PTM-1230C

12MHz Zero-Wait
Mini286 Mainboard
User Manual

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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 to the system is turned **OFF** before changing any hardware settings such as DIP switches or jumpers.

Note

1. When you see an error message appears on the screen after turning the power on, leave the system switched on for one or two hours to recharge the battery. You can then enter the system configuration.

2. Leave your system switched on for 10 to 15 hours to completely recharge the battery.

3. If you had left the system switched off for more than one month, follow step 2 above.

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Introduction

The PTM-1230C motherboard 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-1230C motherboard.

Moreover, the same keyboard commands used on a PC/AT can also be used on the PTM-1230C motherboard. For example, the same <Ctrl> <Alt> <Del> combination of keystrokes that is used for the software reset on the PC/AT may also be used on your PTM-1230C-based system.

For this reason, the PTM-1230C motherboard 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 the minimum of effort.

Note:

Besure the jumper **JP1** is **shorted** when you install your system.
Otherewise, you have to set up your system configuration whenever you turn on your computer.

Features

- 80286-12 microprocessor (optional 80287 coprocessor).
- Use of VTI®'s PC/AT compatible chip set.
- Switchable between 8MHz Normal mode and 12MHz Turbo mode by either a software switch or a hardware switch.
- 8MHz I/O operation to keep compatibility with all existing add-on cards.
- 8MHz Normal mode compatible with IBM PC/AT® and 12MHz Turbo mode 195% faster than IBM PC/AT®.
- Two serial ports and one parallel port onboard.
- Onboard battery backup for CMOS configuration table and real-time clock.
- RAM subsystem of 512KB, 640KB or 1MB.
- RAM configurations of 640/384KB.
- Eight expansion slots.
- Sixteen-level interrupt.
- Three-channel timer for music and time.
- Seven-channel DMA for disk and special I/O.
- 32KB legal DTK BIOS© (ADL certified) developed by DATATECH ENTERPRISES CO., LTD.
- Four-layer motherboard.
- Speed test by Landmark® Speed Test Program.
  for one-wait state = 12MHz
  for zero-wait state = 15.9MHz

Board layout

The illustration below will familiarize you with the layout of the PTM-1230C motherboard and its onboard ports:

Installation

During the course of this section references will be made to jumper settings, used to configure the various functions of the PTM-1230C mainboard. The following diagram shows the locations of all the jumpers that may need to be set.

Location of jumpers

RAM installation

Two jumpers, J8 and J9, are used to configure RAM size on the motherboard. The two RAM banks can be made to contain from 512KB, 640KB and up to 1MB by means of setting jumpers J8 and J9.

For the location of J8 and J9, refer to the illustration on page 4.

To select the proper settings of the jumpers for the RAM size that you want, refer to the table below:

J8	J9	RAM size	RAM address range	RAM type	
				Bank 0	Bank 1
Short	Short	512/0*	000000~07FFFF	256K x 18	None
Short	Open	640/0	000000~09FFFF	256K x 18	64K x 18
Open	Short	640/384	000000~09FFFF 100000~15FFFF	256K x 18	256K x 18
Open	Open	Not allowed			

* 512/0 stands for 512KB base, 0KB expansion memory

ROM installation

To install the ROM chips, refer to the illustration below for the location of the chip sockets and the ROM selection jumper, J22, on the motherboard:

For selection and installation of the ROM BIOS chips, refer to the table below:

Type of BIOS	Type of ROM chip	ROM configuration	J22
Other BIOS of 32KB size	27128 x 2	U58 - Low byte U57- High byte	○○
DTK BIOS or any other of 64KB size	27256 x 2	U58 - Low byte U57 - High byte	○-○

Serial/Parallel port settings

There are two serial ports and one parallel port on the PTM-1230C motherboard. Before actually using these ports, you should set the jumpers J13, J14, J15, J16, J17, J18 and J19 correctly. Refer to the illustrations on pages 3 & 4 to find the port connectors and these jumpers.

The following tables indicate the proper settings of these jumpers:

Parallel port (CN3) jumper settings

CN3	J13	J14	J19
LPT1	short	short	1 2 short
LPT2	open	open	2 3 short
disable	open	short	irrelevant
disable	short	open	irrelevant

Serial port 1 (CN2) jumper settings

CN2	J15	J16
COM1	short	short
COM3	open	open
disable	open	short
disable	short	open

Serial port 2 (CN1) jumper settings

CN1	J17	J18
COM2	short	short
COM4	open	open
disable	open	short
disable	short	open

Display adapter settings

Jumper J11 is used to select the display adapter. To find jumper J11 on the motherboard, refer to the illustration on page 4.

To configure the motherboard for the kind of display adapter you want, set jumper J11 according to the table below:

	Jumper setting
Primary display attached to monochrome display	J11 open
Primary display attached to color graphics monitor adapter	J11 short

One-wait/zero wait states

Jumper J6 is used to select the zero-wait and one-wait states. To find the jumper, refer to the illustration on page 4. The appropriate settings are shown below:

	Jumper setting
One-wait state operation	J6 open
X Zero-wait state operation	J6 short

Panel indicators and switches

How you attach the mainboard to the case of your system unit is largely up to you. This is because the PTM-1230C Turbo mainboard can be used in a variety of 80286-type system unit cases.

Under typical conditions, your system unit will have all the indicators and switches shown below and preferably even a reset switch, a Turbo hardware switch and a Turbo LED. If not, you can either install a new panel display or omit some of these items from your system. Your computer dealer offers an accessory which allows you to add the two switches and the LED to your system.

The cables leading from this control panel will be connected to the appropriate pin connectors on the mainboard. Before you attach the mainboard to the case, you should connect these cables to the mainboard. The locations on the mainboard are given in the diagrams on the following pages.

The pinouts for the keylock pin connector,J1, are given in the following table. Refer to it to connect the keylock cable to the pin connector.

Pin	Assignments
1	LED power
2	Not used
3	Ground
4	Keyboard inhibit
5	Ground

Note that pin 2 is not used and therefore the corresponding socket in the cable connector has no wire lead. The wire for pin 1 can thus easily be identified and the cable connector oriented correctly.

Functions of panel indicators and switches

Now that you have connected the panel indicators and switches, you should understand something about their functions:

- **Keylock** The keylock is used to enable or disable the keyboard. By disabling the keyboard, the user ensures that anyone who does not have a key will be unable to use the computer. Unlocking the keylock enables the keyboard. The keylock connector is located at J1 as previously noted.

- **Power LED** The power LED indicates whether the power is on.

- **Hardware reset** The reset switch restarts the computer from the RAM test stage. If you encounter any problems while using unfamiliar software, you can always restart from the beginning by pressing the restart button. The reset connector is jumper J2.

- **Turbo LED** The Turbo LED indicates operation in Turbo mode. The Turbo LED connector is jumper J4.

- **Turbo switch** The Turbo switch changes operation mode between Turbo and Normal. The Turbo switch connector is jumper J5.

- **Speaker** The speaker connector is located at J3.

The pinouts for the various switch and indicator connectors are given on the following page.

Turbo LED jumper J4 pinouts

Pin	Function
1	Select pin
2	Ground

Speaker jumper J3 pinouts

Pin	Function
1	Data out
2	5 VDC
3	Ground
4	5 VDC

Turbo hardware jumper J5 pinouts

Pin	Function
2	Select pin
1	Ground

Math coprocessor installation

The math coprocessor located at U45 is optional. When a 80287 coprocessor is installed the BIOS will check its presence automatically. Setting any switch to indicate its presence is unnecessary.

But choosing a proper 80287 for correct operation is necessary:

- For Turbo mode, an 80287-8 (8MHz) is required.
- For Normal mode, an 80287-6 (6MHz) is required.

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 the vendor from whom you purchase the chip if you are in doubt as to which one to choose.

Power supply

The final step is attaching the power supply cable to the mainboard at connector J21. Looking from the top of the case, on the left side of the power supply are some cables. Find the 12-pin plastic connector (the four-pin connectors are for the disk drives and hard disks).

Refer to the picture below. Pins 1 and 12 are numbered in the picture for your convenience. The pinout description is on the next page.

Pin	Assignments
1	Power good
2	+5 VDC
3	+12 VDC
4	-12 VDC
5	Ground
6	Ground
7	Ground
8	Ground
9	-5VDC
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, then the system will function properly. Otherwise, the data setting in CMOS RAM will be lost. The following list gives you some guidelines for choosing the right 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.

Battery connector

Finally, there is battery connector J12. This is for connecting four size "AA" batteries instead of the circular lithium battery (next to J12) to the CMOS RAM. For its location, refer to the illustrations on page 4.

The battery connector pin assignments are as follows:

Pin	Assignments
4	Ground
3	Not used
2	Not used
1	6 VDC

Keyboard connector

Having fastened the mothervoard to the case, it only remains to attach the keyboard. The keyboard connector is located at the back of your system unit. Refer to the illustration below:

Location of keyboard connector from back panel

The pin assignments for keyboard connector J20 are as follows:

Pin	Assignments
1	Keyboard clock
2	Keyboard data
3	Spare
4	Ground
5	+5 VDC

You have now finished configuring and connecting the mainboard.

Operation

The main advantage of the PTM-1230C 12MHz zero-wait mini-80286 Turbo 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 12MHz. In the 12MHz Turbo mode, your computer will operate up to 195% faster than a conventional 80286-based computer.

Another special feature of the PTM-1230C mainboard is the zero-wait/one-wait option in the Turbo mode. In zero wait, your system will be around 195% faster than a IBM PC/AT® computer. In one-wait state, operation will be around 80% faster.

Mode	DRAM used	Test Value
8 MHz/1 wait	150 ns	8 MHz
8 MHz/0 wait	120 ns	10.3 MHz
12 MHz/ 1 wait	120 ns	12 MHz
12 MHz/0 wait	80 ns	15.9 MHz

*Testing by Landmark Speed Test Program

To select the Normal/Turbo and one-wait/zero-wait options, refer to the following instructions:

Obtaining 12MHz Turbo mode

This mainboard supports both a software switch and a hardware switch for changes between Normal and Turbo modes.

Setting default operation mode

The Turbo hardware switch, jumper J5 (shown on page 4), gives you the choice of running the PTM-1230C in either Normal or Turbo mode when the power is on. For default operation:

- In Normal mode ..... Place a jumper cap over J5.
- In Turbo mode ..... Take the jumper cap off J5.

Software switch

Before using the software switch, pay attention to whether default operation is in Normal or Turbo mode. If it is in Normal mode, do the following: press and hold down the control < Ctrl > and alternate < Alt > keys on the keyboard while you press the minus < - > key. The cursor on the screen will turn into a box. The Turbo LED on your panel, if you have installed one, will light. For more information on the Turbo LED, refer to the **Panel indicators and switches** section. Now the computer is in Turbo mode.

To return to Normal mode, press the same keys you used to enter Turbo mode. When you enter Normal mode, the cursor will return to the dash (_) form and the Turbo LED will turn off.

If default operation is in Turbo mode, press and hold down the control < Ctrl > and alternate < Alt > keys on the keyboard while you press the minus < - > key to go to Normal mode. The Turbo LED will turn off, and the cursor will turn into a box. To return to Turbo mode, press the same keys: the Turbo LED will light and the cursor will change into a dash.

Hardware switch

If you have a hardware switch on your panel, connect it to jumper J5. More information on this is given in the **Panel indicators and switches** section.

Push the hardware switch on to enter Normal mode, and push it off to enter Turbo mode.

Hardware switch off Hardware switch on

Using the hardware switch means that the only indication of the mode your computer is in will be the Turbo LED. It will turn on in the Turbo mode and turn off in the Normal mode. The cursor will always have the same appearance.

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 **Panel indicators and switches** section.

One-wait/zero-wait option

The one-wait/zero-wait option is selected by jumper J6 on the mainboard. Be aware that this option is only available when the computer is in the Turbo mode. For information on how to set the jumper, refer to **One-wait/zero wait states** in the installation section.

Technical information

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 12MHz 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 space and 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 1 megabyte. The selector portion of the pointer is interpreted as the upper 16 bits of a 20-bit address and 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. In this mode, the information contained in the segment does not use the full 64KB and 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 an Intel® 8254-2 timer/counter 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 period signal.

Channel 2	**Tone Generation for Speaker**
GATE 2	Controlled by bit 0 of port hex 61 PPI bit .
CLK IN 2	1.190MHz OSC.
CLK OUT 2	Used to drive the 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 in decreasing priority:

Level		Function
Microprocessor NMI		Parity or I/O channel check
Interrupt controllers		
CTLR 1	CTLR 2	
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 0AH (IRQ 2)
	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.

DTK BIOS© has been supported and placed in this subsystem.

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.
- Initialize channel 1 of the timer/counter to the rate generation mode (15 microseconds).

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

Direct memory access

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

CTLR 1	**CTLR 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 channels

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 data 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 AO.

• For DMA channels 7 through 5

Source	DMA Page Registers	8237A - 5
Address	A23 ⟷ A17	A16 ⟷ A1

NOTE: The BHE and AO addressing signals are forced to a logic 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).

I/O channel slots

The I/O channel supports:

- Refresh of system memory from channel, microprocessors.
- Selection of data accesses (either 8 bit 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.

Numbering of the I/O slots is as follows:

1-J8 I/O channels

J10-J14 and J16 I/O channels

Math coprocessor

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 coprocessor 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.

Application note

The default operation mode depends on two things: the hardware switch jumper setting as well as the type of keyboard controller (8042) used. The relationship between them is described in the table below.

Default mode	Hardware switch jumper setting	Type of 8042
Turbo	Open	DTK (Mitsubishi Version)
Normal	Short	
Normal	Open	DTK (Intel Version) AMI PHOENIX
Turbo	Short	

Application note

The default operation mode depends on two things: the hardware switch jumper setting as well as the type of keyboard controller (8042) used. The relationship between them is described in the table below.

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Turbo	Open	DTK (Mitsubishi Version)
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Normal	Open	DTK (Intel Version) AMI
Turbo	Short	PHOENIX