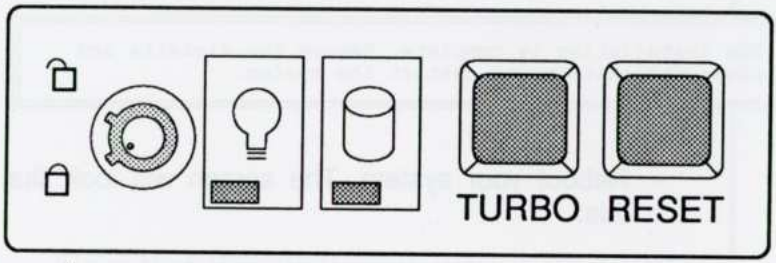
- Reboot your system. The screen will look like this:

```
=========================================================
DTK NEAT Expanded Memory Manager
(C) Copyright Datatech Enterprise Co.,Ltd
All Right Reserved
=========================================================

     User specified PAGE FRAME = D000H
     Test Expanded Memory Page 128
     There are 128 PAGEs for EMS.
     NEMM.SYS has been installed.
```

Connectors

A variety of connections can be made from the PTM-1632C mainboard to a control panel on the front of your system. In addition you can connect a speaker (which comes installed in most system unit cases). There are a variety of different control panel designs currently available with system unit cases. Ideally the control panel will include a keyboard lock, a reset switch, a microprocessor speed switch with a LED (commonly referred to as a Turbo switch) and LEDs that indicate power and hard disk activity. The panel will probably look something like the figure below.



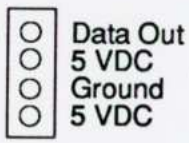
Functions of Panel Indicators and Switches

Following is a brief explanation of the various functions of a control panel that the PTM-1632C supports:

Speaker (Jumper J1)

Jumper J1 is used to connect a speaker. When the four pins are connected to a speaker in a closed circuit, the speaker is functional. Refer to the figure below for the pinouts.

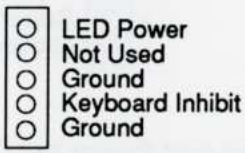
Jumper J1 Pinouts



Keyboard lock (Jumper J2)

Jumper J2 is used to enable the use of the keyboard and the power LED. By disabling the keyboard, you can "lock" the data in your computer. Unlocking the keylock enables the keyboard. Refer to the table below for its pinouts.

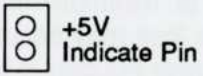
Jumper J2 Pinouts



Turbo LED (Jumper J3)

Jumper J3 is used to enable Turbo LED. The Turbo LED in the hardware switch indicates operation in the Turbo mode.

Jumper J3 Pinouts



Hardware Reset (Jumper J4)

Jumper J4 is used to enable the hardware reset. If you encounter any problems while using unfamiliar software, you can always restart from the beginning by pressing the reset button. Note, however that any data which have not been saved to disk will be lost. Refer to the figure below for its pinouts.

Jumper J4 Pinouts

Hardware Switch (Jumper J5)

The hardware switch (Turbo switch) allows you to toggle the speed between 8MHz and 16MHz. Refer to the figure below for the pinouts.

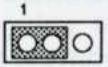
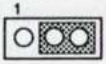
Jumper J5 Pinouts

Select Pin
Ground

Power Good and Power fail Detect (Jumper JP9)

The PTM-1632C provides Power fail detect and external "power-good" signals to indicate proper operation of the power supply. Jumper JP9 is used to select an onboard or external power-good signal.

When the power supply is unstable or the power-good signal does not work well, the external power-good will still operate at minimum line voltage and maximum load, but data loss may occurred. And you are advised to use the Power fail detect function (pins one and two of jumperJP9 shorted).

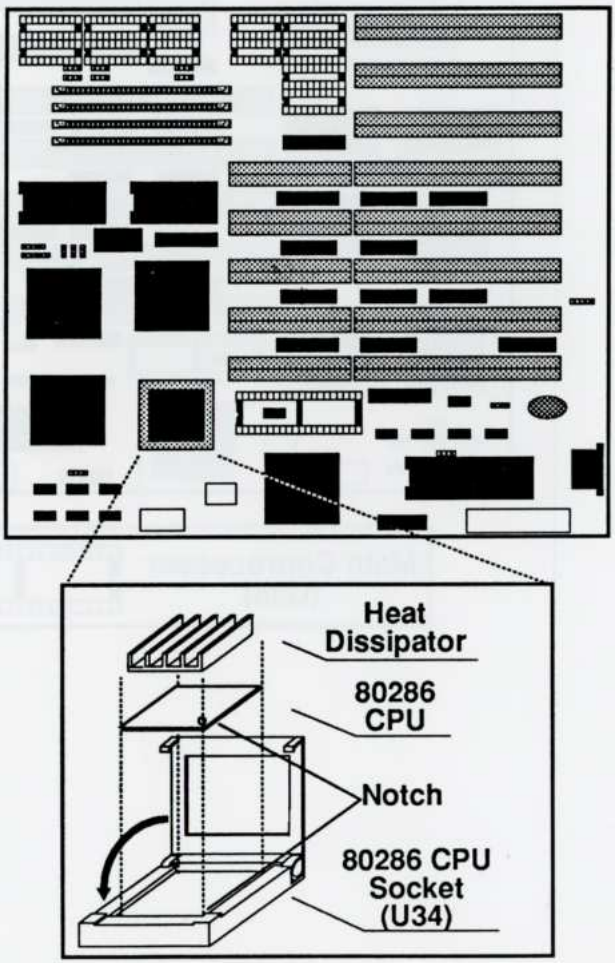
Jumper JP9	Function
	Power Fail Detect Circuit Active
	External Power-Good Function Active

CPU Installation

The CPU is located at U34. You will see a heat dissipator on top of the CPU.

The Intel-80286 CPU is an advanced, high-performance microprocessor with specially optimized capabilities for multiple-user and multi-tasking systems. The 80286 has built-in memory protection that supports operating system and task isolation as well as program and data privacy within tasks.

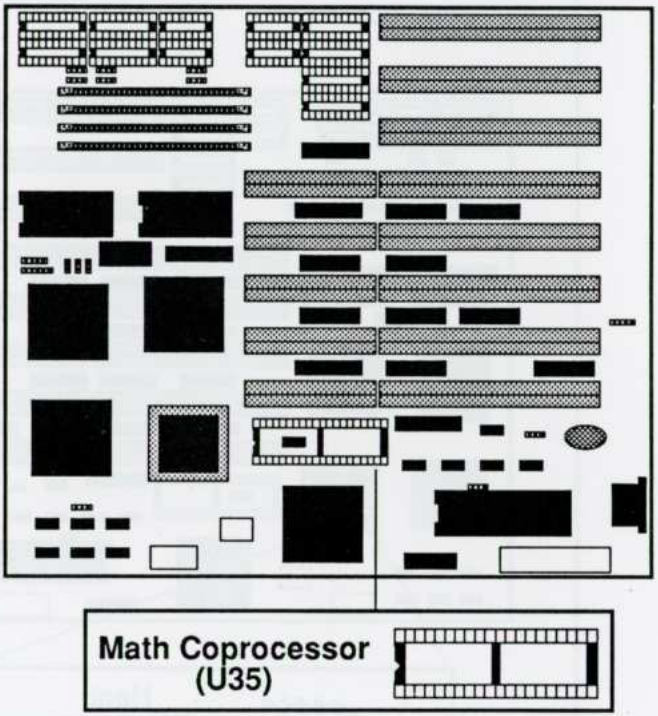
Refer to the figure below for installing the CPU and the heat dissipator.



Math Coprocessor Installation

A math coprocessor located at U35 is optional. When a 80287-10 coprocessor is installed BIOS will check its presence automatically. Setting any switch to indicate its presence is unnecessary.

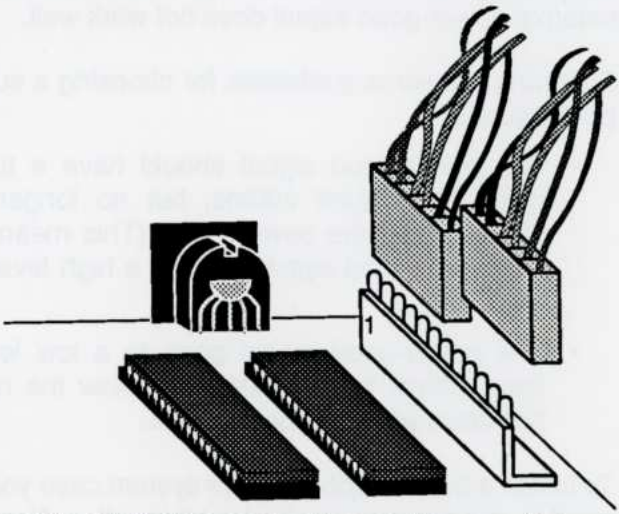
If you install a coprocessor, be certain that it is the correct one for the clock speed in which you intend to do your processing. Consult your chip vendor if you are in doubt.



Connection to Power Supply

If you are installing the PTM-1632C yourself, the final step is attaching the power supply cable to the main-board at connector J8, which is located in the upper right quadrant of the board. There are some cables on the power supply.

Be sure the four black wires of the power supply are located at the middle of the power connectors. Refer to the figure below. Pin 1 is numbered in the picture for your convenience.



The pinouts for the connectors at J8 are as follows:

Pin	Assignment
1	Power Good
2	+5 VDC
3	+12 VDC
4	-12 VDC
5	Ground
6	Ground
7	Ground
8	Ground
9	-5 VDC
10	+5 VDC
11	+5 VDC
12	+5 VDC

Choosing a Power Supply

The power supply provides a "power-good" signal to indicate proper operation of the power supply. The power-good signal is a TTL-compatible high level for normal operation or a low level for fault conditions. If the power-good signal works well, the system will function properly. Otherwise, the CMOS RAM data setting will be lost.

You are advised to use the internal Power fail detect circuit (pins one and two of jumper JP9 shorted) if the external power-good signal does not work well.

Following are some guidelines for choosing a suitable power supply:

- The power-good signal should have a turn-on delay of at least 200ms, but no longer than 500ms when the power is on (This means that the power-good signal goes to a high level later than +5V).
- The power-good signal goes to a low level at least 100ms before +5V falls below the regulation limits when the power is off.

To install a power supply in your system case you may need to consult your dealer for information. Nevertheless, installation is a simple and straightforward procedure.

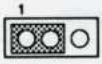
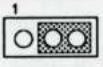
Battery Connector

Jumper JP7 is used to select an external battery or the onboard rechargeable battery. Refer to the Board Layout section for the location of J7.

Be sure pins 1 and 2 of jumper JP7 are open when you install your system. Otherwise, you will have to set up your system configuration whenever you turn on your computer.

Jumper J6 is enables four size "AA" batteries instead of the circular lithium battery to power the CMOS RAM.

Refer to the figures below for setting jumper J7 and the pinouts of J6.

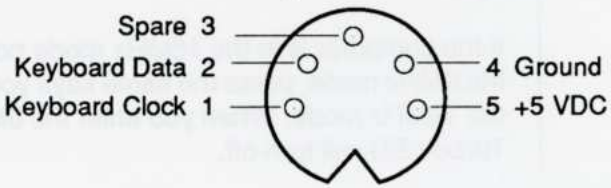
Jumper JP7	Battery
	External
	Onboard

Jumper J6 Pinouts

Keyboard Connector

The keyboard connector may be located at the back of your system unit. The pin assignments for keyboard connector J7 are as follows:

Jumper J7 Pinouts



The main advantage of the PTM-1632C 16MHz mini-80286 mainboard over ordinary PC/AT mainboards is its dual clock system. This innovation makes it possible for your computer to operate at either of two clock speeds: 8MHz or 16MHz.

Entering 16MHz Turbo Mode

The PTM-1632C supports both a software and a hardware switch to toggle between 8MHz and 16MHz (Turbo) modes. The two switches are set up using jumper J5 and are mutually exclusive. You must choose either software or hardware if you are setting up the board yourself.

Software Turbo Switch

When jumper J5 is covered with a jumper cap or is connected to a closed hardware Turbo switch, the speed can be toggled between Turbo and Normal speeds from the keyboard. The clock speed when you turn the system on will be 8MHz (or 16MHz). To switch the speed to 16MHz (or 8MHz), do the following: press and hold down the control <Ctrl> and alternate <Alt> keys on the keyboard while you press the minus <-> key. The Turbo LED on your panel, if you have one, will light.

If the computer is in the 16MHz mode now. To return to the 8MHz mode, press the same keys you used to enter the 16MHz mode. When you enter the 8MHz mode, the Turbo LED will turn off.

Hardware Turbo Switch

If your hardware Turbo switch is connected to pins one and two of jumper J5, pushing the switch on and off will toggle between 8MHz Normal mode and 16MHz Turbo mode.

Alternate Use of Both Switches

Both the hardware and the software switches may be used alternatively, but this is not advised because you may become confused about the mode of operation. When using both switches alternatively, the Turbo LED will be the only accurate indicator of the actual mode: the LED will be on in Turbo mode and off in Normal mode.

Turbo LED and Hardware Switch

Most 80286-type computer cases do not have a Turbo LED or a Turbo hardware switch. However, both of these items are very useful as you probably can already see. Therefore, it is highly recommended that you install both in your system if you do not already have them. For more information, refer to the Panel Indicators and Switches section.

Microprocessor

The 80286 is a high-performance microprocessor with a 16-bit external data path, up to 16 megabytes of directly addressable physical memory and up to one gigabyte of virtual memory space. The operating speed of the 80286 chip is 8MHz in Normal mode and 16MHz in Turbo mode.

The 80286 operates in two modes: protected virtual address and real address.

Virtual Address Mode

The virtual address mode provides a 1-gigabyte virtual address space mapped onto a 16 megabyte physical address space. Virtual address space is larger than physical address: the use of a virtual address that does not map to a physical address location will cause a restartable interrupt.

This mode uses 32-bit pointers that consist of a 16-bit selector and offset components. The selector specifies an index into a memory-resident table and the 24-bit base address of the desired segment is obtained from the memory table. A 16-bit offset is added to the segment base address to form the physical address. The microprocessor automatically references the tables whenever a segment register is loaded with a selector. Instructions that load a segment register will refer to the memory based tables without additional program support. The memory-based tables contain 8-byte values called descriptors.

Real Address Mode

In this mode physical memory is a contiguous array of up to 1MB. the selector portion of the pointer is interpreted as the upper 16 bits of a 20-bit address. The

remaining 4 bits are set to zero. This mode of operation is compatible with the 8088 and the 8086.

Segments in this mode are 64KB in size and may be read, written or executed. An interrupt may occur if data operands or instructions attempt to wrap around the end of a segment not using the full 64KB. The unused end of the segment may be overlayed by another segment to reduce physical memory requirements.

System Timers

The system has three programmable timer/counters controlled by the Intel 8254-2 chip. These are channels 0 through 2 defined as follows:

Channel 0	System Timer
GATE 0	TIED ON
CLK IN 0	1.190MHz OSC
CLK OUT 0	8259A IRQ 0

Channel 1	Refresh Request Generator
GATE 1	TIED ON
CLK IN 1	1.190MHz OSC
CLK OUT 1	Request Refresh Cycle

NOTE: Channel 1 is programmed to generate a 15 microsecond signal.

Channel 2	Tone Generation for Speaker
GATE 2	Controlled by bit 0 of port hex 61 PP1 bit
CLK IN 2	1.190MHz OSC
CLK OUT 2	Used to drive speaker

The 8254-2 timer/counter is treated by system programs as an arrangement of four programmable external I/O ports. Three are treated as counters; the fourth is a control register for mode programming.

System Interrupts

Sixteen levels of system interrupts are provided by the 80286 NMI and two 8259A interrupt controller chips. The following shows the interrupt-level assignments' decreasing priority:

Level	Function
Microprocessor NMI	Parity or I/O Channel Check
Interrupt Controllers	
CTLR1 CTLR2	
IRQ 0	Timer Output 0
IRQ 1	Keyboard (Output Buffer Full)
IRQ 2 ←	Interrupt from CTLR 2
IRQ 8	Realtime Clock Interrupt
IRQ 9	Software Redirected to INT OAH (IRQ2)
IRQ 10	Reserved
IRQ 11	Reserved
IRQ 12	Reserved
IRQ 13	Coprocessor
IRQ 14	Fixed Disk Controller
IRQ 15	Reserved
IRQ 3	Serial Port 2
IRQ 4	Serial Port 1
IRQ 5	Parallel Port 2
IRQ 6	Diskette Controller
IRQ 7	Parallel Port 1

ROM Subsystem

The ROM subsystem has a 32K by 16-bit arrangement consisting of two 32K by 8-bit ROM/EPROM modules. The odd and even address codes reside in separate modules. The top of the first megabyte and the bottom of the last megabyte address space is assigned to ROM (hex 0F0000 and hex FF0000). Parity checking is not done on ROM.

RAM Subsystem

The RAM subsystem starts at address hex 000000 of the 16M address space. It consists of either 640KB or 1MB of 256K or 64K by 1-bit RAM modules. Memory refresh forces one memory cycle every 15 microseconds through channel 1 of the timer/counter. The following functions are performed by the RAM initialization program:

- Write operation to any memory location.
- Initialization of channel 1 of the timer/counter to the rate generation mode (15 microseconds).

NOTE: Memory can be used only after being accessed or refreshed eight times.

Dircet Memory Access

Eight DMA channels are supported by the system. Two Intel 8237-5 DMA controller chips (four channels in each chip) are used to provide eight DMA channels. The DMA channels are assigned as follows:

CTR 1		CTR 2	
CH 0	Spare	CH 4	Cascade for CTRL 1
CH 1	SDLC	CH 5	Spare
CH 2	Diskette	CH 6	Spare
CH 3	Spare	CH 7	Spare

DMA Channel

Channels 0 through 3 are contained in DMA controller 1. Transfers of 8-bit data, 8-bit I/O adapters and 8-bit or 16-bit system memory are supported by these channels. Each of these channels will transfer in 64KB blocks throughout the 16-megabyte system address space.

Channels 4 through 7 are contained in DMA controller 2. To cascade channels 0 through 3 to the microprocessor, use channel 4. Transfers of 16-bit data between 16-bit adapters and 16-bit system memory are supported by channels 5, 6 and 7. DMA channels 5 through 7 will transfer data in 128KB blocks throughout the 16-megabyte system address space. These channels will not transfer data on odd-byte boundaries.

The addresses for the page register are as follows:

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

Address generation for the DMA channels is as follows:

For DMA Channels 3 through 0		
Source	**DMA Page Registers**	**8237A - 5**
Address	A23 ⟺ A16	A15 ⟺ A0

Note: To generate the addressing signal "byte high enable" (BHE), invert address line A0.

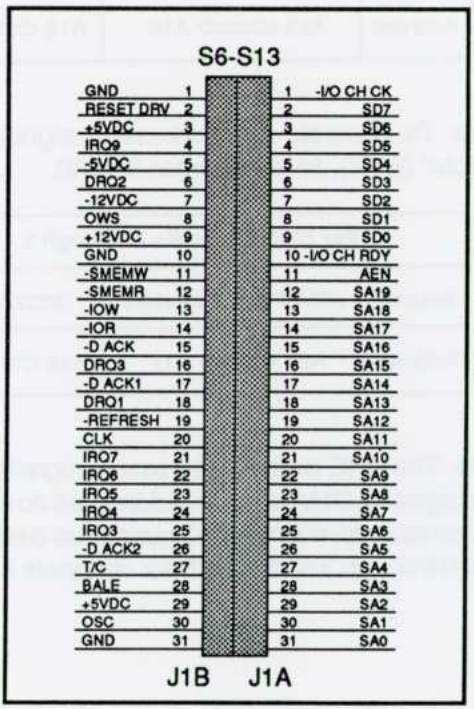
For DMA Channels 7 through 5		
Source	**DMA Page Registers**	**8237A - 5**
Address	A23 ⟺ A17	A16 ⟺ A1

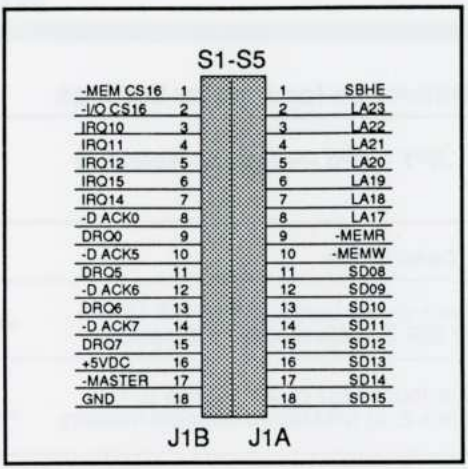
Note: The BHE and A0 addressing signals are forced to a logical 0. DMA channel addresses do not increase or decrease through page boundaries 64KB for channels 0 through 3 and 128KB for channels 5 through 7).

The I/O channel supports:

- Refresh of system memory from channel or microprocessors
- Selection of data accesses (either 8- or 16-bit)
- Interrupts
- 24-bit memory addresses (16MB)
- I/O wait-state generation.
- I/O address space hex 100 to hex 3FF.
- Open-bus structure (allowing multiple microprocessors to share the system's resources, including memory)
- DMA channels

The pinouts of the expansion bus I/O channels are shown as below and on the next page.





Math Coprocessor Control

The math coprocessor functions as an I/O device through I/O port addresses hex 0F8, 0FA and 0FC. The microprocessor sends OP codes and operands to I/O ports. The microprocessor also receives and stores results through the same I/O ports. The "busy" signal sent by the processor forces the microprocessor to wait until the coprocessor is finished executing.

The following describes the math coprocessor controls:

0F0

The latched math coprocessor busy signal can be cleared with an 8-bit "out" command to port F0. The coprocessor will latch "busy" if it asserts its error signal. Data output should be zero.

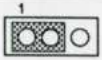
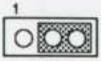
0F1

The math coprocessor will reset if an 8-bit "out" command is sent to port F1. Again, the data output should be zero.

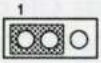
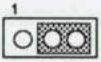
Appendix A

Quick Reference for Jumper Settings

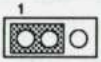
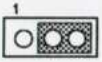
JP1 - JP6 — Banks Seletion

Description	JP1 - JP6 Settings
Using one bank or two banks (banks 0 & 1) with either DIP or SIP DRAMs as onboard memory	
Using three or four banks of DIP (banks 0, 1) and SIP (banks 2, 3) DRAMs as onboard memory	

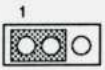
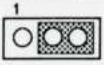
JP7 — Battery Selection

Jumper JP7	Battery
	External
	Onboard

JP8 — Display Mode Selection

Jumper JP8	Video Selection
	Monochrome
	Color

JP9 — Power Good Selection

Jumper JP9	Function
	Power Fail Detect Circuit Active
	External Power-Good Function Active

J1 — Speaker

J2 — Keylock

J3 — Turbo LED

J4 — Hardware Reset

J5 — Turbo Switch

J6 — Enable Four Size "AA" Batteries

J7 — Keyboard Connector

J8 — Power Connector