

Digital
Human Machine Interface —

Pro-face

PL-5900 Series
User Manual

Digital
Digital Electronics Corporation

Introduction

Thank you for purchasing Proface's PL-5900 series Panel Computer, hereafter referred to as "the PL". This unit embodies Proface's latest, cost-effective architecture and is designed for Industrial Automation users.

Prior to using your PL, be sure to read this manual thoroughly to familiarize yourself with the unit's operation procedures and functions.

NOTE:

1. It is forbidden to copy the contents of this manual in whole, or in part, without the permission of the Digital Electronics Corporation.
2. The information in this manual is subject to change without notice.
3. This manual was written with care; however, if you should find any errors or omissions, please contact Digital and inform them of your findings.
4. Please be aware that Digital Electronics Corporation shall not be held liable by the user for any damages, losses, or third party claims arising from the uses of this product.

© 2000 Digital Electronics Corporation

MS-DOS®, Windows® 95, Windows® 98 are registered trademarks of the Microsoft Corporation.

IBM®, and DOS® are registered trademarks of IBM.

AMD-K6®-2 is a trademark of Advanced Micro Devices, Inc.

Product names used in this manual are the trademarks of their respective manufacturers.

Essential Safety Precautions

This manual includes the following cautions concerning procedures that must be followed to operate the PL correctly and safely. Prior to operating the PL, be sure to read this manual and any related materials thoroughly to understand the correct operation and functions of this unit.

Safety Icons

To allow you to use the PL correctly, throughout this manual, the following icons are provided next to items requiring special attention.

These icons indicate the following levels of danger:



Indicates situations where severe bodily injury, death or major equipment damage may occur.



Indicates situations where slight bodily injury or machine damage can occur.

WARNINGS

- **To avoid the possibility of an electric shock, be sure to connect the power cord to the PL before connecting it to the main power supply.**
- **A fire or electrical shock may occur if voltages used with the PL are beyond the specified range. Be sure to use only the specified voltage.**
- **Before opening the PL's protective cover, be sure to turn the unit's power OFF. This is because the PL's internal parts carry high voltages.**
- **To avoid fires or electrical hazards, do not modify the PL in any way.**
- **Do not create touch panel switches that are used to either control or to ensure the safety of equipment and personnel. Mechanical switches, such as an emergency stop switch, a deadman (two-handed) start switch, etc., must be installed and operated via a separate control system.**

 **WARNINGS**

- After the PL's backlight burns out, unlike the PL's "Standby Mode", the touch panel is still active. If the operator fails to notice that the backlight is burned out and touches the panel, a potentially dangerous machine operation mistake can occur.

If your PL's backlight suddenly turns OFF, use the following steps to determine if the backlight is actually burned out.

- 1) If your PL is not set to "Standby Mode" and the screen has gone blank, your backlight is burned out.
 - 2) Or, if your PL is set to Standby Mode, but touching the screen does not cause the display to reappear, your backlight is burned out.
- If metal particles, water or other types of liquids contact any of the PL's internal parts, immediately turn the unit's power OFF, unplug the power cord, and contact either your PL distributor or the Digital Electronics Corporation.
 - Read and understand Chapter 4 "Installation and Wiring" thoroughly in order to select an appropriate installation location for the PL.
 - Before either plugging in or unplugging a board or interface connector, be sure to turn the PL's power OFF.
 - To prevent a possible explosion, do not install the PL in areas containing flammable gases.
 - The PL is not appropriate for use with aircraft control devices, aerospace equipment, central trunk data transmission (communication) devices, nuclear power control devices, or medical life support equipment, due to these devices' inherent requirements of extremely high levels of safety and reliability.
 - When using the PL with transportation vehicles (trains, cars and ships), disaster and crime prevention devices, various types of safety equipment, non-life support related medical devices, etc. redundant and/or failsafe system designs should be used to ensure the proper degree of reliability and safety.



CAUTIONS

- Never strike the touch panel with a hard, heavy or pointed object, or press on the touch panel too strongly, since it may damage the unit.
- Avoid exposing the PL to, or operating the PL in direct sunlight, high temperatures and humidity, and in areas where excessive dust and vibration will occur.
- Avoid using the PL in areas where sudden, extreme changes in temperature can occur. This may cause condensation to form inside the unit, possibly leading to an accident.
- To prevent the PL from overheating, be sure its air circulation vents are clear and clean, and keep the unit's operation area well-ventilated.
- Avoid operating or storing the PL near chemicals, or where chemicals can come into contact with the unit.
- When the Standard display is connected to the PL, after turning the display OFF, be sure to wait at least three (3) seconds before turning it ON again.

When PL Hard Disk (HDD) data is lost:

- The Digital Electronics Corporation cannot be held responsible or provide any compensation for damage(s) caused by the loss of data stored in the PL's hard disk drive (HDD). It is therefore strongly suggested that all important data and software be backed up regularly to an external data backup device.
- Please be aware that the Digital Electronics Corporation bears no responsibility for any damages resulting from the customer's application of this unit's hardware or software.
- Since the PL unit's hard disk drive (HDD) is a consumable item, i.e. it has a limited lifetime, be sure to back up its data regularly and prepare a spare HDD unit.
- To prevent file data damage, be sure to shut down the PL's OS before turning OFF the main power.
- After turning OFF the PL's power, wait until the internal HDD stops spinning before turning on the power again (approx. 5 seconds).

■ About the PL's Display Panel

- The PL's currently displayed data, its voltage and brightness setting each affect the intensity of *Contouring*. (i.e, when some parts of the screen are brighter than others, creating a wavelike pattern)
- There are minute grid-points (dark and light) on the Display Panel's surface. This is part of the PL's design and not a defect.
- Shadows may appear at the top of the LCD. This is normal for an LCD display.
- Sometimes the display area may look as if the display colors have changed. This is a common attribute of LCD's and is not a defect.
- Displaying a single image for long periods can cause an afterimage to remain when the display is changed to another screen. To prevent this, periodically turn the PL OFF and then ON again to remove this afterimage.

Table of Contents

Introduction	1
Essential Safety Precautions	2
Table of Contents	6
UL/c-UL(CSA) Application Notes	9
CE Marking Notes	9
Prior To Using the PL	10
Special Features	11
Package Contents	12
Documentation Conventions	13

Chapter1 PL Basics

1.1 PL System Design	1-1
1.2 Optional Items	1-2
1.3 PL Series Panel Types	1-5

Chapter2 Specifications

2.1 General Specifications	2-1
2.1.1 Electrical	2-1
2.1.2 Environmental	2-2
2.1.3 Structural	2-3
2.2 Functional Specifications	2-4
2.2.1 General	2-4
2.2.2 Display	2-4
2.2.3 Expansion Slots	2-4
2.2.4 Clock (RTC) Accuracy	2-4
2.3 Interface Specifications	2-6
2.3.1 Printer Interface (LPT1)	2-6
2.3.2 Keyboard Interface	2-6
2.3.3 Mouse Interface	2-7
2.3.4 RS-232C Interface (COM1/COM2/COM3)	2-7
2.3.5 RAS Interface	2-8
2.4 PL Part Names and Features	2-10
2.5 External Dimensions	2-12
2.5.1 PL-5900T External Dimensions	2-12
2.5.2 PL-5900T with PL-FD500 External Dimensions	2-13
2.5.3 PL-5900T with Mirror Disk Unit External Dimensions	2-14
2.5.4 PL-5900T with PL-RC500 External Dimensions	2-15

2.5.5	PL-5901T External Dimensions	2-16
2.5.6	PL-5901T with PL-FD500 External Dimensions	2-17
2.5.7	PL-5901T with Mirror Disk Unit External Dimensions	2-18
2.5.8	PL-5901T with PL-RC500 External Dimensions	2-19
2.5.9	Panel Cut Dimensions	2-20

Chapter3 Installing Optional Units and Expansion Boards

3.1	Installation	3- 1
3.1.1	Removing the Rear Maintenance Cover	3- 2
3.1.2	Installing the DIM Module	3- 3
3.1.3	Installing the FDD Unit	3- 4
3.1.4	Removing/ Installing the HDD Unit	3- 7
3.1.5	Installing an Expansion Board	3- 8
3.1.6	Connecting the CD-ROM Unit	3- 9

Chapter4 Installation and Wiring

4.1	Installation Cautions	4- 1
4.2	Installing the PL	4- 3
4.2.1	Installation Procedures	4- 3
4.3	Wiring the PL	4- 7
4.3.1	Connecting the Power Cord	4- 7
4.3.2	Power Supply Cautions	4- 10
4.3.3	Grounding Cautions	4- 11
4.3.4	Cautions When Connecting I/O Signal Lines	4- 11

Chapter5 System Setup

5.1	Setup Procedures	5- 1
5.2.1	STANDARD CMOS FEATURES	5- 2
5.2	System Parameters	5- 2
5.2.2	IDE Primary Master/IDE Primary Slave	5- 3
5.2.3	Advanced BIOS Features	5- 4
5.2.4	Advanced Chipset Features	5- 7
5.2.5	Integrated Peripherals	5- 9
5.2.6	SIS 950 Super I0 Device	5- 11
5.2.7	Power Management Setup	5- 13
5.2.8	PM Wake Up Events	5- 15
5.2.9	PnP/ PCI Configurations	5- 17
5.2.10	IRQ Resources	5- 19
5.2.11	DMA Resources	5- 20
5.2.12	PC Health Status	5- 21

Chapter6 OS Setup

6.1	Floppy Disk Utility Programs	6-1
6.1.1	MS-DOS® Software	6-2
6.1.2	Windows® 95/Windows® 98 (SR2).....	6-2
6.2	MS-DOS Utility Programs.....	6-4
6.2.1	ATPH59.EXE (Touch Panel Handler).....	6-4
6.2.2	CALIB59.EXE (Touch Panel Data Calibration)	6-12
6.2.3	KEYEM_PL.EXE (Keyboard Emulator)	6-14
6.2.4	DISP.EXE (Display ON/OFF Program)	6-21
6.2.5	BLSET.EXE (Backlight Burnout Detection Program).....	6-21

Chapter7 Maintenance and Inspection

7.1	Regular Cleaning	7- 1
7.1.1	Cleaning the Display	7- 1
7.1.2	Replacing the Installation Gasket.....	7- 2
7.2	Replacing the Backlight	7- 2
7.3	Periodic Maintenance Points	7- 6

Appendices

A.1	Hardware Configuration	App-1
A.1.1	I/O Map	App-1
A.1.2	Memory Map	App-2
A.1.3	Interrupt Map	App-3
A.2	RAS Feature	App-4
A.2.1	PL's RAS Features	App-4
A.2.2	RAS Feature Details	App-5
A.2.3	RAS Feature Overview	App-9
A.3	Serial Communication	App-10
A.4	Touch Panel Handler	App-11
A.5	BIOS List.....	App-19

UL/c-UL(CSA) Application Notes

The PL5900-T41-24V/PL5901-T41-24V series units are UL/c-UL (CSA) 1950 recognized products. (UL File No. E171486). Please pay special attention to the following instructions when applying for UL/c-UL approval for machinery which includes any of these PL units.

Equipment with a PL mounted in it requires UL/c-UL evaluation for the combination of the PL and equipment.

The PL conforms as a component to the following standards:

UL 1950, Third Edition, dated March 1,1998 (Standard for Safety of Information Technology Equipment, including Electrical Business Equipment)

CSA-C22.2 No. 950-M95 (Standard for Safety of Information Technology Equipment, including Electrical Business Equipment)

PL5900-T4* (UL Registration Model: 2880065-02)

PL5901-T4* (UL Registration Model: 2880065-01)

- The PL should be used as a built-in component of another product.
- Use the PL indoors only.
- When connecting the PL's power cord, be sure to use a cord that is appropriate for the current and voltage used, and that has conductive wires that are 0.75 mm² or larger.
- When an end-use product will include the PL, be sure to design the PL's power cut-off switch as a separate disconnect device and locate it where the operator can easily reach it.
- Danger of explosion if backup battery is incorrectly replaced. Replaced only with same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.
- Be sure the unit the PL is built into is a (c)UL1950 approved structure.

CE Marking Notes

The PL5900-T41-24V/PL5901-T41-24V series units are CE marked, EMC compliant products.

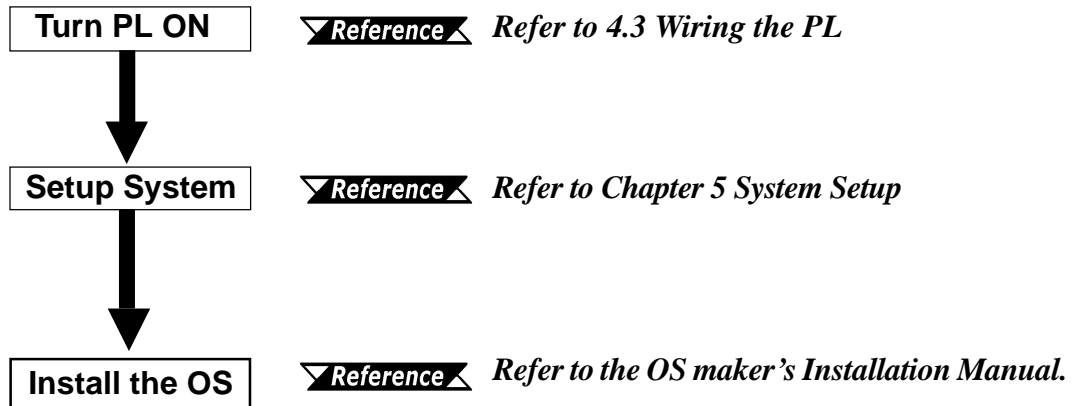
<These units comply with the following standards>

■ EMI (EN50081-2)

EN55011 Group1 (Class A) and EMS (EN50082-2)

Prior To Using the PL

Prior to actual use, be sure to setup your PL as follows.



- **After completing the hardware setup, before any data or applications can be installed on the hard disk drive, the OS (Windows or MS DOS) must be used to initialize the HDD and create partitions. For details concerning these procedures, refer to the OS maker's installation manual.**
- **The PL is designed for use with the MS-DOS, Windows® 95, or Windows® 98 (SR2) operating systems. Other operating systems are not supported by this PL's driver software.**
- **For system setup and OS installation, a PS/2 type (mini-DIN) keyboard is required.**
- **When using MS-DOS/Windows® 95/Windows® 98 (SR2), be sure to install the PL-5900 Series Driver and Utility Disk's Display Driver (For installation procedures, see the disk's readme files.**
- **For information on the PL's bundled utility software, see the README file on the Driver and Utility Disk.**
- **Since the PL's hard disk drive (HDD) is a consumable item, i.e. it has a finite usage lifetime, be sure to back up its data frequently and prepare a spare HDD unit.**
- **After turning the PL OFF, be sure to wait at least 5 seconds before turning ON again. If the unit is started within 5 seconds, it may not start up correctly.**

Special Features

The PL-5900 series displays are equipped with the following features:

■ **The Latest, High-Performance Architecture**

Designed around the AMD-K6[®]-2 300 MHz CPU, the PL utilizes the type of high-performance architecture that offers you superior compatibility. Add to this unrivalled support of the Windows[®]95 and other operating systems.

■ **Bright 10.4" LCD with a Wide Viewing Angle**

The PL's large 10.4-inch 640 x 480 dot TFT LCD display offers excellent visibility and brightness.

This top of the line TFT color LCD model allows you to create detailed and powerful visual images, with excellent brightness, a wide viewing angle, and a display capable of 260,000 colors.

■ **Easy Front Panel Installation**

The PL is designed to be installed easily into the front of any panel or device. It is also rugged enough for use in harsh, industrial environments, such as those found in the factory automation industry and its front panel boasts an IP65f equivalent rating.

■ **High Resolution, Analog Type Resistive Film Touch Panel**

Standard equipment with the PL is a high resolution 1024 x 1024 touch panel. Also, the separately sold mouse emulation utility provides mouse-like functionality and pointer control.

■ **Highly Expandable**

The PL units consist of two types; a 1-slot type (with 1 PCI bus also available), and a 3-slot type (with 2 PCI buses available). These slots can accommodate both Digital's own optional boards as well as other commercially available expansion boards.

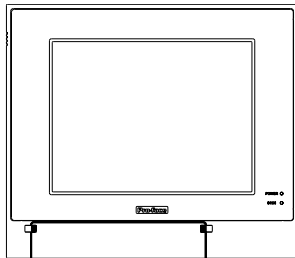
Digital also offers a wide variety of optional products, such as FDD units, DIM memory modules and others.

Package Contents

The PL's packing box contains the items listed below. Please check to confirm that all items shown below have been included.

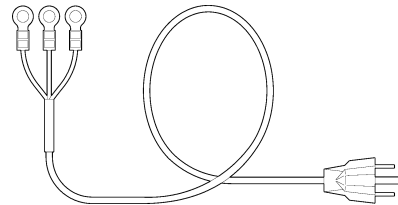
■ **PL Unit**

PL-5900T/PL-5901T



■ **Power Cord**

(included in the PL5900-T11/PL5901-T11)



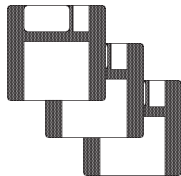
Be careful when handling the PL not to damage the built-in HDD



This cord is designed only for AC100V use. Any other voltage will require a different cord.

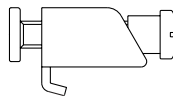
■ **Floppy Disks (3)**

(PL5900 Series Driver and Utility Disks)



■ **Installation**

**Fasteners
(4 brackets/set)**



■ **Installation**

Gasket

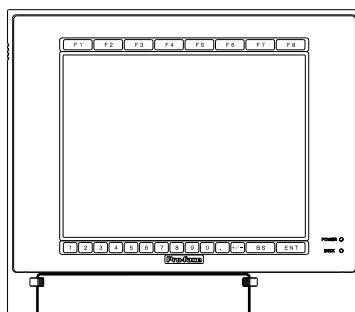


■ **Function Labels**






Attach the function labels as shown below.

■ **CD-ROM (1)**



Documentation Conventions

The list below describes the documentation conventions used in this manual.

Symbol	Meaning
	Indicates important information or procedures that must be followed for correct and risk-free software/device operation.
	Provides useful or important supplemental information.
*1	Indicates useful or important supplemental information.
	Refers to useful or important supplemental information
1) , 2)	Indicates steps in a procedure. Be sure to perform these steps in the order given.
PL	Abbreviation for the PL-5900 Series Industrial Computers.

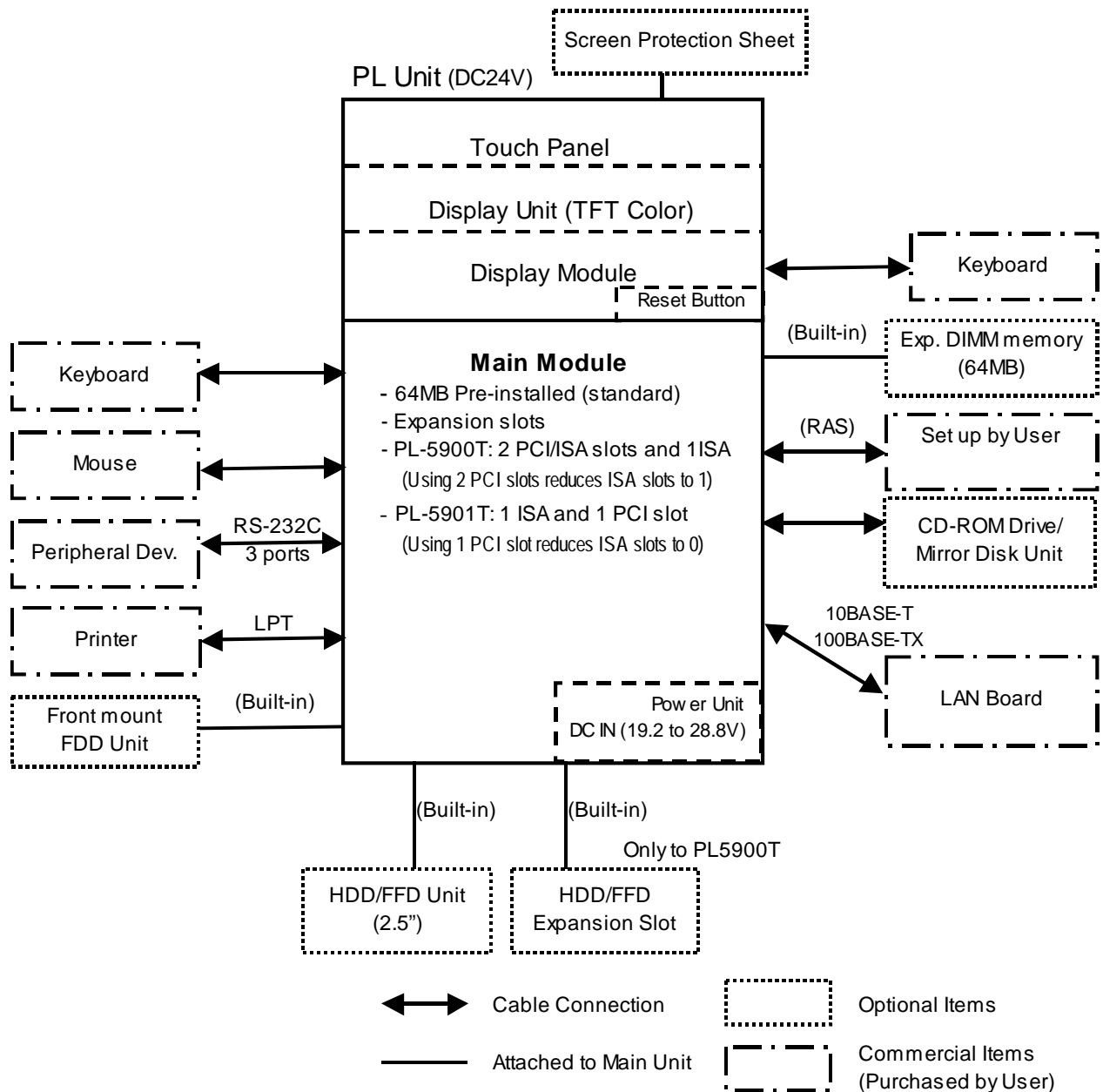
Memo

Chapter

1 PL Basics

1. PL System Design
2. Optional Items
3. PL Series Panel Types

1.1 PL System Design



The above system configuration illustrates the PL's internal design and range of connectable peripherals. The user's actual configuration may differ.

1.2 Optional Items

Options

Name	Model number	Description
DIM Module	PL-EM500	SDRAM (DIMM) Provides 64MB of memory
HDD Unit	PL-HD220	10GB 2.5" HDD Unit (OS not included)
FDD Unit	PL-FD500	IBM PC Compatible 3.5" FDD unit (Attaches to front slot)
FFD Unit (Flash File Disk)	PL-FF200	Flash File Disk Provides 20MB of memory, connected to IDE I/F. Used as HDD.
CD-ROM Unit	PL-DK200	IDE (AT API) compatible CD-ROM drive unit – for development and maintenance use. (special connection cable is included with CD-ROM unit)
Mirror Disk Unit	PL-MD200- HU01	IDE compatible mirror disk unit without OS for data protection in case of HDD malfunction. Contains 2 2.5inch, 2.1GB drives.
LAN Board	DAX-IET02	NE2000 compatible board. Includes connectors for 10BASE-5, 10BASE-2 and 10BASE-T.
RS-232C/RS-485 Adaptor	PL-RC500	Converts an RS-232C interface to an RS-485 interface. Connects to COM3.
Screen Protection Sheet	PL-CS001	Disposable, dirt-resistant sheet for screen protection. The Touch Panel can be used through this sheet. (10 sheets/set)
Glare Resistant Sheet	PL-NGS01	Disposable, glare-resistant sheet for screen protection. The Touch Panel can be used through this sheet. (10 sheets/set)
Mouse Emulator V2	PL-TD000	This software adds mouse and keyboard-like functionality to the Touch Panel. (Windows® 95/Windows 98® only)

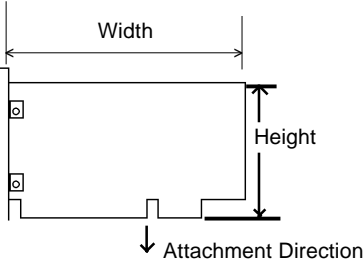
Maintenance Options

Name	Model number	Description
Mirror Disk Unit Replacement HDD	PL-MD200- MD01	Mirror Disk Unit's replacement HDD (1).
Installation Fasteners	GP070-AT01	Used to install the PL into a panel or cabinet. Same as original equipment brackets. (4 brackets/set)
Installation Gasket	PL-WS500	Used to prevent moisture from entering into the PL's case from the front face. Same as original equipment gasket.
Backlight	GP577T- BL00-MS	Spare Backlight for maintenance. (2 bulbs/set)



- **Since the PL's hard disk drive (HDD) is a consumable item, i.e. it has a finite usage lifetime, be sure to back up its data frequently and perform regular maintenance.**

Commercially Available Products

Item	Description	Installation Area
<p>PCI/ISA Bus Compatible Board</p>	<p>PL-5900T series units: -Slot 1 boards can be up to 180 mm wide. -Slots 2 and 3 can be up to 210 mm wide.</p> <p>PL5901T series units: -Slot 1 PCI boards can be up to 180mm wide. -Slot 1 ISA boards can be up to 210mm wide. All boards can be up to 122 mm high. The thickness of the devices attached to the face of an expansion board can be: - Slot 1 (both PL-5901T and PL-5900T) up to 13 mm - Slot 2 (only PL-5900T) up to 18 mm - Slot 3 (only PL-5900T) up to 13 mm</p>  <p>The diagram shows a rectangular expansion board with a notch on the bottom edge. A horizontal double-headed arrow above the board is labeled 'Width'. A vertical double-headed arrow on the right side is labeled 'Height'. A downward-pointing arrow below the notch is labeled 'Attachment Direction'.</p>	<p>Inserted into the PL's expansion slots.</p>

<Expansion Slot's Width and Power Supply>

- Check that your expansion board's "foot" matches the width of the expansion slot. The PL-5900T unit's slot 2 can be up to 25 mm and slot 3 can be up to 20 mm wide. Be sure the width of your expansion board matches that of the intended slot.

<Commercially Available Boards>

- Certain commercially available boards may not be compatible with Digital's PL unit. Installing incompatible boards may result in either damage to or failure of the PL and will void your warranty. Prior to using those boards, be sure to contact your local PL distributor.

<PCI Bus>

- Within the entire range of PCI buses currently available on the market, there may be certain devices which will not operate when used with the PL. Prior to the use of any PCI Bus, be sure to contact your local PL distributor.

<ISA Bus>

- Only 8-bit access is supported. The driver software for the 16-bit access board requires 8-bit access. Prior to installing commercially available ISA Bus compatible boards, please contact your local PL distributor.

ISA Bus Interface Usage Limitations

	Normal Mode		DMA Mode
	I/O Access	Memory Access	Memory Access
8-bit Operations	O	O	O
16-bit Operations	X	X	O

<Main Memory>

- Be sure to use only DIM modules manufactured by Digital. Installing other DIM modules may result in either damage to the PL or a malfunction.

<IDE Interface>

- The PL is equipped with three IDE interfaces, two (2) of which can be used by the HDD or FFD units (PL-5901T can use only one), and one (1) which can be used by either the CD-ROM drive or the Mirror Disk unit. Physically, even though up to three (3) IDE drive units can be connected at the same time, IDE interface specifications require that a controller's simultaneous operation be limited to a single master and slave unit, for a total of two devices. The following chart shows the combinations available when using two IDE units (PL-5901T can use only one).

HDD Unit	MS	M	M	M	S				S		
FFD Unit		S			M	MS	M	M		S	
Mirror Disk Unit			S				S		M	M	M
CD-ROM Drive Unit				S				S			S

MS: Combination of 2 units - Master or Slave, is possible.

M: Used only for Master.

S: Used only for Slave.

PL-5901T cannot use this combination.

<When using Commercial-type PC Peripheral Devices>

- Within the range of peripheral devices currently available on the market there may be certain devices which will not operate correctly when used with the PL. Prior to using any peripheral device, be sure to contact your local PL distributor.

1.3 PL Series Panel Types

DC24V Series Unit Model Numbers:

PL590* - T*_*-DC24V

A B C D E

Item	Code	Meaning
A	PL590	PL-5900 Series Unit
B	0	3-slot type
	1	1-slot type
C	T	TFT Color LCD display
D	1	Standard Model (no certification)
	4	CE Marking, UL/cUL Approval

Memo

Chapter

2 Specifications

1. General Specifications
2. Functional Specifications
3. Interface Connector Specifications
4. PL Part Names and Features
5. PL Dimensions

2.1 General Specifications

2.1.1 Electrical

■ PL5900-T11, PL5901-T11

	PL5900-T11	PL5901-T11
Input Voltage	AC100V	
Rated Voltage	AC85V to AC132V	
Frequency	50/60Hz	
Allowable Voltage Drop	1 cycle or less (however, pause occurrences must be more than 1 second apart)	
Power Consumption	100VA or less	80VA or less
Voltage Endurance	AC1500V 20mA for 1 minute (between charging and FG terminals)	
Insulation Resistance	10M Ω or higher at DC500V (between charging and FG terminals)	

■ PL5900-T42-24V, PL5901-T41-24V

	PL5900-T41-24V	PL5901-T41-24V
Input Voltage	DC24V	
Rated Voltage	DC19.2V to DC28.8V	
Allowable Voltage Drop	10 ms or less (however, pause occurrences must be more than 1 second apart)	
Power Consumption	100W or less	80W or less
Voltage Endurance	AC1000V 20mA for 1 minute (between charging and FG terminals)	
Insulation Resistance	10M Ω or higher at DC500V (between charging and FG terminals)	

2.1.2 Environmental

Ambient Operating Temperature	0°C to 45°C (with HDD attached: 5°C to 45°C)
Storage Temperature	-10°C to 60°C
Ambient Humidity	30%RH to 85%RH
Air Purity Level	0.1mg/m ³ or less (free of conductive particles and dust)
Atmospheric Pressure Resistance	800 to 1114hPa (2000 meters or lower)
Vibration Resistance	19.6m/s ² at 10Hz to 25Hz in X, Y, Z directions for 30 minutes With HDD attached: 4.9m/s ² With FD unit attached: 9.8m/s ²
Noise Endurance (via noise simulator)	Noise Voltage: 1500Vp-p Pulse Width: 50ns, 500ns, 1µs Rise Time: 1ns
Noise Immunity	2kV IEC 61000-4-4
Electrostatic Discharge Immunity	6kV IEC 61000-4-2 Level 3



- **When using any of the PL's optional devices, be sure to check that device's specifications for any special conditions or cautions that may apply to its use.**
- **Since the PL unit's hard disk drive (HDD) is a consumable item, i.e. it has a limited lifetime, be sure to back up its data regularly and prepare a spare HDD unit.**
- **The Hard Disk lifetime given here may be reduced due to unforeseen environmental factors, however, generally speaking, at an operating temperature of 20°C the disk should last for 20,000 hours (of operation) or approximately 5 years, whichever comes first.**
- **Using the Hard Disk in an environment that is excessively hot and/or humid will shorten the disk's usage lifetime. A maximum wet bulb temperature of 29°C or less is recommended. The following data shows equivalent conditions.**

Temperature	Humidity
at 35°C	no higher than 71%
at 40°C	no higher than 54%
at 50°C	no higher than 33%

2.1.3 Structural

	PL-5900T	PL-5901T
Grounding	Exclusive grounding: Use your country's applicable standard.	
Rating (Front face of installed unit)	Equivalent to IP65f (JEM 1030) *1	
External Dimensions	W 311mm[12.99in.] x H 271mm[10.76in.] x D 130mm[6.38in.] (excluding projections)	W 311mm[12.99in.] x H 271mm[10.76in.] x D 93mm[4.75in.] (excluding projections)
Weight	6.0 kg (13.2 lb) or less	5.5 kg (12.1 lb) or less
Cooling Method	Natural air ventilation	

**1 The front face of the PL unit, installed in a solid panel, has been tested using conditions equivalent to the standard shown in this specification . However even though the PL unit's level of resistance is equivalent to the standard, oils that should have no effect on the PL can possibly harm the unit. This can occur in areas where either vaporized oils are present, or where low viscosity cutting oils are allowed to adhere to the face of the unit for long periods of time. If the PL's front face protection sheet becomes peeled off, these conditions can lead to the ingress of oil into the PL and separate protection measures are suggested. Also, if non-approved oils are present, it may cause deformation or corrosion of the front panel's plastic cover. Therefore, prior to installing the PL be sure to confirm the type of conditions that will be present in the PL's operating environment.*

2.2 Functional Specifications

2.2.1 General

CPU		AMD-K6 [®] -2 300MHz Processor	
DRAM (SDRAM DIMM)		64MB Standard (2 DIMM sockets: max. 128MB)	
BIOS		AWARD PC/AT Compatible	
Secondary Cache Memory		512Kbytes (built-in)	
Graphics		VGA (640 x 480 dots) VESA 16 colors/256 colors/16-bit color/32-bit color	
Video Memory		UMA (Unified memory architecture) type	
Touch Panel	Type	Resistive Film (Analog)	
	Resolution	1024 x 1024	
	Interface	COM4 : uses Mouse Emulator	
Interfaces	Serial	RS-232C (w/FIFO)	COM1 D-Sub 9 pin (male)
			COM2 D-Sub 9 pin (male)
			COM3 D-Sub 9 pin (male)
	Printer	Centronics Standard (ECP/EPP equivalent) D-sub 25 pin, female	
	Keyboard	PS/2 Interface (mini DIN 6 pin, female)	
	Mouse	PS/2 Interface (mini DIN 6 pin, female)	
	USB^{*1}	USB 1.0 Interface (side/front)	
	Network	IEEE802.3 10BASE-T , 100BASE-T X	
	RAS	RAS Interface (D-sub 25 pin, male)	
Disk I/F	FDD Unit	Front Access/ 2 modes/ 3.5 inch FD	
	E-IDE	Side-mount 2.5 inch HDD I/F PL-5900T : 2 slots PL-5901T : 1 slot Rear-mount Mirror Disk/CD-ROM (1 slot)	

**1 Since MS-DOS[®] and Windows[®]95 OSR2 do not support this function, this feature cannot be used if those OS types are installed in the PL.*

2.2.2 Display

Display Type	TFT Color LCD
Resolution	640 x 480 pixels
Dot Pitch	0.33 mm x 0.33 mm
Effective Display Area	W211.2 mm x H158.4 mm
Display Colors	32-bit color
Contrast Control	Not available
Backlight	CFL (User replaceable)
Backlight Lifetime	50,000 hours or longer at an ambient temperature of 25°C. (Until the backlight's brightness dims to half of the original level.)



When it is time to change the backlight, please contact your local PL distributor.



7.2 Replacing the Backlight.

2.2.3 Expansion Slots

■PL5900T

	Board Size		Slot Pitch	Board Thickness
	PCI	ISA		
1 st slot	180 x 122 mm	180 x 122 mm	-	Less than 13 mm
2 nd slot	210 x 122 mm	180 x 122 mm	25 mm	Less than 18 mm
3 rd slot	None	210 x 122 mm	20 mm	Less than 13 mm
Power Supply	5V: 3A -5V: 0.1A	12V: 0.6A -12V: 0.1A (total for 3 slots)		

■PL5901T

	Board Size		Slot Pitch	Board Thickness
	PCI	ISA		
1 st slot	180 x 122 mm	210 x 122 mm	-	Less than 13 mm
Power Supply	5V: 1A -5V: 0.1A	12V: 0.5A -12V: 0.1A		



For the 1st and 2nd slots either a PCI or an ISA type expansion board can be used.

2.2.4 Clock (RTC) Accuracy

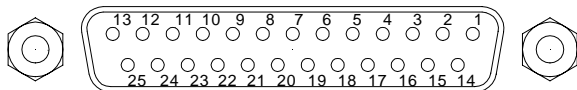
Clock(RTC) accuracy	± 180 seconds per month
---------------------	---

The PL unit's built-in clock (RTC) has a slight error. At the PL's specified ambient temperature and with the power turned OFF the error is ± 180 seconds per month. However, ambient temperature fluctuations and the age of the unit may increase this error to ± 300 seconds per month. If the PL unit's RTC clock accuracy is vital to system performance, regular adjustment of this clock is required.

2.3 Interface Specifications

2.3.1 Printer Interface (LPT1)

D-sub 25 Pin (Female)



- O.D.: Open Drain
- T.S.: 3-state Input
- TTLIN: TTL Input

Screw Size: (4-40UNC): Inch Type

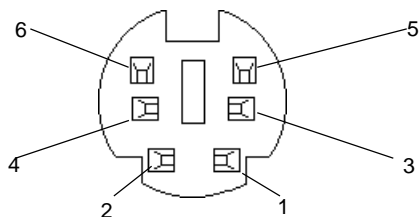
Pin No.	SPP/ECP Mode Signal Name	EPP Mode Signal Name	Direction	Electrical Specif.	Pin No.	SPP/ECP Mode Signal Name	EPP Mode Signal Name	Direction	Electrical Specif.
1*1	STRB	WRITE	In/Output	O.D/T.S	14*1	AUTOFD	DSTRB	In/Output	O.D/T.S
2	DATA0	DATA0	In/Output	T.S	15	ERROR	ERROR	Input	TTL
3	DATA1	DATA1	In/Output	T.S	16*1	INIT	INIT	In/Output	O.D/T.S
4	DATA2	DATA2	In/Output	T.S	17*1	SLCTIN	ADSTRB	In/Output	O.D/T.S
5	DATA3	DATA3	In/Output	T.S	18	GND	GND		
6	DATA4	DATA4	In/Output	T.S	19	GND	GND		
7	DATA5	DATA5	In/Output	T.S	20	GND	GND		
8	DATA6	DATA6	In/Output	T.S	21	GND	GND		
9	DATA7	DATA7	In/Output	T.S	22	GND	GND		
10	ACKNLG	ACKNLG	Input	TTL	23	GND	GND		
11	BUSY	WAIT	Input	TTL	24	GND	GND		
12	PE	PE	Input	TTL	25	GND	GND		
13	SLCT	SLCT	Input	TTL					

*1 When using the printer interface in SPP mode, pins 1, 14, 16 and 17 become O.D.
When using ESC or EPP modes, these pins will change to T.S.

2.3.2 Keyboard Interface

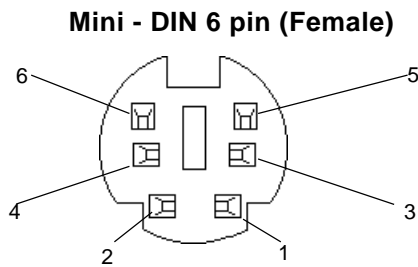
Mini - DIN 6 pin (Female)

(Both front and side)



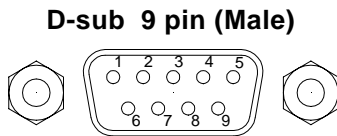
Pin No.	Signal Name
1	KEY DATA
2	NC
3	GND
4	+5V
5	KEY CLK
6	NC
SHIELD	GND

2.3.3 Mouse Interface



Pin No.	Signal Name
1	Mouse DATA
2	NC
3	GND
4	+5V
5	Mouse CLK
6	NC
SHIELD	GND

2.3.4 RS-232C Interface (COM1/COM2/COM3)



Screw Size: (4-40UNC): Inch Type

Pin No.	Signal Name	Pin No.	Signal Name
1	CD	6	DSR
2	RXD	7	RTS
3	TXD	8	CTS
4	DTR	9	RI/5V
5	GND		



The GND terminal is the signal ground. Be sure to connect it with the cable's opposite side SG terminal.

No. 9 pin (RI/5V) is used by COM2 and COM3 only. If COM1 is used, the pin becomes RI. The changeover from RI to 5V is set via the PL side face slide switch.

Reference 2.4 PL Part Names and Features

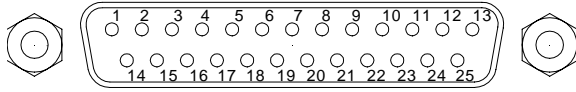


Be sure to confirm what settings will be used by the other device and set the dip switches accordingly. Failure to do so can result in a unit malfunction or damage.

Whenever changing the PL dip switches, be sure to first turn the PL's power supply OFF. Failure to do so can cause a PL malfunction.

2.3.5 RAS Interface

D-Sub 25 pin (Male)



Screw Size: (4-40UNC): Inch Type

Pin No.	Signal Name	Pin No.	Signal Name
1	GND	14	GND
2	+5V	15	+5V
3	+12V	16	NC
4	NC	17	NC
5	RESET INPUT (+)	18	NC
6	DIN 0 (+)	19	NC
7	DOUT (-)	20	NC
8	DOUT (+)	21	LAMP OUT (-)
9	ALARM OUT (-)	22	LAMP OUT (+)
10	ALARM OUT (+)	23	NC
11	RESET INPUT (-)	24	DIN1 (-)
12	DIN 0 (-)	25	NC
13	DIN 1 (+)		

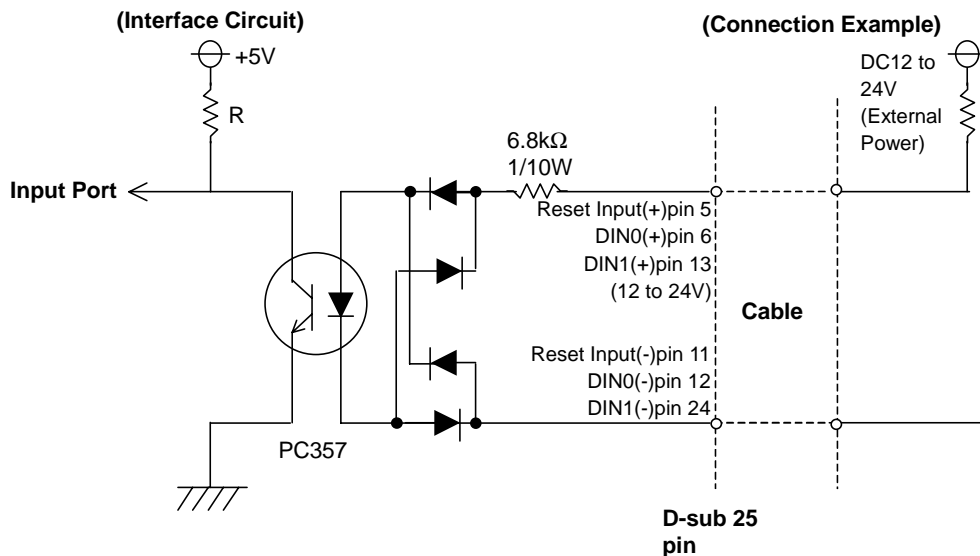


For detailed RAS Feature information,

Reference Appendix 2 RAS Feature.

■ External Input Signal (Used for both DIN and Remote Set Input)

- External Power : DC12V to DC24V
- Input Hold : Hold Diode
- Isolation : Used (Photo isolation)



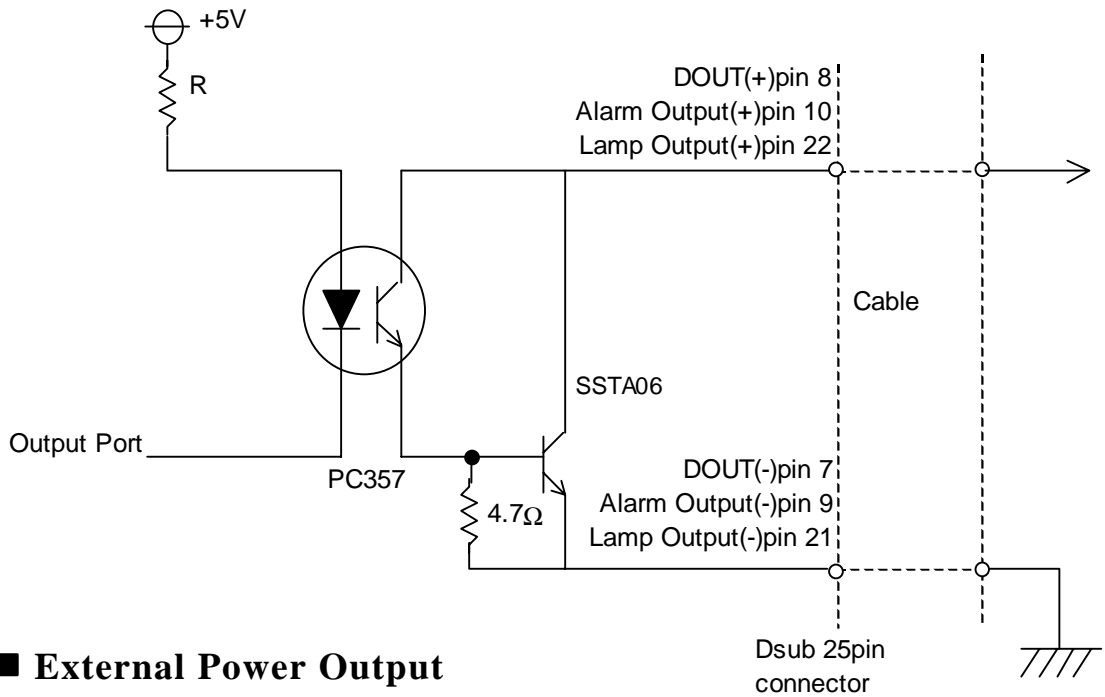
The power supply used for sink/source type input can use either polar or non-polar connection.

■ External Output Signal (DOOUT, Alarm Output, Lamp Output Port)

- Output Specification : DC24V 100mA (MAX)
- Isolation : Used (Photo isolation)

(Interface Circuit)

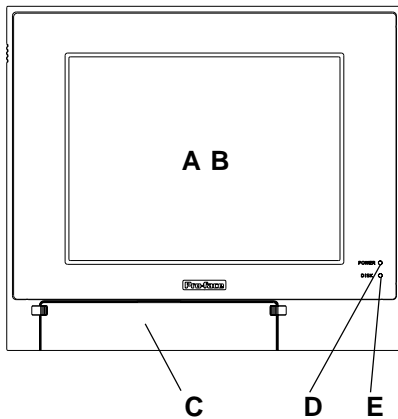
(Connection Example)



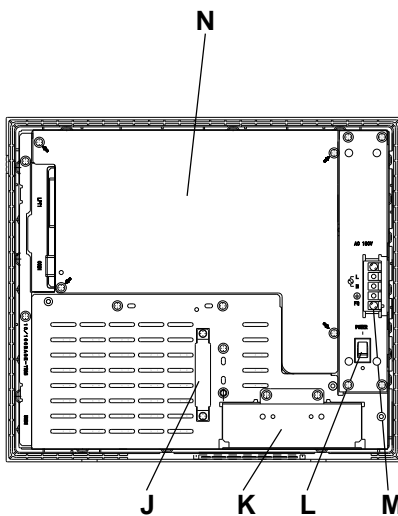
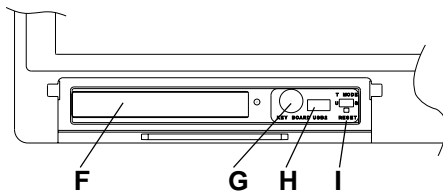
■ External Power Output

- +5V :100mA (MAX)
- +12V :100mA (MAX)

2.4 PL Part Names and Features



<Inside the front maintenance cover>



A: Display

Display output area. The built-in VGA controller supports PC compatible architecture.

B: Touch Panel

This high-resolution analog touch panel allows you to configure a keyboard-less system.

C: Front Maintenance Cover

Open this cover to access the Keyboard I/F, Reset Switch and connect the optional FDD unit.

D: Power Lamp LED

The status of the lamp changes according to the alarm type detected by the RAS feature.

Reference 2-3-5 RAS Interface

E: Hard Disk Access LED (DISK)

The LED lights during accesses to the hard disk/flash file disk.

F: FDD Front Face Blank Panel

Remove this cover to install the optional FDD Unit.

G: Keyboard Connector

A PS/2 compatible keyboard is connected here.

H: USB Connector (USB2)

To use the USB connector, you must install Windows 98 (SR2).

I: Hardware Reset Switch

J: IDE I/F Cover

To connect the optional CD-ROM drive unit (PL-DK200), the Mirror Disk Unit(PL-MD200-HU01), or RS-232C/RS-485 Adapter remove this cover and use this connector.

K: FDD Rear Face Blank Panel

Remove this cover to install the optional FDD Unit.

L: Power Switch

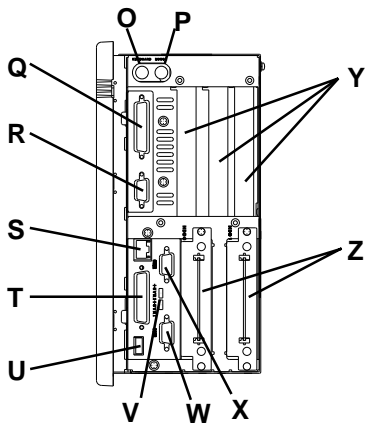
Turns the PL's power ON or OFF.

M: Power Terminals

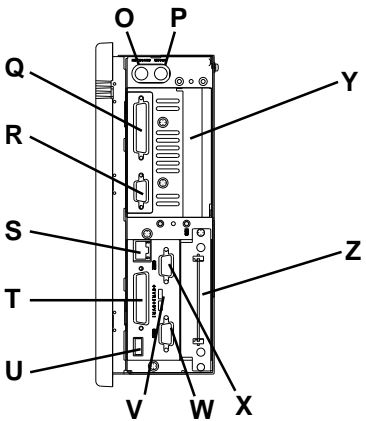
The PL's AC100V/DC24V power cord terminals are connected here.

N: Rear Maintenance Cover

Remove this cover to install the optional DIM module, or an expansion board.



PL-5900T



PL-5901T

O: Keyboard Connector

A PS/2 compatible keyboard can be connected here.

P: Mouse Connector

A PS/2 compatible mouse can be connected here.

Q: Printer Connector (LPT1)

Centronics standard interface (D-sub 25 pin female connector), which connects a parallel device, such as a printer (supports ECP/EPP).

R: RS-232C Connector (COM1)

S: Ethernet Connector (10BASE-T, 100BASE-TX)

IEEE802.3 standard Ethernet interface.

T: RAS Connector

Interface for DIN, DOUT, Watchdog, and Remote Reset. (D-sub 25 pin male connector)

U: USB Connector (USB1)

To use the USB connector, you must install Windows 98 (SR2).

V: Signal Changeover Slide Switch (+5RI)

This switch changes the COM2/COM 9-pin current from RI to 5V.

W: RS-232C Connector (COM2)

X: RS-232C Connector (COM3)

Y: Expansion Slot(s)

Z: HDD/FFD Expansion Unit Slot

Houses an additional HDD unit, or FFD unit.



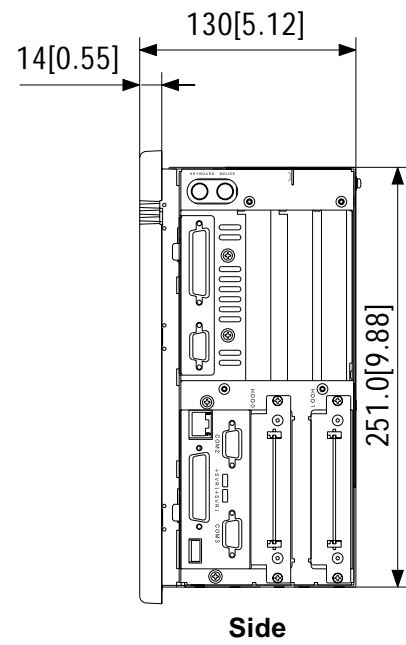
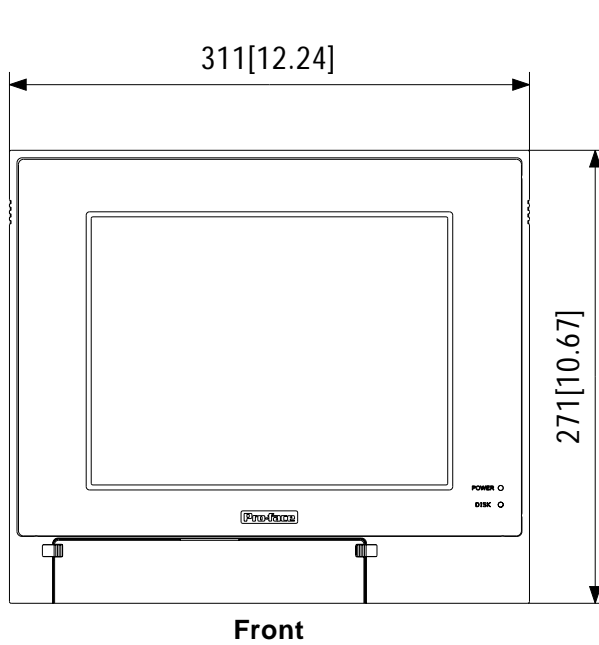
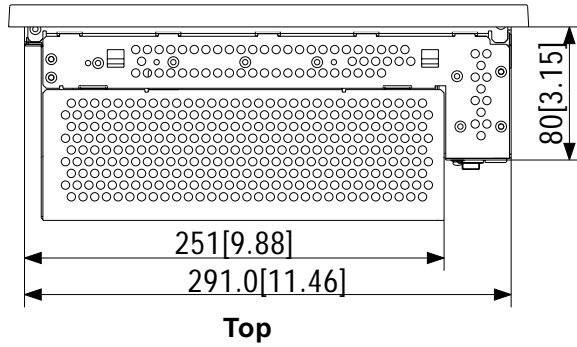
- **When attaching peripheral units to the PL, be sure the PL's power cord is disconnected from the main power supply.**
- **To avoid an electrical shock, be sure to disconnect the PL's power cord from the power supply before connecting the cord's power terminals or any peripheral devices to the PL.**

Reference 4.3.1 Connecting the Power Cord

2.5 External Dimensions

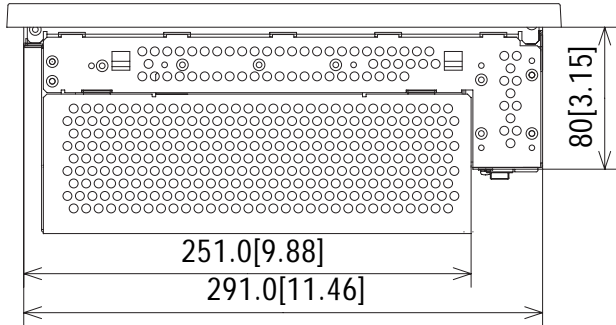
2.5.1 PL-5900T External Dimensions

(Unit: mm [in.] - excluding projections)

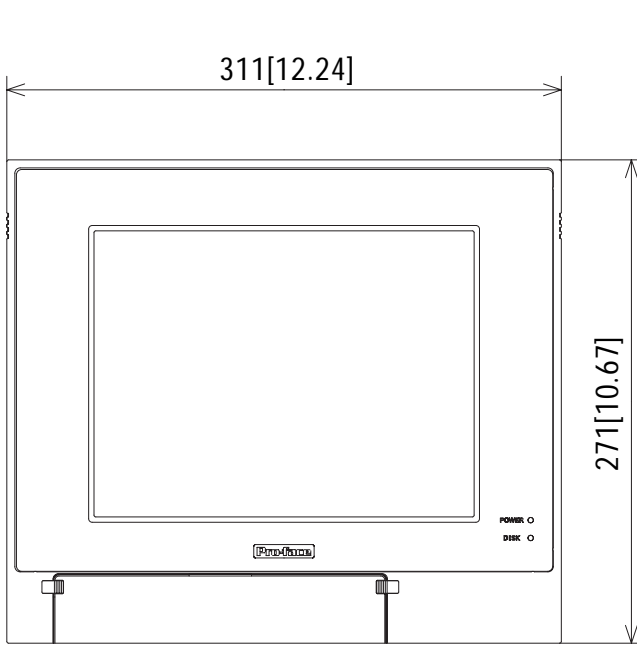


2.5.2 PL-5900T with PL-FD500 External Dimensions

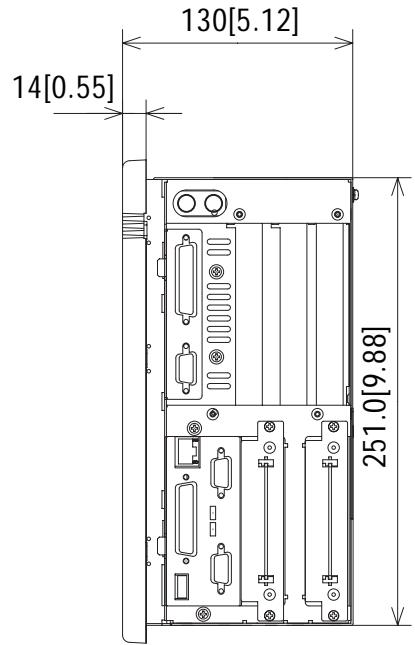
(Unit: mm [in.] - excluding projections)



Top



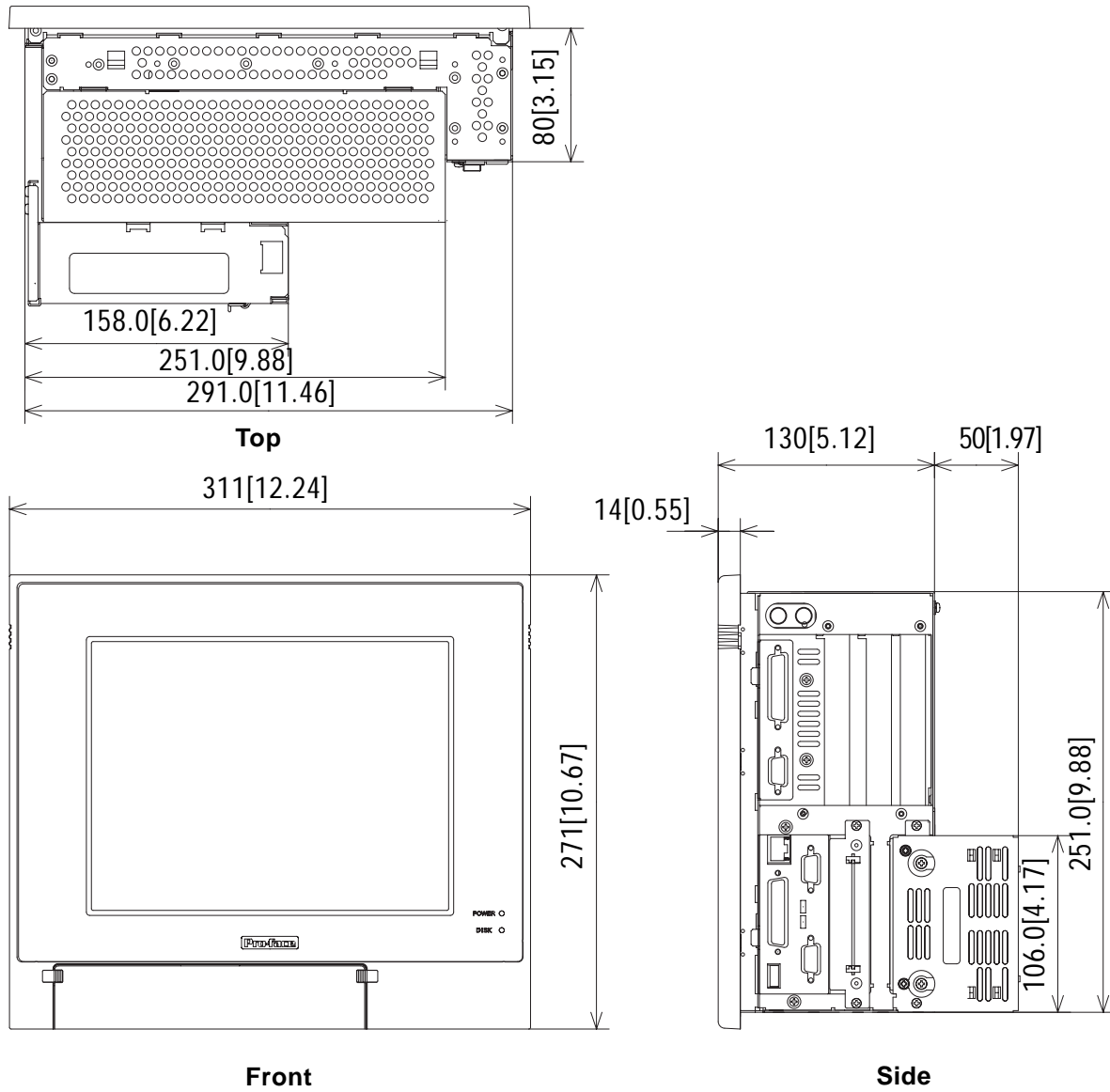
Front



Side

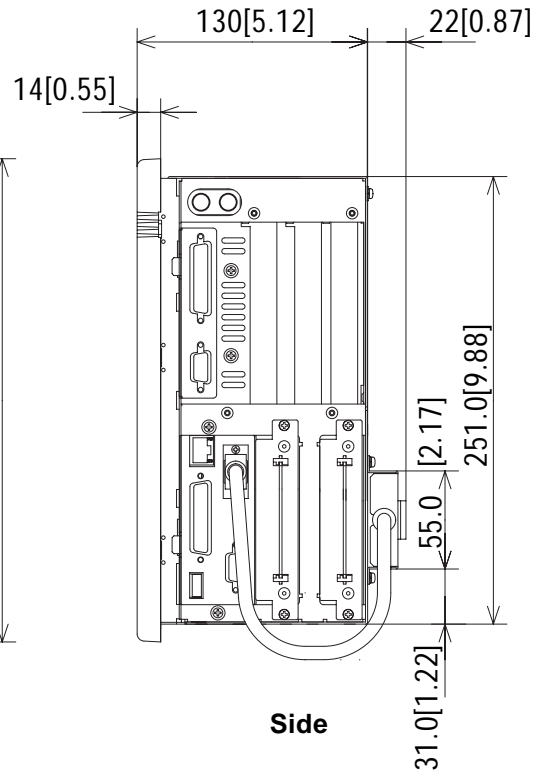
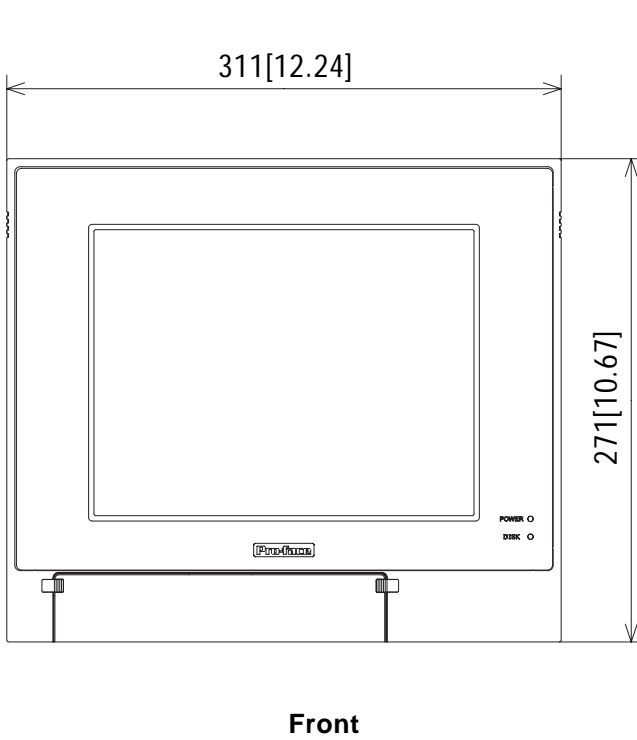
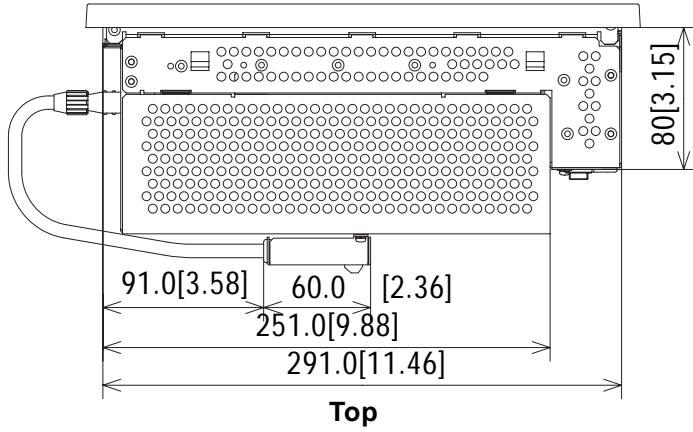
2.5.3 PL-5900T with Mirror Disk Unit External Dimensions

(Unit: mm [in.] - excluding projections)



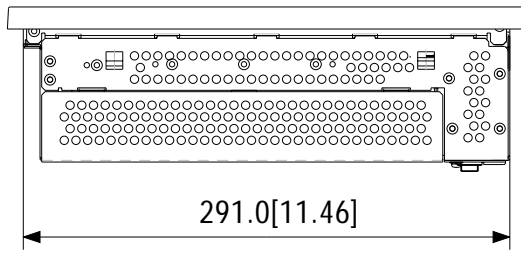
2.5.4 PL-5900T with PL-RC500 External Dimensions

(Unit: mm [in.] - excluding projections)

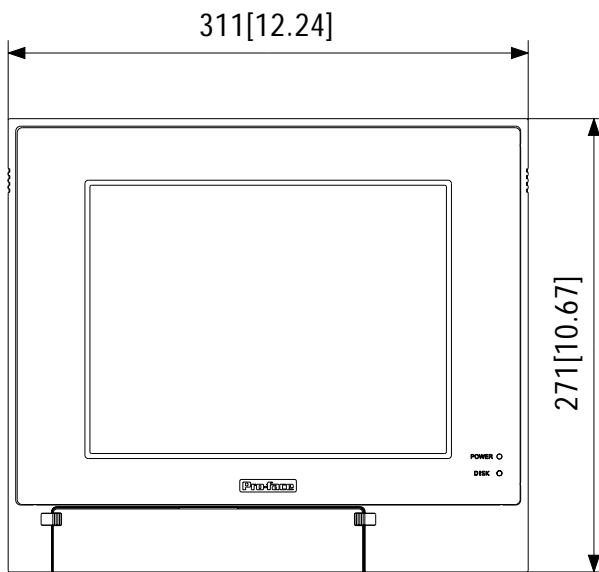


2.5.5 PL-5901T External Dimensions

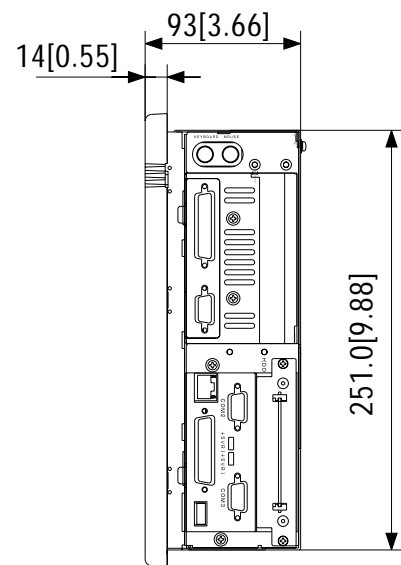
(Unit: mm [in.] - excluding projections)



Top



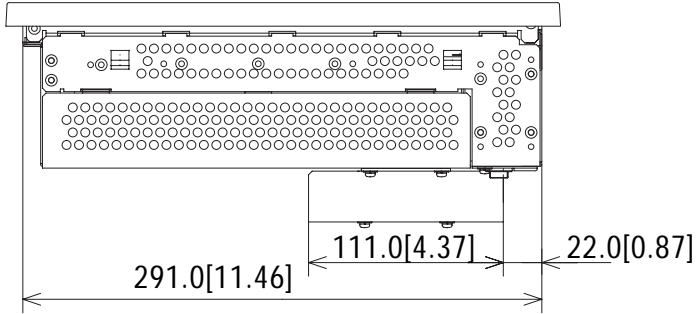
Front



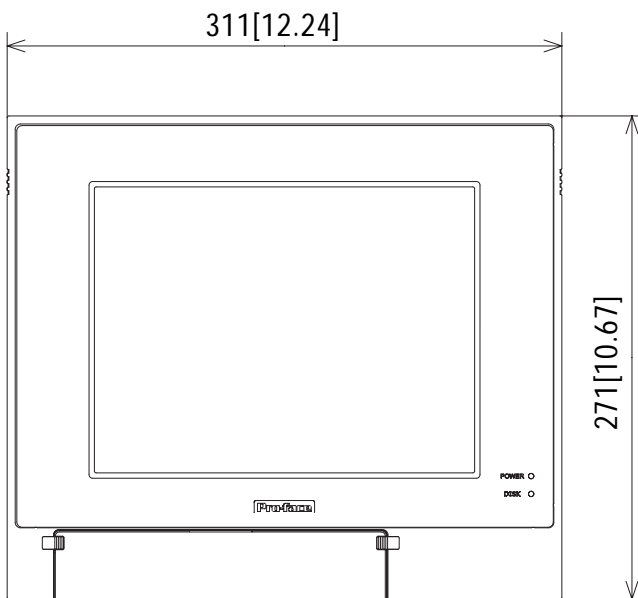
Side

2.5.6 PL-5901T with PL-FD500 External Dimensions

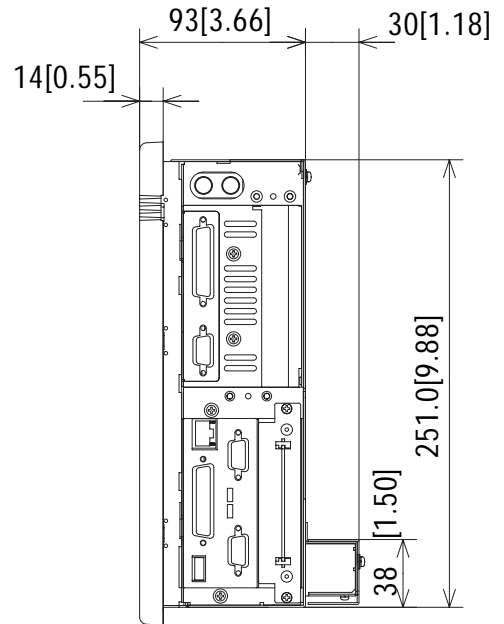
(Unit: mm [in.] - excluding projections)



Top



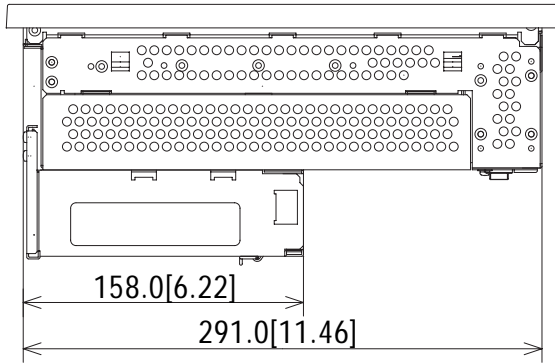
Front



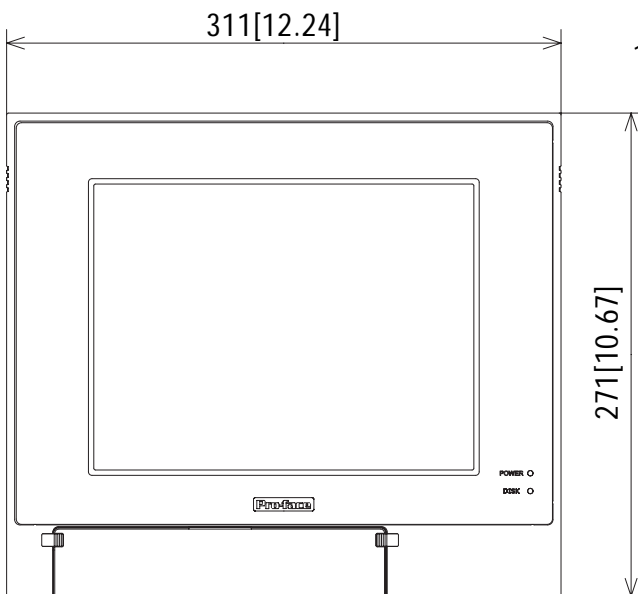
Side

2.5.7 PL-5901T with Mirror Disk Unit External Dimensions

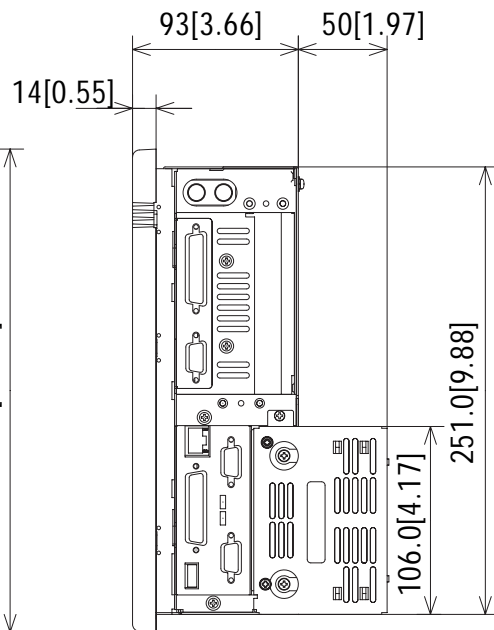
(Unit: mm [in.] - excluding projections)



Top



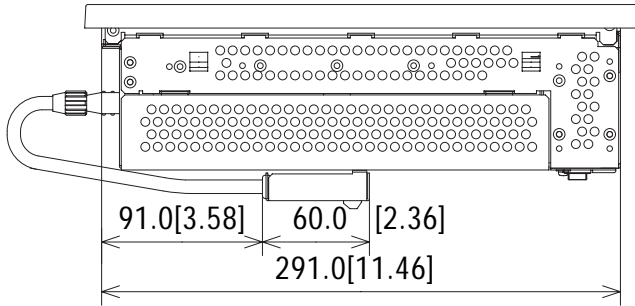
Front



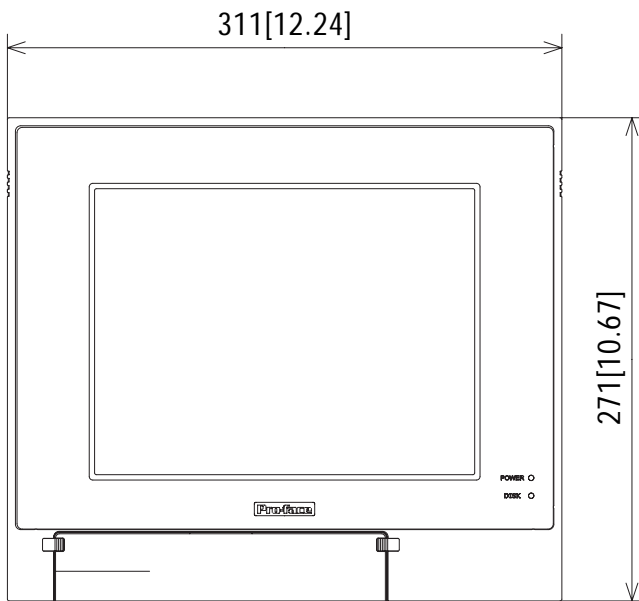
Side

2.5.8 PL-5901T with PL-RC500 External Dimensions

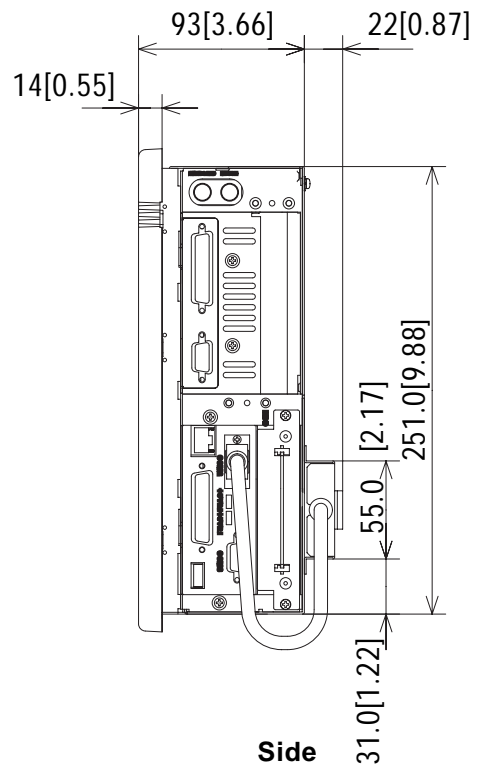
(Unit: mm [in.] - excluding projections)



Top



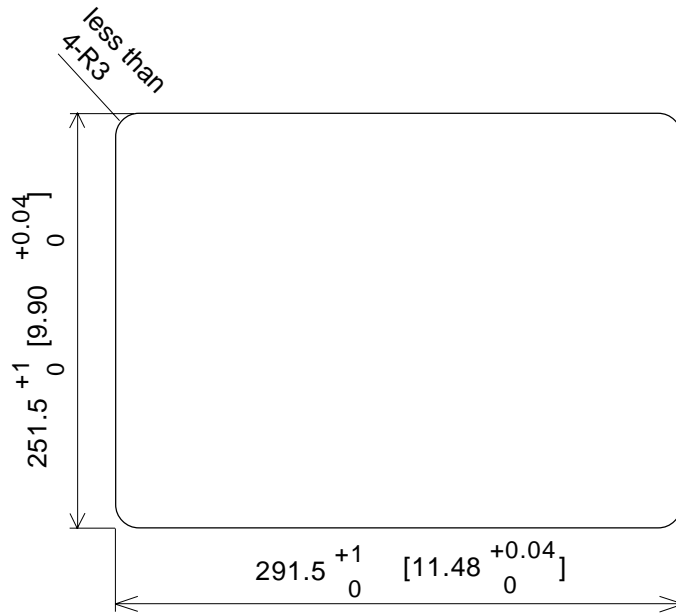
Front



Side

2.5.9 Panel Cut Dimensions

(Unit: mm [in.])



- **Be sure the thickness of the panel is from 1.6 to 10 mm.**
- **All panel surfaces used should be strengthened. Especially, if high levels of vibration are expected and the PL's installation surface (i.e. an operation panel's door, etc.) can move (i.e. open or close) due consideration should be given to the PL's weight.**
- **To insure that the PL's moisture resistance is maintained, be sure to install the PL into a panel that is flat and free of scratches or dents.**
- **Be sure all installation tolerances are maintained to prevent the unit from falling out of its installation panel.**

Chapter

3 Installing Optional Units and Expansion Boards

A wide variety of optional units and expansion boards made by Digital can be installed in the PL, as well as a number of commercially available PCI-bus or ISA-bus compatible boards. This chapter describes how to install these products in the PL.

3.1 Installation

The following explanation pages describe the installation procedures for the PL's DIM module, FDD unit, HDD unit, expansion boards, and CD-ROM drive unit.

Reference For information about the installation of other option units, please refer to those unit's individual *[Installation Guide]*.

WARNING

To prevent an electric shock or PL damage, confirm that the PL unit's power has been turned OFF before installing any optional units or expansion boards.



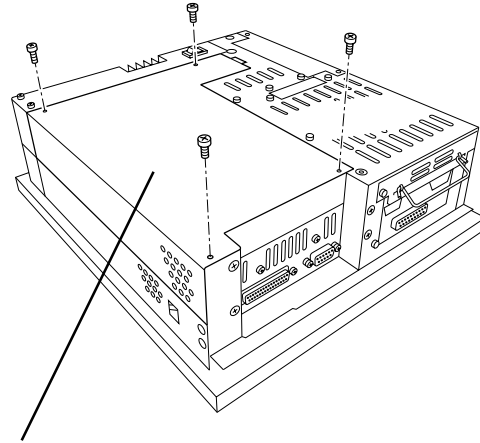
- **Use a screwdriver to loosen or tighten the screws. Be careful not to tighten screws too tightly, since it may damage the equipment.**
- **Be careful when removing or inserting any screws that they do not fall inside the PL.**

3.1.1 Removing the Rear Maintenance Cover



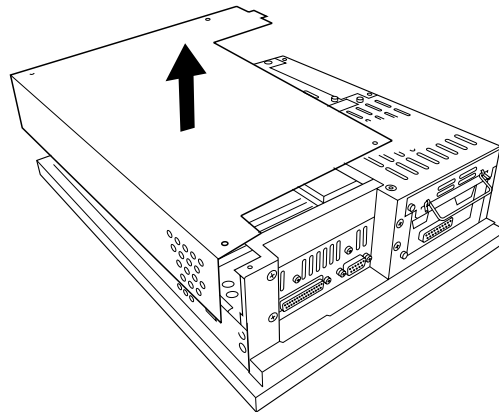
Be sure to handle the rear maintenance cover carefully, since it is made of aluminum and is easily bent.

- 1) Unscrew the four (4) attachment screws used to hold the rear maintenance cover and half cover.



**Rear Maintenance
Cover**

- 2) Remove the rear maintenance cover by lifting the cover in the direction shown.



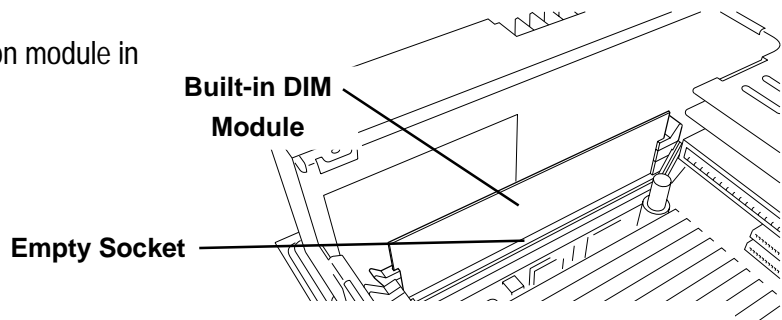
3.1.2 Installing the DIM Module



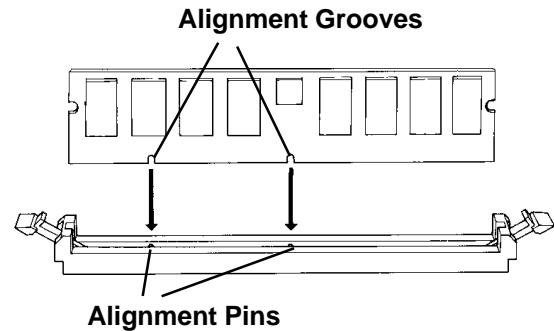
Since DIM module sockets are fragile and break easily, be sure to install the DIM module carefully.

The PL comes with a single DIM module pre-installed. There is one more empty socket that can be used to expand your PL unit's memory. Use the following procedure to install a second DIM module in that socket.

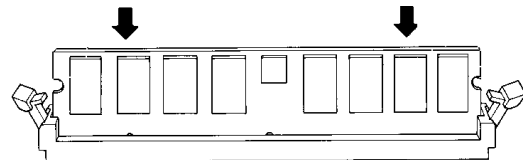
- 1) Install the DIM expansion module in the empty socket.



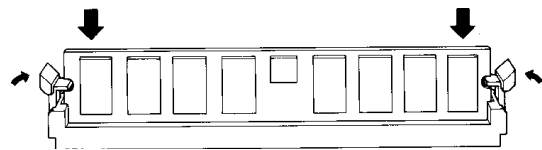
- 2) Position the Alignment Grooves so that they fit the Alignment Pins.



- 3) Insert the DIM module into the DIM module socket.



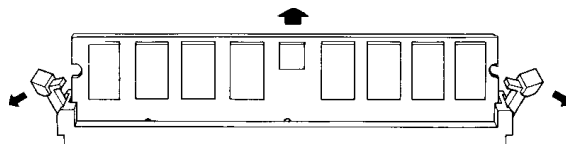
- 4) Push the DIM module down until the ejector tabs lock.



- 5) Replace the rear maintenance cover and the half cover and secure them in place with their attachment screws.

◆ To Remove the DIM Module

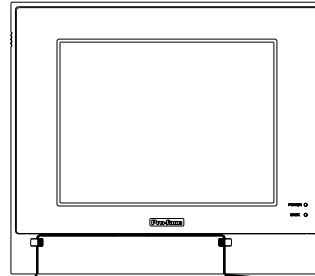
To remove a module, press down on the socket's ejector tabs to release the module.



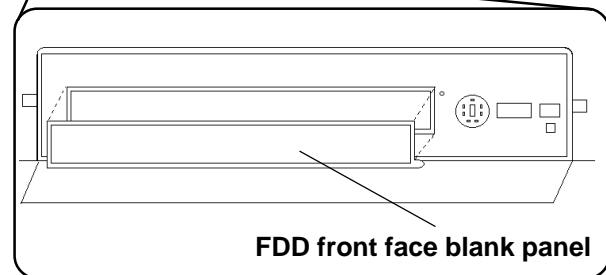
3.1.3 Installing the FDD Unit

The attachment procedures for the PL-5900T and the PL-5901T are different. The following steps, up to 3), are the same. After that, refer to your unit's specific instructions.

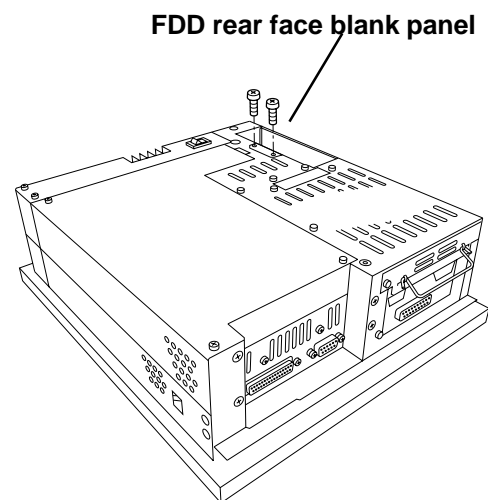
- 1) Open the front maintenance cover and remove the FDD front face blank panel.



- 2) Close the front maintenance cover.

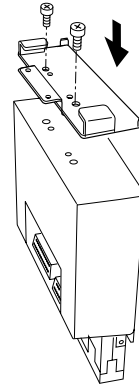


- 3) Remove the two (2) attachment screws from the FDD rear face blank panel and remove the cover.

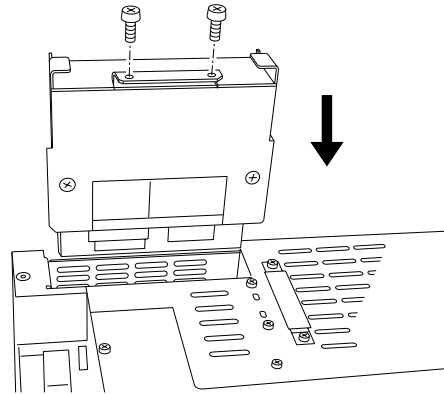


■ PL-5900T (3-Slot model)

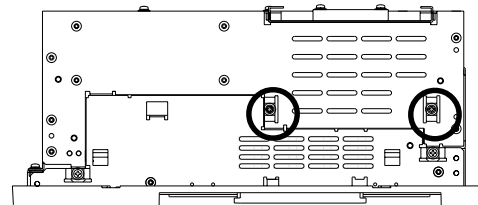
- 4) Attach the FDD rear face blank panel removed in step 3 to the FDD unit and secure it with the two (2) attachment screws. (Do not use the bracket that comes with the FDD Unit.)



- 5) Insert the FDD unit so that the PL and FDD unit connectors are securely connected.

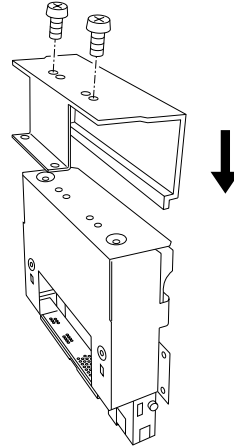


- 6) Secure the FDD unit to the PL using all four attachment screws. (Two (2) FDD unit and two (2) PL bottom face screws)

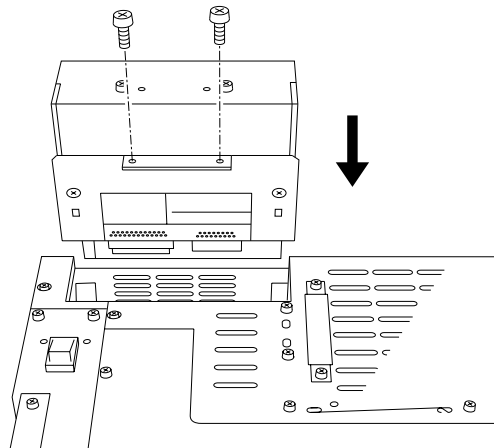


■ PL-5901T (1-Slot model)

- 4) Attach the bracket that comes with the FDD unit and secure it with the two (2) attachment screws. (Do not use the FDD rear blank panel removed in step 3.)



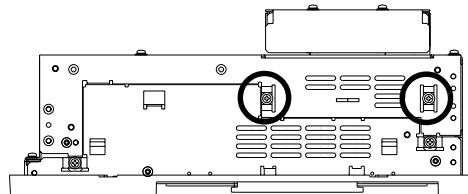
- 5) Insert the FDD unit so that the PL and FDD unit connectors are securely connected.



- 6) Secure the FDD unit to the PL using all four attachment screws. (Two (2) FDD unit and two (2) PL bottom face screws)



Note: As this drawing shows, even when the FDD unit is inserted completely, it will protrude slightly from the back of the PL.



3.1.4 Removing/ Installing the HDD Unit

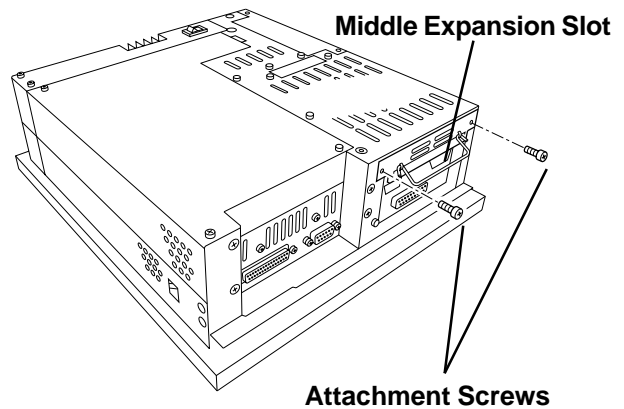


Note: The following insertion/removal procedure is the same for the FFD unit.

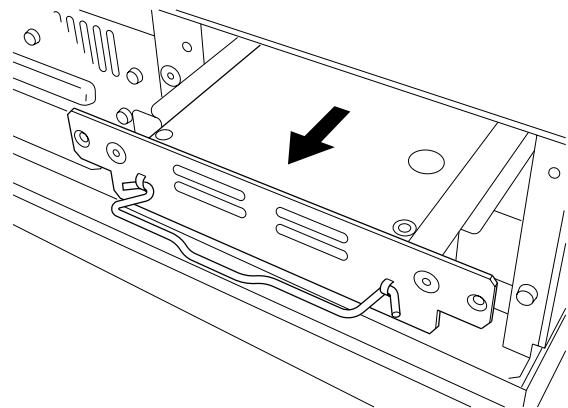


Since the HDD unit is a precision instrument, be sure not to subject it to excessive vibration or sudden shocks.

- 1) Remove the two (2) attachment screws from the Expansion Slot Cover. (Middle cover on the PL-5900)



- 2) Grasp the HDD unit's handle and pull the unit slowly out of the PL. Be sure you do not damage the unit.



- 3) Insert the new HDD unit into the PL's guideways and push it in until its rear connector is securely connected.

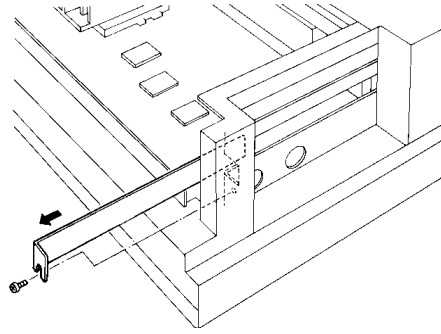
- 4) Secure the unit in place with its two(2) attachment screws.

3.1.5 Installing an Expansion Board

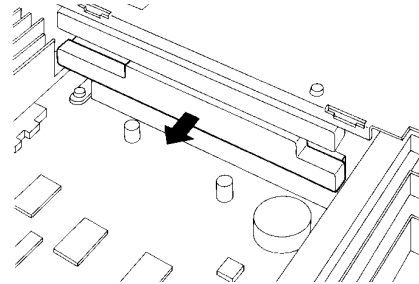
- 1) Unscrew the desired expansion slot's cover attachment screw, and remove the cover.

Reference 3.1.1, *Removing the Rear Maintenance Cover*

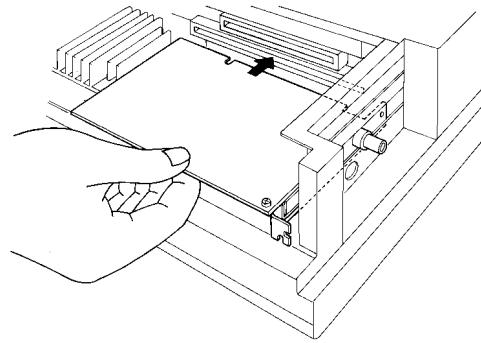
Unscrew the Blank Panel's attachment screw to remove the Blank Panel.



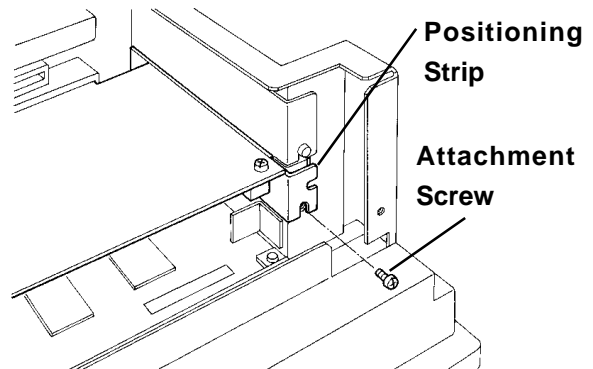
- 2) Remove the expansion slot's duster cover.



- 3) Insert the expansion board into the expansion slot.



- 4) Secure the expansion board's metal positioning strip in place with its attachment screw.



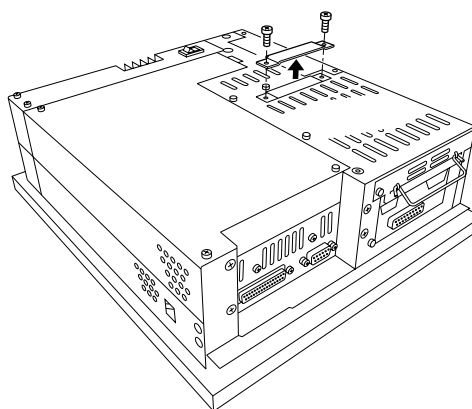
- 5) Last, replace the rear maintenance cover and half cover and secure them in place with their attachment screws.

3.1.6 Connecting the CD-ROM Unit

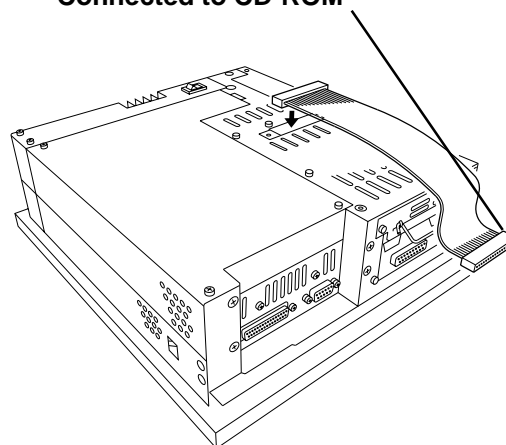
- 1) Unscrew the two (2) IDE I/F cover attachment screws, and remove the cover.
- 2) Connect the CD-ROM unit cable to the PL's IDF I/F connector.



Be sure that the cable is securely connected before turning ON the PL's power switch.



Connected to CD-ROM



Memo

Chapter

4 Installation and Wiring

4-1 Installation Cautions

4-2 Installing the PL

4-3 Wiring the PL

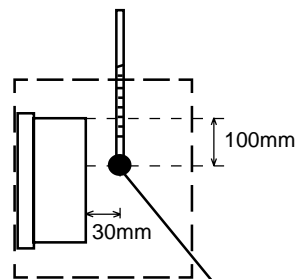
This chapter explains how to install and wire the PL-5900 series units, as well as the cautions required both before and during installation.

4.1 Installation Cautions

1) Temperature Cautions

The PL should be installed in a vertical position, and forced air cooling should be used, instead of natural air circulation.

Also, be sure to confirm that the area near the PL will be within the allowable temperature range by placing a temperature sensor in the location shown in the left-side drawing. If this area's temperature exceeds the allowed limit, a machine breakdown can occur.

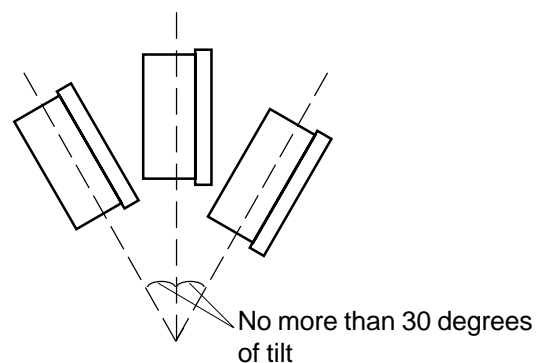
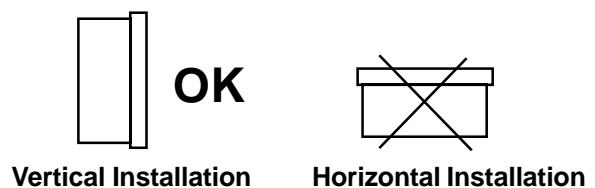


Temperature Sensor
0°C to 45°C (without HDD unit)
5°C to 45°C (with HDD unit)

2) Installation Cautions

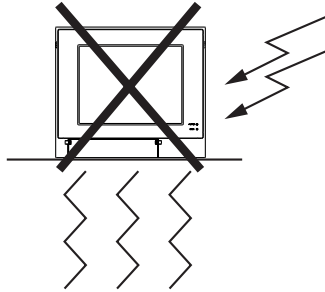
Be sure to install the panel in an upright (vertical) position.

Also, be sure that the panel's viewing angle is tilted no more than 30 degrees from parallel to the operator (i.e. directly in front).



■ Vibration and Shocks

If the PL is moved when its enclosure doors are open, or while it is installed in a rack equipped with caster wheels, the hard disk can receive excessive vibration or jolting. Be especially careful at this time.



PL Configuration	Can Withstand
HDD	Up to 4.9m/s ²
FDD	Up to 9.8m/s ²
No drives	Up to 19.6m/s ²



- ***The Hard Disk Drive is precision equipment and should not be moved or jolted . Especially when the PL is turned ON, even changing the PL's direction while it is on a table, or repositioning the unit should not be performed, since it can lead to a hard disk crash or malfunction.***
- ***When using a fan to cool the PL unit, be sure that the fan does not point directly at any of the PL's disk drive units, since it can lead to a hard disk crash or malfunction.***

4.2 Installing the PL

4.2.1 Installation Procedures

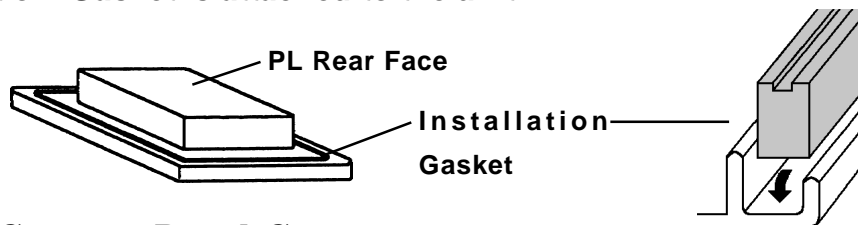
Follow the steps given below when installing the PL.

■ Attaching the Installation Gasket

Even if the your PL's Installation Gasket is not needed to prevent water from entering the unit, the gasket also acts as a vibration absorber and should always be attached. To install the gasket, place the PL face down on a soft surface and attach the gasket to the rear side of the display face, in the plastic bezel's groove (see picture below). Be sure the grooved face of the gasket is vertical.



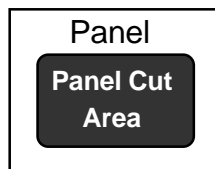
Before mounting the PL into a cabinet or panel, check that the Installation Gasket is attached to the unit.



■ Create a Panel Cut

Create a panel cut for the PL, like that pictured here. Two additional items, the installation gasket and the installation fasteners are also required when installing the PL.

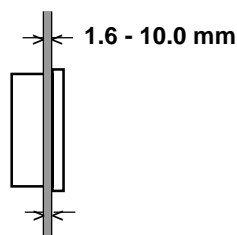
Reference 2.5 PL Dimensions



- To obtain the maximum degree of moisture resistance, be sure to attach the PL to a smooth, flat surface.
- The panel itself can be from 1.6 to 10.0 mm thick.



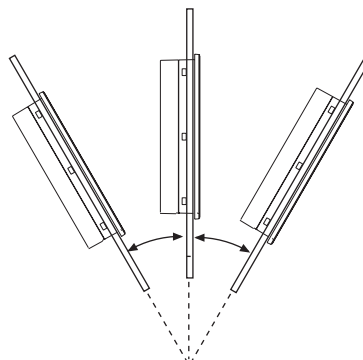
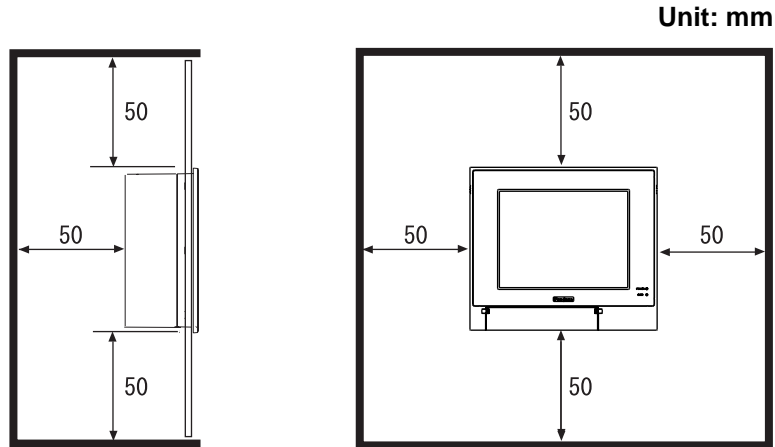
Strengthening may be required for the panel. Be sure to consider the weight of the PL when designing the panel.



Chapter 4 - Installation and Wiring



- To enhance the PL's maintainability, operability and ventilation, allow at least 50 mm clearance between the PL and any other objects. (The clearance must be large enough to allow you to insert or remove expansion boards and to attach connectors.)



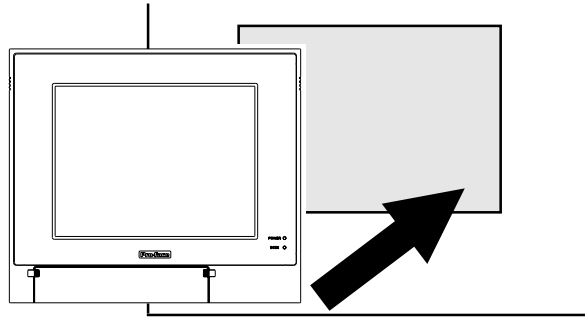
less than 30° from vertical



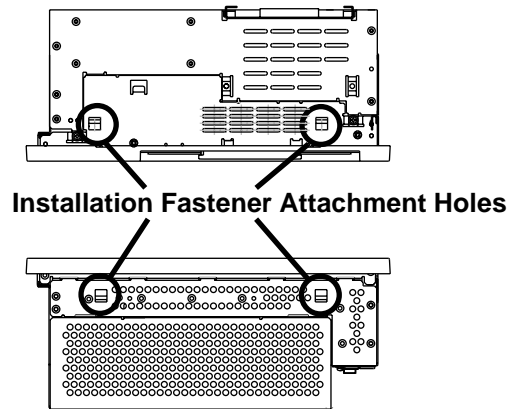
- Avoid using the PL where the ambient temperature will exceed 45°C.
- Avoid placing the PL next to other devices that might cause overheating.
- Be sure that the panel's viewing angle is tilted no more than 30 degrees from parallel to the operator (i.e. operator is directly in front).
- Keep the PL away from arc-generating devices such as magnetic switches and non-fuse breakers.
- Avoid using the PL in environments where corrosive gases are present.

■ **Installation**

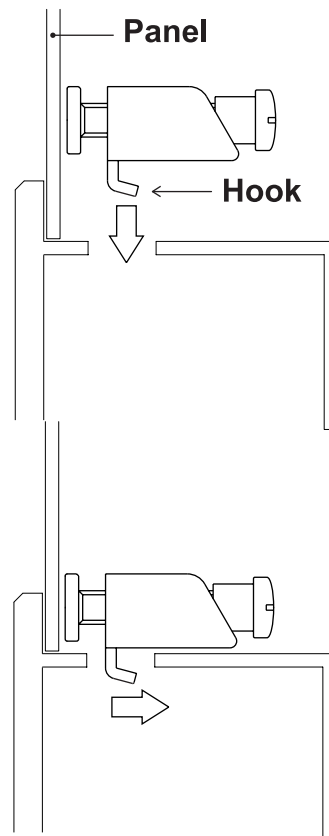
1) Insert the PL into the panel.



2) Insert the installation fastener hooks into the four (4) installation fastener holes on PL's top and bottom sides.



3) Slide the installation fasteners to the rear face.

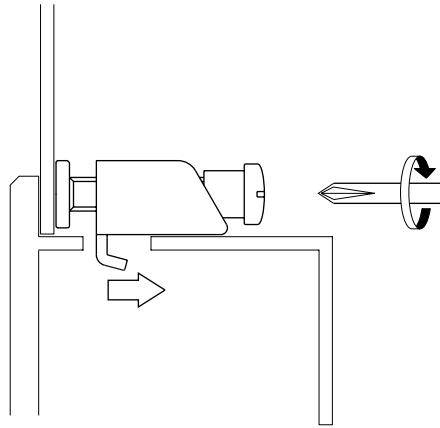


Chapter 4 - Installation and Wiring

- 4) Tighten the screws of the installation fasteners. Be sure to tighten the four screws in an even, crisscross pattern.



Do not use excessive force when tightening the main unit attachment screws. The torque required to render it waterproof is 0.5 N•m.

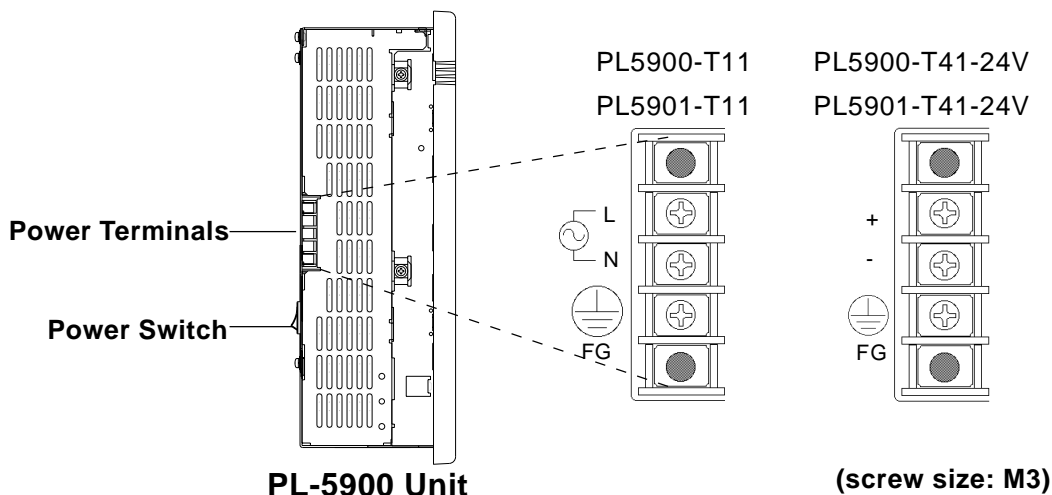


4.3 Wiring the PL

4.3.1 Connecting the Power Cord

Connect the PL's power cord to the PL's rear face power terminals.

(Side View)



+	Positive electrode
-	Negative electrode
FG	Grounding Terminal connected to the PL chassis.

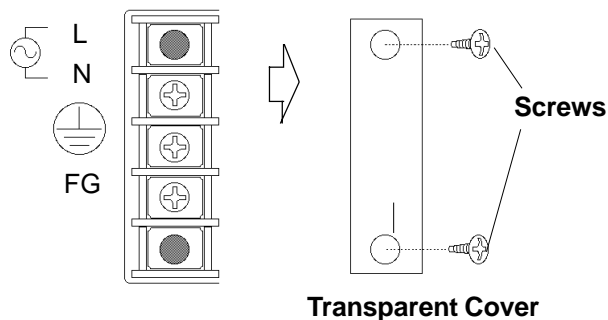
L	AC Input Live Line
N	AC Input Neutral Line
FG	Grounding Terminal connected to the PL chassis.

Use the following steps when connecting the power cord to the PL's power terminals.

⚠ WARNINGS

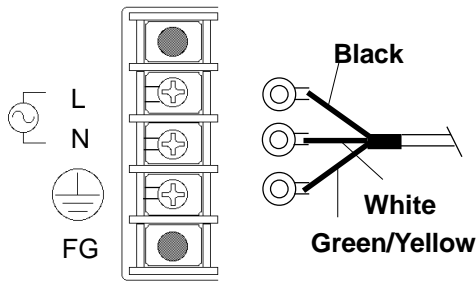
- To prevent an electric shock, be sure to turn the PL's power supply OFF before connecting the power cord terminals to the PL.
- To prevent fires, electrical hazards and equipment damage, be sure to use only the specified power supply voltage when operating the PL.

- 1) Confirm that the PL's power switch is turned OFF. Then, remove the power terminal's transparent plastic cover.



■ **PL5900-T11, PL5901-T11**

2) Loosen and remove the middle three screws from the terminal strip. Align the crimp terminals with each screw hole, and tighten the screws.

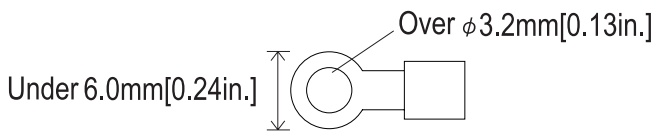


Crimp Terminal Types :



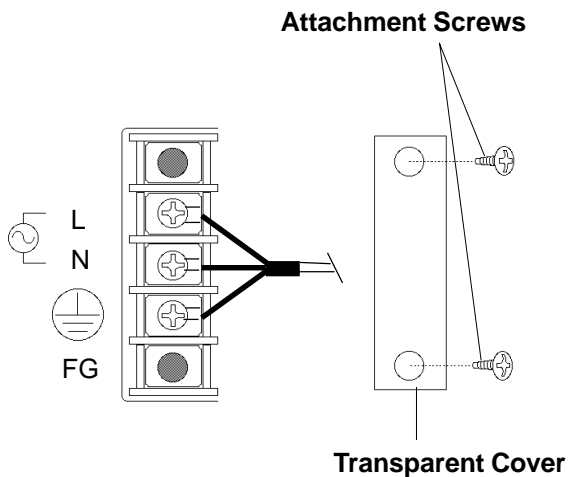
Note: V1.25-3, by J.S.T. or equivalent (JIS standard part number : RAV1.25-3)

- Crimp terminals must be the same as shown below.



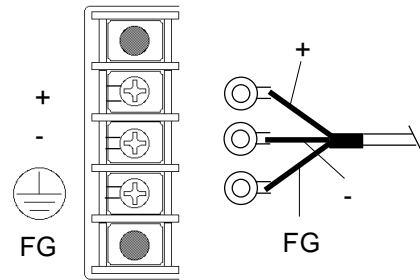
- **The colors used in these figures are for the cable which came with the PL.**
- **This power cable is designed only for AC100V/115V use. Any other power level should use its own specially designed cable.**

3) Reattach the terminal strip's transparent cover and secure it in place with its attachment screws.



■ PL5900-T41-24V, PL5901-T41-24V

- Loosen and remove the middle three screws from the terminal strip. Align the crimp terminals with each screw hole, and tighten the screws.

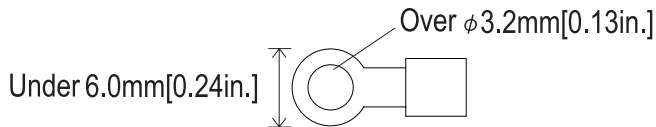


Crimp Terminal Types :

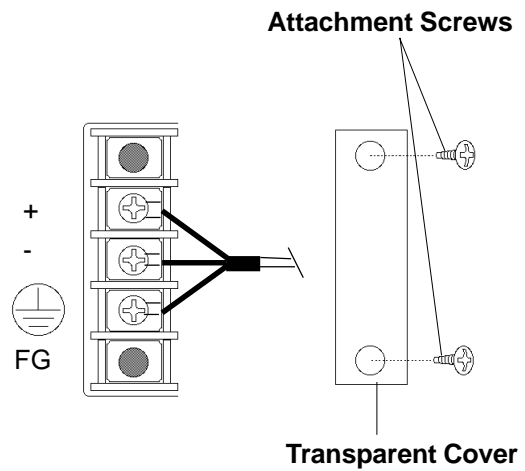


Note: V1.25-3, by J.S.T. or equivalent (JIS standard part number : RAV1.25-3)

- Crimp terminals must be the same as shown below.



- Reattach the terminal strip's transparent cover and secure it in place with its attachment screws.



4.3.2 Power Supply Cautions

When connecting the PL unit's AC power terminals, please be aware of the following:

- If voltage fluctuations are expected to vary beyond the specified range, connect a constant voltage transformer.

Reference 2-1 General Specifications

- Use a low-noise power supply both between the lines and between the PL and its ground. If there is still excess noise, connect an insulating transformer (noise-prevention type).



Note:

Be sure any constant or insulating transformer used has a capacity of 200VA or more.

- Wire the power cords of the PL, I/O devices, and power supply devices separately.

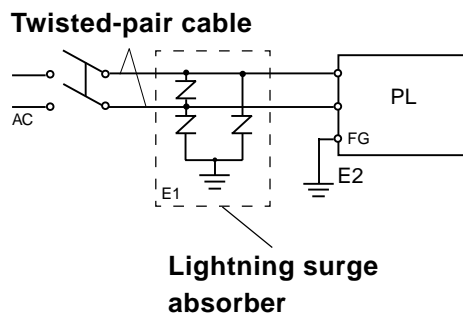
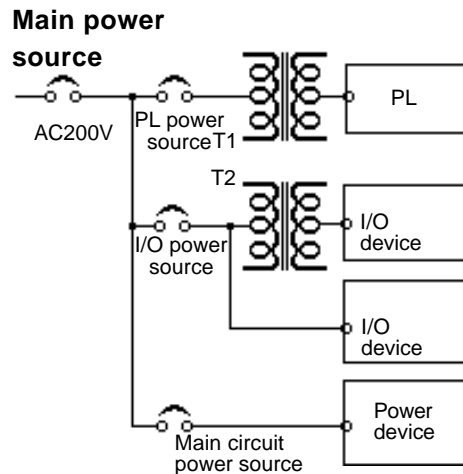
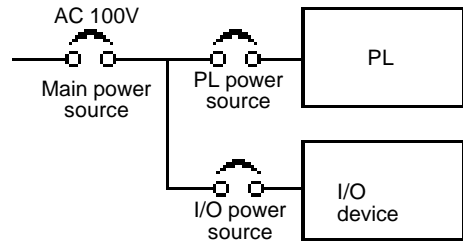
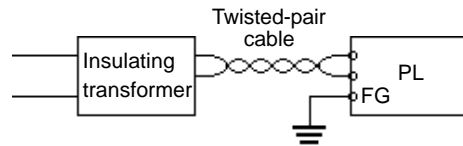
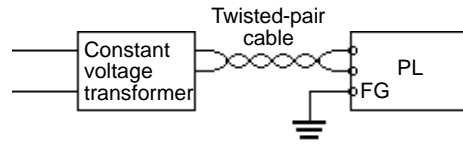
- Attaching a ferrite core to the power cord will improve noise immunity.
- Isolate the main circuit (high voltage, large current) line, I/O signal lines, and power cord, and do not bind or group them together.

- To prevent damage from lightning, connect a lightning surge absorber.



- **Ground the lightning surge absorber (E1) and the PL (E2) separately.**

- **Select a lightning surge absorber which will not exceed the allowable circuit voltage, even when the voltage rises to the maximum.**



4.3.3 Grounding Cautions

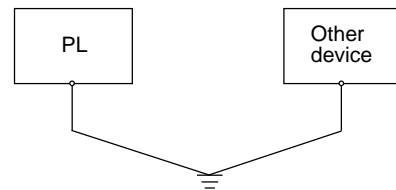
- Set up a dedicated ground when using the rear panel's FG terminal.

(a) Dedicated Ground - best *1

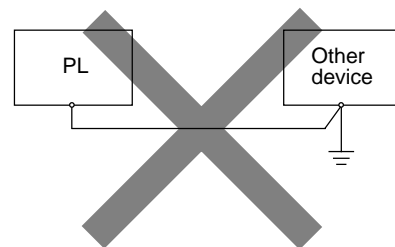


- If a dedicated ground is not possible, use a shared ground, as shown in figure (b).
- The grounding point must be as close to the PL as possible, and the grounding wires must be as short as possible. If the wires must be long, use thick, insulated wires and run them through conduits.

(b) Shared Ground - allowed *1



(c) Shared ground - not allowed



4.3.4 Cautions When Connecting I/O Signal Lines

- I/O signal lines must be wired separately from charged lines. If the power cord needs to be wired together with the (I/O) signal lines for any reason, use shielded lines and ground one end of the shield to the PL's FG terminal.
- To improve noise immunity, attaching a ferrite core to the power cord is recommended.

**1 Use a grounding resistance of less than 100Ω and a 2mm² or thicker wire, or your country's applicable standard. For details, contact your local PL distributor.*

Memo

Chapter

5 System Setup

5-1 Setup Procedures

5-2 System Parameters

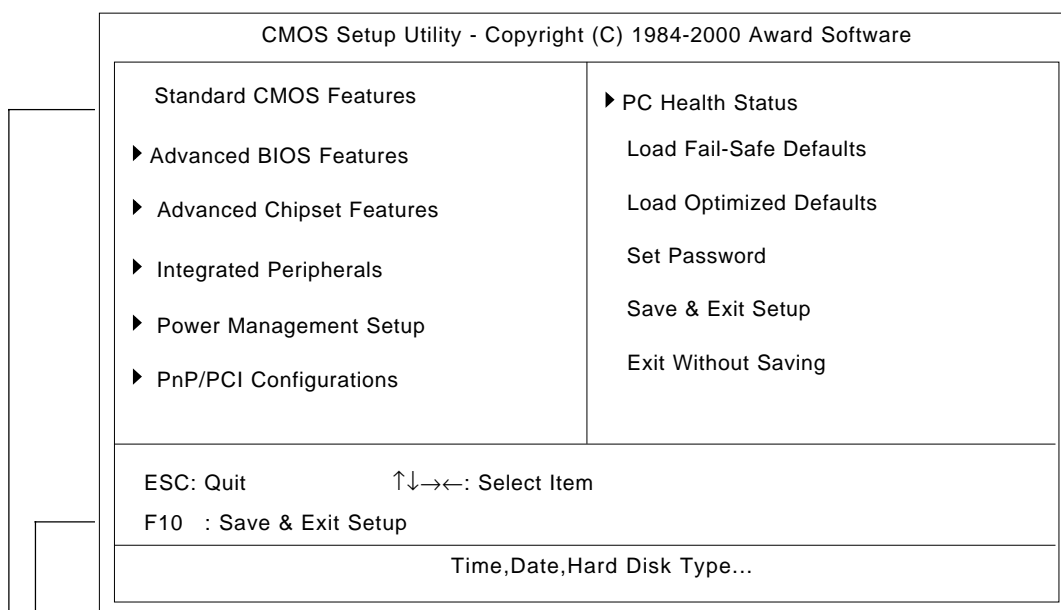
5.1 Setup Procedures

This chapter explains how to enter a PL unit's system settings, as well as the cautions required both before and during set up.



Note: The following settings are those pre-set at the factory.

- 1) Connect a PS/2 keyboard to the PL.
- 2) Turn the PL unit's power ON.
- 3) After the message "Press to Enter SETUP" appears, press the [DEL] key until the following screen is displayed.



KEYBOARD ACTION KEYS

A summary of the keyboard keys used to move through screens and make selections.

SYSTEM SETTING SELECTION AREA

Each of the titles (areas) listed refers to a system setting area.

- 4) Use the arrow keys to move the cursor to the desired selection and use the [Enter] key to select an item.

5.2 System Parameters

Use the menu screen to select a System Item, and then enter the desired system information. Each item's detailed settings are shown here.

5.2.1 STANDARD CMOS FEATURES

Select STANDARD CMOS FEATURES and the following screen will appear.

CMOS Setup Utility - Copyright (C) 1984-2000 Award Software		
Standard CMOS Features		
		Item Help
Date (mm:dd:yy):	Thu, Aug 24 2000	
Time (hh:mm:ss):	11 : 15 : 14	
▶ IDE Primary Master	Press Enter10056 MB	Menu Level ▶
▶ IDE Primary Slave	Press Enter None	Change the day, month, year and century
Drive A	1.44M, 3.5 in.	
Drive B	None	
Video	EGA/VGA	
Halt On	All, But Disk/Key	
Base Memory	640K	
Extended Memory	56320K	
Total Memory	57344K	
↑↓→←: Move Enter:Select +/-/PU/PD:Value F10:Save ESC:Exit F1:General Help F5:Previous Values F6:Fail-Safe Defaults F7:Optimized Defaults		

■ Date/Time

This data sets the PL's internal time and date.

Hours :00 - 23

Minutes :00 - 59

Seconds :00 - 59

■ IDE Primary Master/ IDE Primary Slave

This display shows the capacity of the PL's IDE hard disk drive. Press [Enter] to display the parameter setting menu.

Reference "5.2.2 IDE Primary Master/IDE Primary Slave"

■ Drive A/Drive B

This setting determines the format used by the PL's internal floppy disk drive.

The available settings are [360K - 5.25in], [1.2M - 5.25in], [720K - 3.5in], [1.44M - 3.5in.], [2.88M - 3.5in.] and [None].

The A: drive's [1.44M - 3.5in] and the B: drive is [None]. These selections are factory set and recommended for most users.

■ Video

The selections for the screen (video) mode. The [EGA/VGA] and is recommended for most users. The other available settings are [CGA40], [CGA80] and [Mono].

■ **Halt On**

Designates the type of processing that will be performed when an error occurs during the Initial Start-Up Self Test. The [All But Disk /Key] and is recommended for most users.

[All Errors] : Displays all errors and stops the unit.

[No Errors] : Displays all errors and does not stop the unit.

[All, But Keyboard]: Displays all errors, except for those related to the keyboard, and stops the unit. If the User has no keyboard connected, please use this setting.

[All, But Diskette]: Displays all errors, except for those related to the disk drive (FDD), and stops the unit.

[All, But Disk/Key]: Displays all errors, except for those related to the disk drive (FDD) and keyboard, and then stops the unit.

5.2.2 IDE Primary Master/IDE Primary Slave

Selecting IDE Primary Master or IDE Primary Slave from the Standard CMOS Features menu brings up the following screen.

CMOS Setup Utility - Copyright (C) 1984-2000 Award Software		
IDE Primary Master		
IDE HDD Auto-Detection	Press Enter	Item Help
IDE Primary Master	Auto	Menu Level ▶▶ To auto-detect the HDD's size, head...on this channel
Access Mode	Auto	
Capacity	10056 MB	
Cylinder	19485	
Head	16	
Precomp	0	
Landing Zone	19484	
Sector	63	
↑↓→←: Move Enter:Select +/-/PU/PD:Value F10:Save ESC:Exit F1:General Help F5:Previous Values F6:Fail-Safe Defaults F7:Optimized Defaults		

■ **IDE HDD Auto-Detection**

This setting enables auto-detection of the IDE hard disk drive.

■ **Access Mode**

This setting determines the access mode of the PL's IDE hard disk drive. The available settings are [CHS], [LBA], [Large], and [Auto]. The factory default setting is [Auto] and is recommended for most users.

■ **IDE Primary Master (Slave)**

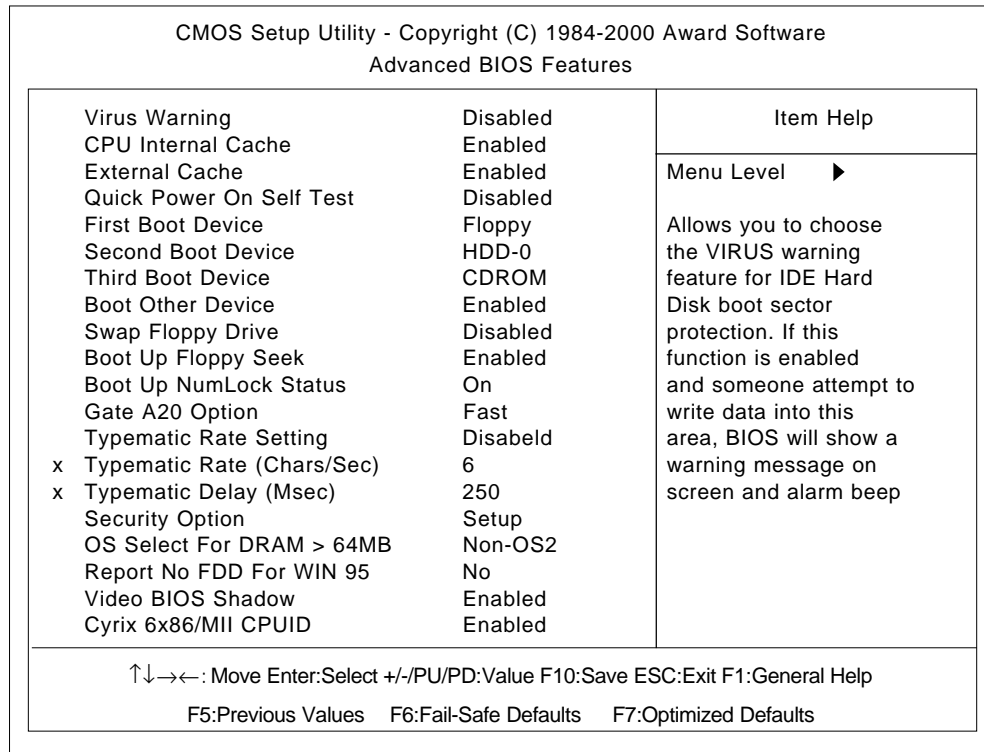
This setting sets the method for determining the parameter settings of the PL's IDE hard disk drive. The available settings are [None], [Auto], and [Manual]. The factory default setting is [Auto] and is recommended for most users.

■ **Capacity/ Cylinder/ Head/ Precomp/ Landing Zone/ Sector**

This setting determines the parameters of the PL's IDE hard disk drive. The setting is required when the [IDE Primary Master (Slave)] is set to [Manual]. When the [IDE Primary Master (Slave)] is set to [None] or [Auto], the auto-detected values will be used.

5.2.3 Advanced BIOS Features

Select Advanced BIOS Features from the Main Menu and the following screen will appear.



■ **Virus Warning**

This setting determines whether to display a warning when a write to the boot sector is attempted. The available settings are [Enabled] or [Disabled]. The factory default setting is [Disabled] and is recommended for most users.

■ **CPU Internal Cache**

This setting determines the usage of the CPU's internal cache memory. The available settings are [Disabled] or [Enabled]. The factory default setting is [Enabled] and is recommended for most users.

■ **External Cache**

This setting determines the usage of the external cache memory (L2). The available settings are [Disabled] or [Enabled]. The factory default setting is [Enabled] and is recommended for most users.

■ **Quick Power On Self Test**

This setting determines whether the quick self test is performed when the power is turned on. The available settings are [Disabled] or [Enabled]. The factory default setting is [Disabled] and is recommended for most users.

■ **First Boot Device/ Second Boot Device/ Third Boot Device**

The selections for the search drive sequence of the operating system. The available settings are [Floppy], [HDD-0], [CDROM], [HDD-1], and [Disabled]. The factory default settings are [Floppy] for the [First Boot Device], [HDD-0] for the [Second Boot Device], and [CDROM] for the [Third Boot Device].

■ **Boot other Device**

This setting determines whether to allow the startup from devices other than those selected as [First Boot Device], [Second Boot Device], and [Third Boot Device]. The available settings are [Disabled] or [Enabled]. The factory default setting is [Enabled] and is recommended for most users.

■ **Swap Floppy Drive**

This setting swaps Drive A with Drive B for the recognition. The available settings are [Disabled] or [Enabled]. The factory default setting is [Disabled] and is recommended for most users.

■ **Boot Up Floppy Seek**

The setting specifies the function to check whether the floppy disk drive is installed upon the system boot-up process. The available settings are [Disabled] or [Enabled]. The factory default setting is [Enabled] and is recommended for most users.

■ **Boot Up Numlock Status**

This setting specifies the Numlock key status upon the startup. The available settings are [On] and [Off]. The factory default setting is [On] and is recommended for most users.

■ **Gate A20 Option**

The available settings are [Normal] and [Fast]. When [Normal] is selected, the Keyboard control will be employed to control Gate A20. When [Fast] is selected, the Chipset will be employed. The factory default setting is [Fast] and is recommended for most users.

■ **Typematic Rate Setting**

The setting specifies the keyboard speed for the repeat process of the character. The available settings are [Enabled] and [Disabled]. The factory default setting is [Disabled] and is recommended for most users.

■ **Typematic Rate (Chars/ Sec)**

This setting specifies the actual typematic rate (repeated character input per second) when the [Typematic Rate Setting] option is set to [Enabled]. The available settings are [6], [8], [10], [12], [15], [20], [24], [30]. The factory default setting is [6] and is recommended for most users.

■ **Typematic Delay (Msec)**

When [Typematic Rate Setting] is set to [Enabled], this setting determines the delay period until the initial repetition is started. (msec)=millisecond. The available settings are [250], [500], [750], and [1000]. The [250] selection is factory set.

■ Security Option

This setting designates the area to request a password. Select [Setup] or [System] upon BIOS setup, or [System] upon system startup. This setting is NOT available when the password is set using [Set Password] in the menu items. The factory default setting is [Setup] and is recommended for most users.

■ OS Select For DRAM > 64MB

The available settings are [Non-OS2] and [OS2]. The factory default setting is [Non-OS2] and is recommended for most users.

■ Report No FDD For WIN 95

This setting determines if the FDD node is reported by BIOS to WIN95. The available settings are [No] and [Yes]. The factory default setting is [No] and is recommended for most users.

■ Video BIOS Shadow

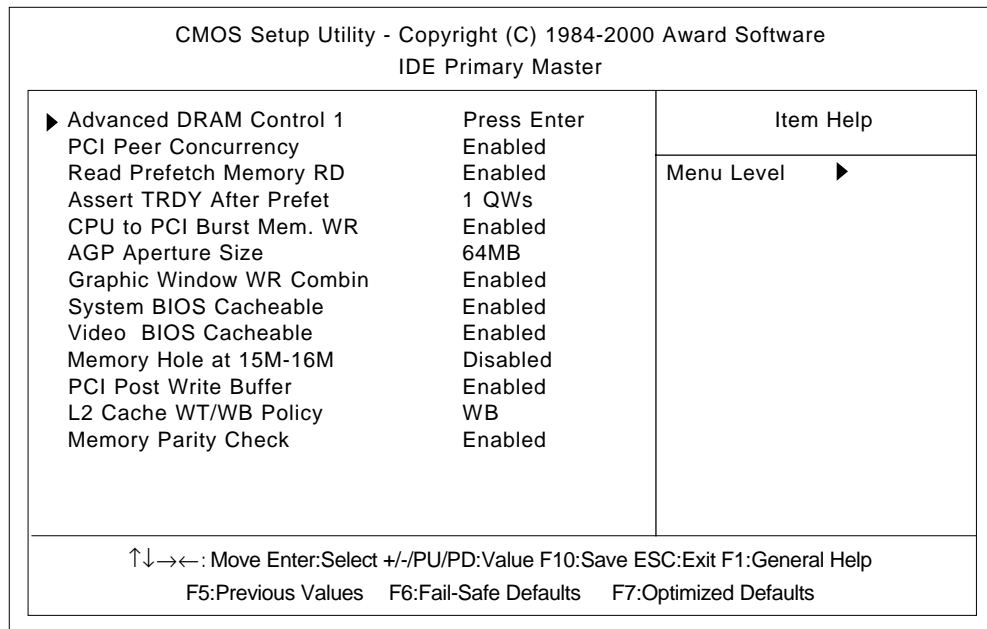
This setting determines whether to expand the Video BIOS ROM in RAM (C0000-C7FFF). The factory default setting is [Enabled] and is recommended for most users.

■ Cyrix 6x86/MII CPUID

This setting determines whether to send CPUID when Netware ver. 5.0 is used. The available settings are [Enabled] and [Disabled]. The factory default setting is [Enabled] and is recommended for most users.

5.2.4 Advanced Chipset Features

Select Advanced Chipset Features from the Main Menu and the following screen will appear.



■ Advanced DRAM Control 1

These selections display the DRAM setting. Press [Enter] to display the setting item menu. The available setting is [100MHz] or [133MHz]. The factory default setting is [100MHz] and is recommended for most users.

■ PCI Peer Concurrency

This setting determines if the CPU will use L2/DRAM in parallel with PCI-to-PCI access. The available settings are [Disabled] and [Enabled]. The factory default setting is [Enabled] and is recommended for most users.

■ Read Prefetch Memory RD

This setting determines if the Memory Read command is used by the chipset to prefetch data. The available settings are [Disabled] and [Enabled]. The factory default setting is [Enabled] and is recommended for most users.

■ Assert TRDY After Prefet

This setting determines the TRDY assert data used for memory processing by the chipset. The available settings are [2QWs] and [1QWs]. The factory default setting is [1QWs] and is recommended for most users.

■ CPU to PCI Burst Mem. WR

The setting determines whether the PCI write buffer is used. The write buffer is not used when the [Disabled] option is selected. The available settings are [Disabled] and [Enabled]. The factory default setting is [Enabled] and is recommended for most users.

■ **AGP Aperture Size**

This setting specifies the memory used by the graphic board. The available settings are [4MB], [8MB], [16MB], [32MB], [64MB], [128MB], and [256MB]. The factory default setting is [64MB] and is recommended for most users.

■ **Graphic Window WR Combin**

This setting determines if the value designated in the GWBA register is accepted as the Graphic Window Base Address. The available settings are [Disabled] and [Enabled]. The factory default setting is [Enabled] and is recommended for most users.

■ **System BIOS Cacheable**

This setting determines whether to cache the system BIOS. An OS that uses the system BIOS operate faster. The available settings are [Enabled] and [Disabled]. The factory default setting is [Enabled] and is recommended for most users.

■ **Video BIOS Cacheable**

This setting determines whether to cache the video BIOS. The available settings are [Enabled] and [Disabled]. The factory default setting is [Enabled] and is recommended for most users.

■ **Memory Hole At 15M-16M**

This setting determines whether to designate the memory space from 15MB to 16MB as the buffer area for the ISA bus card. The available settings are [Disabled] and [Enabled]. The factory default setting is [Disabled] and is recommended for most users.

■ **PCI Post Write Buffer**

This setting determines if the PCI Post Write Buffer is controlled or not. The available settings are [Disabled] and [Enabled]. The factory default setting is [Enabled] and is recommended for most users.

■ **L2 Cache WT/WB Policy**

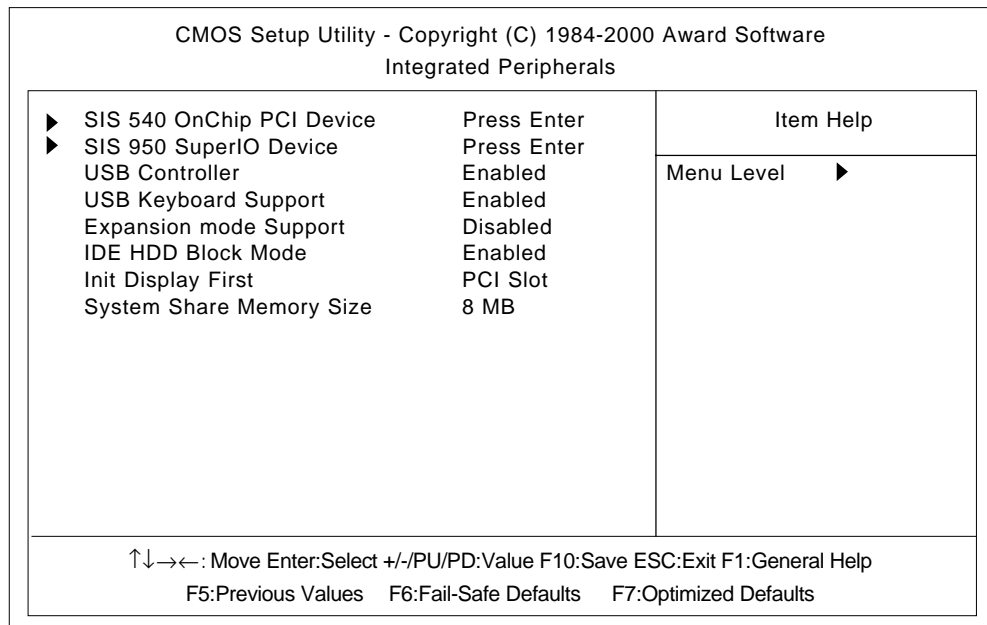
This setting determines degree of similarity between the L2 Cache and the System DRAM. The available settings are [WT] and [WB]. The factory default setting is [WB] and is recommended for most users.

■ **Memory Parity Check**

This setting determines whether parity checks are performed when parity protected memory is used. The available settings are [Disabled] and [Enabled]. The factory default setting is [Enabled] and is recommended for most users.

5.2.5 Integrated Peripherals

Select Integrated Peripherals from the Main Menu and the following screen will appear.



■ SIS 540 Onchip PCI Device

This setting enables the onboard Ethernet interface. Press [Enter] to display the menu items for this setting. The available settings are [Enabled] and [Disabled]. The factory default setting is [Disabled] and is recommended for most users.

■ SIS 950 Super 10 Device

This setting configures the various onboard interfaces. Press [Enter] to display the menu items for the setting.

Reference "5.2.6 SIS 950 Super 10 Device"

■ USB Controller

This setting determines whether to use USB controller. The available settings are [Disabled] and [Enabled]. The factory default setting is [Enabled] and is recommended for most users.

■ USB Keyboard Support

This setting determines whether to use the USB interface keyboard. The available settings are [Disabled] and [Enabled]. The factory default setting is [Enabled] and is recommended for most users.

■ Expansion mode Support

This setting determines if the VGA Expansion Mode is supported or not. Settings available are [Disabled] and [Enabled]. The factory setting is [Disabled].

■ IDE HDD Block Mode

This setting determines whether to enable the Block Mode on the HDD supporting the Block Mode. The available settings are [Disabled] and [Enabled]. The factory default setting is [Disabled] and is recommended for most users.

■ Init Display First

This setting determines the type of VGA card that is given priority - AGP or PCI. The available settings are [PCI Slot] and [AGP]. The factory default setting is [PCI Slot] and is recommended for most users.

■ System Share Memory Size

This setting determines the amount of system memory used for video. The available settings are [2MB], [4MB], [6MB], [8MB], [16MB], [32MB], [64MB] and [Enabled]. The factory default setting is [8MB] and is recommended for most users.

5.2.6 SIS 950 Super I/O Device

Select SIS 950 Super I/O Device from the Integrated Peripherals menu and the following screen will appear.

CMOS Setup Utility - Copyright (C) 1984-2000 Award Software SIS 950 SuperIO Device		
Onboard FDC Controller	Enabled	Item Help
COM Port 1	3F8/IRQ4	
COM Port 4	2E8/IRQ10	Menu Level ▶▶
UART Mode Select	Normal	
x UR2 Duplex Mode	Half	
Onboard Parallel Port	3BC/IRQ7	
Parallel Port Mode	SPP	
x ECP Mode Use DMA	3	
COM Port 2	2F8	
COM Port 2 Use IRQ	IRQ3	
COM Port 3	3E8	
COM Port 3 Use IRQ	IRQ11	
↑↓→←: Move Enter:Select +/-/PU/PD:Value F10:Save ESC:Exit F1:General Help F5:Previous Values F6:Fail-Safe Defaults F7:Optimized Defaults		

■ Onboard FDC Controller

This setting enables or disables the onboard floppy disk controller. The available settings are [Disabled] and [Enabled]. The factory default setting is [Enabled] and is recommended for most users.

■ COM Port 1

This setting determines the port address and the interrupt request number used by the onboard serial port 1. The available settings are [Disabled], [3F8/IRQ4], [2F8/IRQ3], [3E8/IRQ4], [2E8/IRQ10] and [Auto]. The factory default setting is [3F8/IRQ4] and is recommended for most users.

■ COM Port 4

This setting determines the port address and the interrupt request number used by the onboard serial port connected to the touch panel inside the PL. The available settings are [Disabled], [3F8/IRQ4], [2F8/IRQ3], [3E8/IRQ4], [2E8/IRQ10] and [Auto]. The factory default setting is [2E8/IRQ10] and is recommended for most users.

■ UART Mode Select

This setting determines the operation mode of the onboard serial port 2. The available settings are [Normal], [IrDA], [ASKIR] and [SCR]. The factory default setting is [Normal] and is recommended for most users.

■ UR2 Duplex Mode

This setting determines the communication mode when serial port 2 is set to [IrDA] or [ASKIR] mode in [UART Mode Select]. The available settings are [Full] and [Half]. The factory default setting is [Half].

■ Onboard Parallel Port

This setting determines the port address and the interrupt request number used by the onboard parallel port. The available settings are [Disabled], [3BC/IRQ7], [278/IRQ5] and [3BC/IRQ7]. The factory default setting is [378/IRQ7] and is recommended for most users.

■ Parallel Port Mode

This setting determines the operation mode of the onboard parallel port. The available settings are [SPP], [EPP], [ECP] and [ECP+EPP]. The factory default setting is [SPP] and is recommended for most users.

■ ECP Mode Use DMA

This setting determines the DMA channel used in ECP mode. The available settings are [1] and [3]. This setting is user-definable when the Parallel Port Mode is set to [ECP] or [ECP+EPP].

■ COM Port 2

This setting determines the port address used by the onboard serial port 2. The available settings are [Disabled], [3F8], or [2F8], [3E8] and [2E8]. The factory default setting is [2F8] and is recommended for most users.

■ COM Port 2 Use IRQ

This setting determines the interrupt request number used by the onboard serial port 2. The available settings are [IRQ15], [IRQ3], [IRQ4], [IRQ9], [IRQ10] and [IRQ11]. The factory default setting is [IRQ3] and is recommended for most users.

■ COM Port 3

This setting selects the port address used by the onboard serial port 3. The available settings are [Disabled], [3F8], [2F8], [3E8] and [2E8]. The factory default setting is [3E8] and is recommended for most users.

■ COM Port 3 Use IRQ

This setting determines the interrupt request number used by the onboard serial port 3. The available settings are [IRQ15], [IRQ3], [IRQ4], [IRQ9], [IRQ10] and [IRQ11]. The factory default setting is [IRQ11] and is recommended for most users.

5.2.7 Power Management Setup

Select Power Management Setup from the Main Menu and the following screen will appear.

CMOS Setup Utility - Copyright (C) 1984-2000 Award Software		
Power Management Setup		
ACPI function	Disabled	Item Help
Video Off Option	Susp,Stby -> Off	
Video Off Method	V/H SYNC+Blank	Menu Level ▶
Watchdog Function	Disabled	
x Watchdog Timer (sec)	5	
▶ PM Wake Up Events	Press Enter	
↑↓→←: Move Enter:Select +/-/PU/PD:Value F10:Save ESC:Exit F1:General Help F5:Previous Values F6:Fail-Safe Defaults F7:Optimized Defaults		

■ ACPI Function

This setting enables the ACPI function when ACPI-compatible peripherals are connected. The available settings are [Enabled] and [Disabled]. The factory default setting is [Disabled] and is recommended for most users.

■ Video Off Option

This setting determines the On/Off condition of the display. The available settings are [Always On], [Suspend → Off], [Susp, Stby → Off], and [All Modes → Off]. The factory default setting is [Susp, Stby → Off] and is recommended for most users.

■ Video Off Method

This setting determines the method to blank the display screen. The available settings are [Blank Screen], [V/H SYNC+Blank], and [DPMS Supported]. The [Blank Screen] selection blanks the display. The [V/H SYNC+Blank] blanks the display and also suspends the Vertical/Horizontal synchronization signal of the display. The [DPMS Supported] selection controls the operation when a CRT that supports DPMS is used. The factory default setting is [V/H SYNC+Blank] and is recommended for most users.

Chapter 5 - System Setup

■ Watchdog Function

This setting enables or disables the Watchdog function. The available settings are [Enabled] and [Disabled]. The factory default setting is [Disabled] and is recommended for most users.

■ Watchdog Timer (sec)

This setting determines the length of time of the Watchdog Timer. The available setting range is between [5] and [255]. The factory default setting is [5]. This setting is effective when the [Watchdog Function] is set to [Enabled].

■ PM Wake Up Events

This selection displays the settings for system wake up. Press [Enter] to display the Parameter Setting menu.

▼Reference▲ *"5.2.8 PM Wake Up Events"*

5.2.8 PM Wake Up Events

Select PM Wake Up Events from the Power Management Setup Menu and the following screen will appear.

CMOS Setup Utility - Copyright (C) 1984-2000 Award Software		Item Help
PM Wake Up Events		
IRQ [3-7,9-15],NMI	Enabled	
IRQ 8 Break Suspend	Disabled	
MACPME Power Up Control	Enabled	Menu Level ▶▶
PCIPME Power Up Control	Enabled	
KB Power ON Password	Enter	
Power Up by Alarm	Disabled	
x Month Alarm	NA	
x Day of Month Alarm	0	
x Time (hh:mm:ss) Alarm	0 0 0	

↑↓→←: Move Enter:Select +/-/PU/PD:Value F10:Save ESC:Exit F1:General Help
F5:Previous Values F6:Fail-Safe Defaults F7:Optimized Defaults

■ IRQ [3-7, 9-15], NMI

This setting determines if the system is reset when an allowed interrupt is detected. The available settings are [Disabled] and [Enabled]. The factory default setting is [Enabled] and is recommended for most users.

■ IRQ 8 Break Suspend

This setting determines if the data required to trigger the power-saving suspend mode is allocated to IRQ8 or not. The available settings are [Disabled] and [Enabled]. The factory default setting is [Disabled] and is recommended for most users.

■ MACPME Power Up Control

This setting determines if the PL starts via input from a LAN or not. The available settings are [Disabled] and [Enabled]. The factory default setting is [Enabled] and is recommended for most users.

■ PCIPME Power Up Control

This setting determines if the PL starts via input from a PCI card or not. The available settings are [Disabled] and [Enabled]. The factory default setting is [Enabled] and is recommended for most users.

■ KB Power ON Password

This setting defines the password when the system is powered-on by the keyboard switch. Press [Enter] to display the setup menu.

■ Power Up by Alarm

This setting determines whether to set the timer to start automatic startup. The available settings are [Disabled] and [Enabled]. The factory default setting is [Disabled] and is recommended for most users.

■ Month Alarm

This setting selects the month when the system starts up automatically. The available settings are [NA] and [1] through [12]. This function is available when the [Power Up by Alarm] option is set to [Enabled].

■ Day of Month Alarm

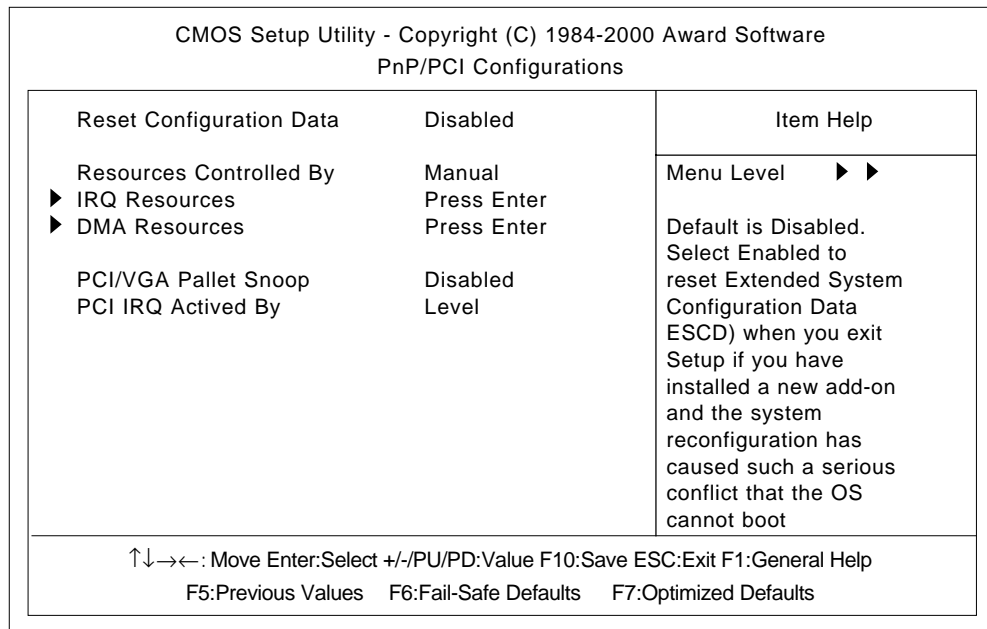
This setting selects the day when the system starts up automatically. The available settings are from [0] to [31]. This function is available when the [Power Up by Alarm] option is set to [Enabled].

■ PM Wake Up Events

This setting specifies the time when the system starts up automatically. The available settings are [00] to [23] for "hh" (hour), [00] to [59] for "mm" (minute), and [00] to [59] for "ss" (second). This function is available when the [Power Up by Alarm] option is set to [Enabled].

5.2.9 PnP/ PCI Configurations

Select PnP/ PCI Configuration from the Main Menu and the following screen appears.



■ Reset Configuration Data

This setting determines whether to initialize the ESCD (Extended System Configuration Data) used by Plug and Play devices when setup is complete. The available settings are [Disabled] and [Enabled]. The factory default setting is [Disabled] and is recommended for most users.

■ Resources Controlled By

This setting selects the method for allocating the Plug and Play I/O Port, IRQ, and DMA resources. The available settings are [Auto (ESCD)] and [Manual]. The factory default setting is [Manual] and is recommended for most users.

■ IRQ Resources

This selection displays the configuration settings for devices assigned an IRQ. Press [Enter] to display the setup menu.

▼ **Reference** ▲ [5.2.10 IRQ Resources](#)

■ DMA Resources

This selection displays the configuration settings for devices assigned a port address. Press [Enter] to display the setup menu.

▼ **Reference** ▲ [5.2.11 DMA Resources](#)

■ **PCI/VGA Pallet Snoop**

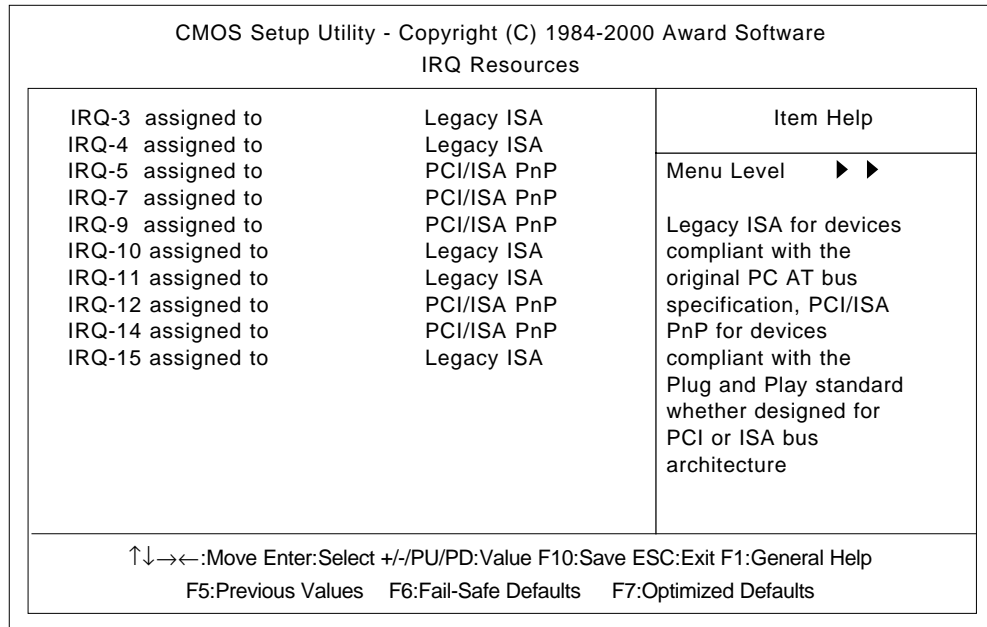
This setting is used when a MPEG card and a VGA card are both installed in the PL. The available settings are [Disabled] and [Enabled]. The factory default setting is [Disabled] and is recommended for most users.

■ **PCI IRQ Activated By**

This setting defines the method of interruption used by the PCI slot. The available settings are [Level] and [Edge]. The factory default setting is [Level] and is recommended for most users.

5.2.10 IRQ Resources

Select IRQ Resources from the PnP/ PCI Configurations menu and the following screen will appear.



■ IRQ-3 assigned to ~ IRQ-15 assigned to

This setting determines the type of device assigned to the IRQ. This function is available when the [Resource Control By] option under the [PnP/ PCI Configurations] menu is set to [Manual].

[PCI/ISA PnP] .. Select to use a PnP-ready PCI or ISA card.

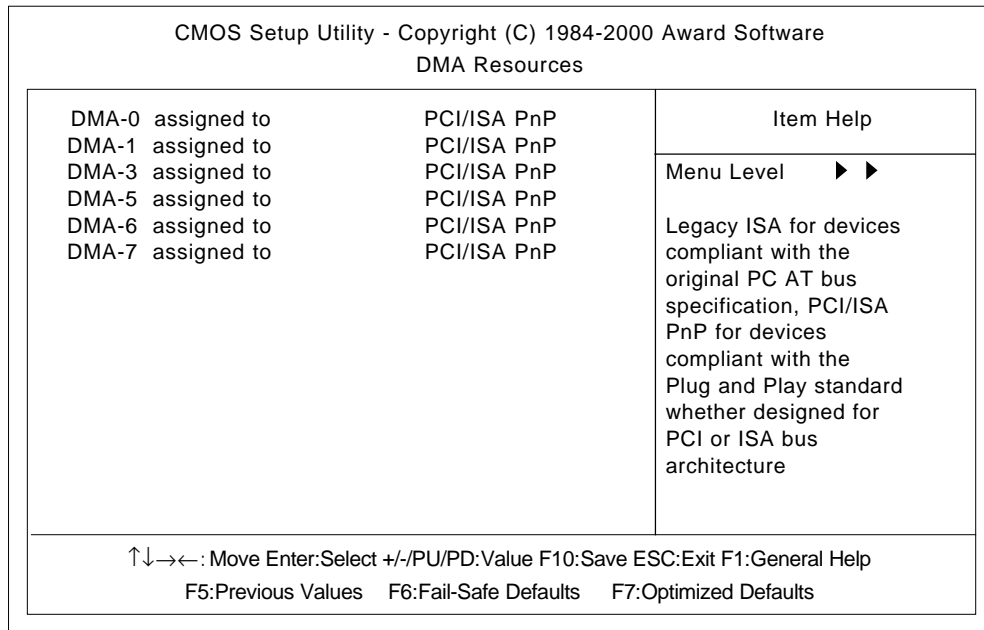
[Legacy ISA] Select to use a non-PnP ISA card.

The initial settings are as shown below.

	Initial Value		Initial Value
IRQ-3 assigned to	Legacy ISA	IRQ-10 assigned to	Legacy ISA
IRQ-4 assigned to	Legacy ISA	IRQ-11 assigned to	Legacy ISA
IRQ-5 assigned to	PCI/ISA PnP	IRQ-12 assigned to	PCI/ISA PnP
IRQ-7 assigned to	PCI/ISA PnP	IRQ-14 assigned to	PCI/ISA PnP
IRQ-9 assigned to	PCI/ISA PnP	IRQ-15 assigned to	Legacy ISA

5.2.11 DMA Resources

Selecting DMA Resources from the PnP/PCI Configuration menu and the following screen will appear.



■ **DMA-0 assigned to ~ DMA-7 assigned to**

This setting determines the type of device assigned to the port address. This function is available when the [Resource Control By] option under the [PnP/PCI Configurations] menu is set to [Manual].

[PCI/ISA PnP]...Select to use a PnP PCI or ISA card.

[Legacy ISA]...Select to use a non-PnP ISA card.

The initial settings are as shown below.

	Initial Value		Initial Value
DMA-0 assigned to	PCI/ISA PnP	DMA-5 assigned to	PCI/ISA PnP
DMA-1 assigned to	PCI/ISA PnP	DMA-6 assigned to	PCI/ISA PnP
DMA-3 assigned to	PCI/ISA PnP	DMA-7 assigned to	PCI/ISA PnP

5.2.12 PC Health Status

Select PC Health Status from the Main Menu and the following screen will appear.

CMOS Setup Utility - Copyright (C) 1984-2000 Award Software		
PC Health Status		
CPU Warning Temperature	Disabled	Item Help
System Warning Temp	: Disabled	
IN0(Vcore) : Tolerance	: Disabled	Menu Level ▶
IN1(3.3V) : Tolerance	: Disabled	
IN2(5V) : Tolerance	: Disabled	
IN3(12V) : Tolerance	: Disabled	
IN4(-12V) : Tolerance	: Disabled	
IN5(-5V) : Tolerance	: Disabled	
CPU Fan : Tolerance	: Disabled	
Power Fan : Tolerance	: Disabled	
↑↓→←: Move Enter:Select +/-PU/PD:Value F10:Save ESC:Exit F1:General Help F5:Previous Values F6:Fail-Safe Defaults F7:Optimized Defaults		

■ CPU Warning Temperature

This setting defines the CPU temperature at which a warning will be issued. The available settings are [40°C/104°F], [45°C/113°F], [50°C/122°F], [55°C/131°F], [60°C/140°F], [65°C/149°F], [70°C/158°F], [75°C/167°F], [80°C/176°F] and [Disabled]. The factory default setting is [Disabled].

■ System Warning Temp

This setting defines the motherboard temperature at which a warning will be issued. The available settings are [40°C/104°F], [45°C/113°F], [50°C/122°F], [55°C/131°F], [60°C/140°F], [65°C/149°F], [70°C/158°F], [75°C/167°F], [80°C/176°F] and [Disabled]. The factory default setting is [Disabled].

■ IN0 (Vcore)/ In1 (3.3V)/ IN2 (5V)/ IN3 (12V)/ IN4 (-12V)/ IN5 (-5V)

This setting determines the allowable range of the voltage of IN0 (Vcore)/ In1 (3.3V)/ IN2 (5V)/ IN3 (12V)/ IN4 (-12V)/ IN5 (-5V). The available settings are [+/-4%], [+/-6%] and [Disabled]. The factory default setting is [Disabled].

Chapter 5 - System Setup

■ CPU FAN

This setting determines the allowable range of CPU FAN speed. The available settings are [$\pm 30\%$], [$\pm 50\%$] and [Disabled]. The factory default setting is [Disabled] and is recommended for most users.

■ POWER FAN

This setting determines the allowable range of the Power Fan speed. The available settings are [$\pm 30\%$], [$\pm 50\%$] and [Disabled]. The factory default setting is [Disabled] and is recommended for most users.

Chapter

6 OS Setup

6-1 Floppy Disk Utility Programs

6-2 MS-DOS® Programs

This chapter provides information about the set up of the PL's MS-DOS® or Windows® 95 operating systems.

6.1 Floppy Disk Utility Programs

The following additional program files are designed to run on the MS-DOS/Windows®95 operating system. For details, please refer to the additional "README" files.

■ README Files

File Name	Contents
READMEE.TXT	This file contains the latest detailed software program information. Please be sure to read this file.
README.95E	This file contains the latest detailed software program information. Please be sure to read this file.

6.1.1 MS-DOS® Software

File name	Description
ATPH59.EXE	Touch panel handler Converts input from the touch panel in line with display panel resolution (640 x 480). It is also compatible with Digital Panel Computers of the PL-386 family. This is not a mouse emulation program.
CALIB59.EXE	Touch panel data calibration By touching the specified position on the panel, the difference between the logic value and measured value is corrected. Furthermore, it is possible to create files with data based on calibration results obtained here, to be used on the ATPH59.EXE application.
KEYEM_PL.EXE	This utility software displays a keyboard on the screen to allow touch panel data input. (Only for Japanese version MS-DOS users)
DISP.EXE	Display On/Off program Turns the display, including the backlight, either ON or OFF.
BLSET.EXE	This utility software provides a means of turning the Touch Screen OFF when a backlight burnout is detected. This feature can help to prevent accidents and injuries by preventing an accidental PL operation mistake.
EXTCOM.SYS	COM port driver (reception interrupt acknowledge). For details, see the README.TXT file on the same disk.



- **Must be MS-DOS version 6.0 or later.**
- **Digital does not guarantee this software will work with any OS other than those previously mentioned.**
- **This software is made for use with MS-DOS. Do not use it in a Windows® environment.**
- **For an explanation of the EXTCOM.SYS, and FUNCKEY.EXE applications, refer to their respective README.TXT file.**

6.1.2 Windows® 95/Windows® 98 (SR2)

■ **System Monitor/RAS Features**

File Name	Contents
PL_WPS.EXE	Program for entering monitoring parameter settings
PL_SMON.EXE	System Monitor Program
PL_IOC.DLL	System Monitor/RAS API-DLL file (Windows® 95/Windows® 98 SR2)
PL_DLL.DLL	System Monitor/RAS Program DLL file (Windows® 95/Windows® 98 SR2)
PLSYSMON.VXD	Hardware control driver (Windows® 95/Windows® 98 SR2)

■ Screen Saver Type Backlight Control Programs

File Name	Contents
Backlightcontrol.scr	Screen saver main program
PL_BLIOC.DLL	Backlight control API-DLL file (Windows® 95/Windows® 98 SR2)
BLCTRL.VXD	Backlight control driver (Windows® 95/Windows® 98 SR2)
DISP.EXE	Backlight control program (Windows® 95/Windows® 98 SR2)



If the User installs an OS (operating system) other than that written here, the correct operation of these utility programs cannot be guaranteed.

■ Keyboard Emulator (Keyclick32)

This program allows the User's mouse operation to perform keyboard-like data input.

Certain application programs do not support this keyboard emulator. Please test each application individually to check if the keyboard emulator will operate correctly. Also, this application cannot be used to enter Windows® 95/Windows® 98 (SR2) startup screen User Name and Password information.

Also, to change the Keyclick program's font size a keyboard is required. For details concerning the Keyclick program's operation, simply click on the HELP button to call up the program's online help data.

■ Backlight OFF Screen Saver

This software is used to turn OFF the PL's backlight after a specified period of inactivity. The use of this feature will help to extend the life of the PL's backlight.

Certain application programs may not allow the PL's backlight to turn OFF. Please test each program individually to check if the screen saver will operate correctly.

■ Screen Display ON/OFF Utility

This command line utility is used to turn OFF both the PL's backlight and display.

Settings Used DISP [ON/OFF]

Option Switch ON: Displayed / OFF: Not Displayed

Return Value 0: Completed Normally / -1: Option Switch Error

■ PL Series Special Graphics Accelerator Driver

Uses a specialized hardware feature to speed up Windows® 95/Windows® 98 (SR2) screen displays.

■ Function Key Utility (Funckey 32)

This utility reserves an area of the PL screen for using function keys. For usage instructions, refer to C:\Proface\Funckey's Help feature.

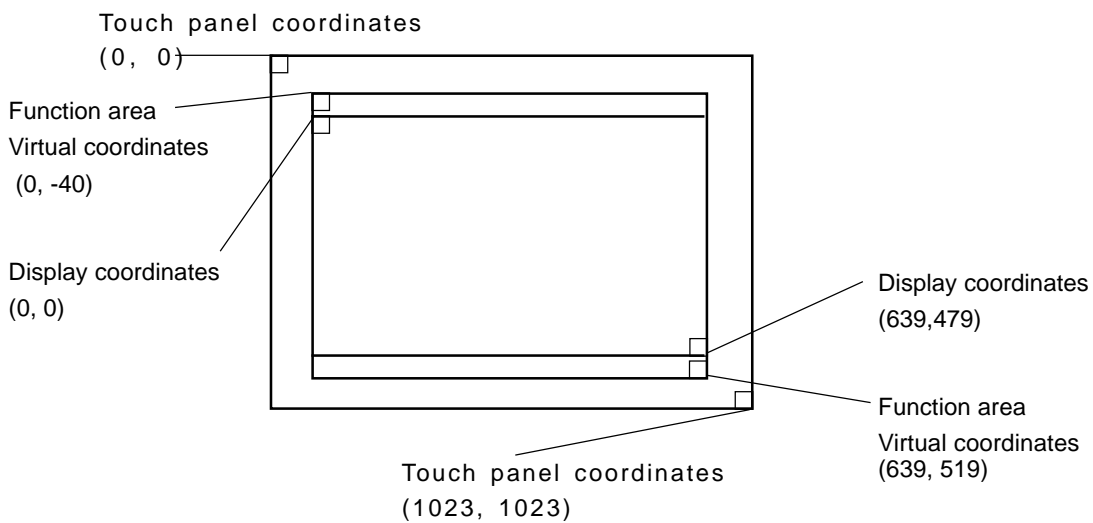
(When the taskbar has been shifted to the bottom of the PL screen, the lower row of function keys cannot be used)

6.2 MS-DOS Utility Programs

6.2.1 ATPH59.EXE (Touch Panel Handler)

With an analog touch panel, input is recognized within a 1024 x 1024 pixel area, with the lower left-hand corner as the coordinate origin point. However, most display panels use the upper left-hand corner as the origin point and have a resolution of 640 x 480 pixels. Consequently, depending on the conditions of use, the touch panel position and display position may not be the same. Here, the ATPH59.EXE application solves this problem by converting input from the touch panel into the corresponding display panel coordinates, allowing the use of application programs which use absolute coordinate input or area input from a touch panel.

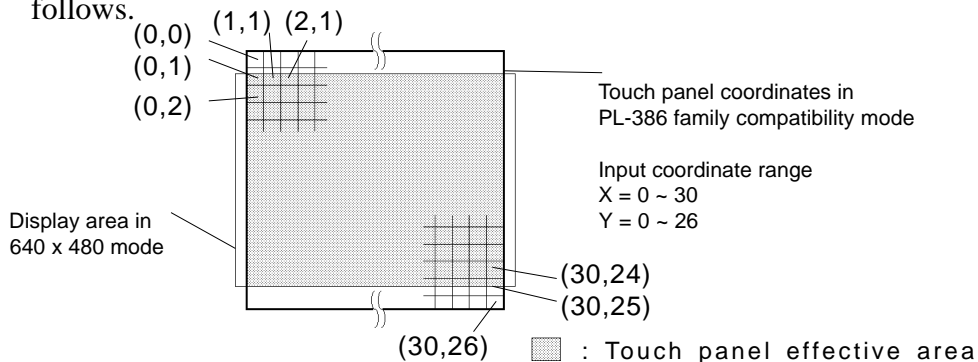
The relationship between touch panel coordinates and display coordinates is as follows.



Relationship between touch panel coordinates and display coordinates when using the PL-386 Series compatibility mode

To ensure compatibility with 16 x 14 (31 x 27 by double precision) touch panels used on the Digital PL-386 family of Panel Computers, the TPH.EXE (PL-386 command) function can be used as is.

The relationship between touch panel coordinates and display coordinates is as follows.



- **A 2-point touch gives the midpoint coordinate between the two coordinate values.**
- **The touch panel handler cannot be used in conjunction with a mouse emulator on Windows®. Cancel all resident programs before starting up Windows®.**

■ Start-up

ATPH59 [Parameter] [-]

* Parameters

- a<n>** Specifies the I/O base address of the touch panel's SIO port.
Hexadecimal, Default: 2e8 (COM4)
- | | | |
|----|-----|--------|
| n= | 3f8 | (COM1) |
| | 2f8 | (COM2) |
| | 3e8 | (COM3) |
| | 2e8 | (COM4) |
- q<n>** Specifies the interrupt level (IRQ) of the touch panel's SIO port.
Default: 10 (COM4)
- | | | |
|----|----|--------|
| n= | 4 | (COM1) |
| | 3 | (COM2) |
| | 11 | (COM3) |
| | 10 | (COM4) |
- i<n>** Sets the software interrupt vector number when calling up functions.
Hexadecimal, Default: n=59
- r** Cancels the resident command.
- c <path name>** Specifies the data file containing the calibrated value obtained from CALIB59.EXE (touch panel data calibration). When defaulted to, ATPH59.CAL of the current directory is used.
* Example `atph59 -a2e8 -q10 -cc:\atph59.cal`



Note:

Normally, only "atph59" is needed.

At startup, the following message will appear on the screen.

**Analog Touch Panel Handler ATPH59.EXE Version X.XX Copyright (c) 2000 Digital Electronics Corporation
Stay resident.**

After startup, these commands reside in memory.



Important

- ***If an error is generated because, for example, there is no file created by the CALIB59.EXE application, the following message appears on the screen, and the system will start up in a mode that does not calibrate data.***

**WARNING!! Can't open CAL file.
Stay resident.**

- ***Unless properly calibrated, the display and touch panel input positions may not be the same.***

■ Functions

ATPH59.EXE calls up functions using a software interrupt (default: INT 59h).

For information on functions in the PL-386 compatibility mode, see pages 6-7 to 6-10.

INT 59h Function List

Function code	Description
8100h	Touch panel input (unrestricted wait)
8101h	Touch panel input (immediate restore)
8102h	Touch panel non-destructive input
0200h	Input buffer clear
8500h	Touch panel status detection
FE00h	Resident check

8100h Touch panel input (unrestricted wait)

Returns coordinates of the area/position touched. Waits until data is input.

Input AX = 8100h

Output AH = 0: Successfully completed
 BX = Y coordinate in 640 x 480 mode (-40 - 519)
 DX = X coordinate in 640 x 480 mode (0 - 639)
 CX = Number of valid input buffers on touch panel

8101h Touch panel input (immediate restore)

Returns coordinates of the area/position touched. Immediately restored if nothing is entered.

Input AX = 8101h

Output AH = 0: Input ON
 1: Input OFF
 BX = Y coordinate in 640 x 480 mode (-40 - 519)
 DX = X coordinate in 640 x 480 mode (0 - 639)
 CX = Number of valid input buffers on analog touch panel

8102h Touch panel non-destructive input

Returns coordinates of the area/position touched. Does not update the touch panel input buffer.

Input AX = 8102h

Output AH = 0: Input on
 1: Input off
 BX = Y coordinate in 640 x 480 mode (-40 - 519)
 DX = X coordinate in 640 x 480 mode (0 - 639)
 CX = Number of valid input buffers on analog touch panel

0200h Input buffer clear

Clears touch panel input buffers.

Input AX = 0200h

Output AH = 0: Successfully completed

8500h Touch panel status detection

Returns touch panel status

Input AX = 8500h

Output AH = Status in 640 x 480 mode

Bit 1	Bit 0	Description
0	0	Area touched
0	1	Unchanged
1	0	Not available
1	1	Area released

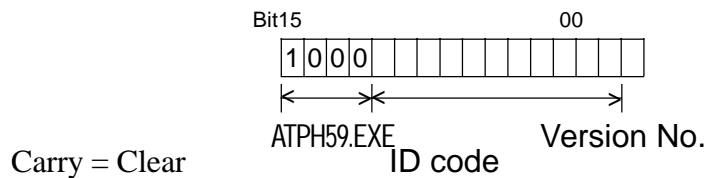
* For an explanation on how to use the function, see “function 500h.”

FE00h Resident check

When the ATPH59.EXE application resides in memory, returns a fixed message and version.

Input AX = FE00h

Output AH = 0: Successfully completed
 BL = ‘Y’
 BH = ‘B’
 CX = Version No.



Functions available in PL-386 Compatibility Mode

The following data details the functions available in the PL-386 compatibility mode (when the user’s PL-386 application is used without further conversion, updating or formatting).

INT 59h Function List

Function code	Description
0000h	Touch panel initialization
0100h	Touch panel input (unrestricted wait)
0101h	Touch panel input (immediate restore)
0102h	Touch panel non-destructive input
0300h	Coordinate code register
0400h	Coordinate code input (unrestricted wait)
0401h	Coordinate code input (immediate restore)
0402h	Coordinate code non-destructive input
0500h	Touch panel status detection

0000h Touch panel initialization

Same as 0200h (Input buffer clear)

Input AX = 0000h

Output AH = 0: Successfully completed

0100h Touch panel input (unrestricted wait)

Returns coordinates of the area/position touched. Waits until input is made.

Input AX = 0100h

Output AH = 0: Successfully completed
 BH = Y coordinate range in PL-386 compatibility mode (0 - 26)
 BL = X coordinate range in PL-386 compatibility mode (0 - 30)
 CX = Number of valid data sets in touch panel input buffers

0101h Touch panel input (immediate restore)

Returns coordinates of the area/position touched. Immediately restored after input is made.

Input AX = 0101h

Output AH = 0: Input on (“1” when input is off)
 BH = Y coordinate range in PL-386 compatibility mode (0 - 26)
 BL = X coordinate range in PL-386 compatibility mode (0 - 30)
 CX = Number of valid data sets in touch panel input buffers

0102h Touch panel non-destructive input

Returns coordinates of the area/position touched. Does not update touch panel input buffer.

Input AX = 0102h

Output AH =0: Input present (No input = 1)
 BH = Y coordinate range in PL-386 compatibility mode (0 - 26)
 BL =X coordinate range in PL-386 compatibility mode (0 - 30)
 CX = Number of valid data sets in touch panel input buffers

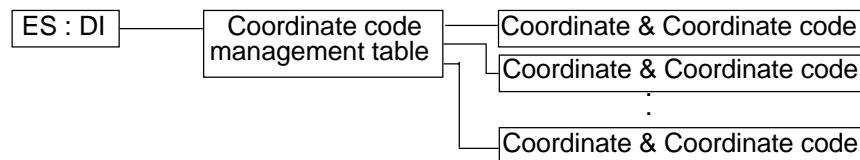
0300h Coordinate code register

Registers code corresponding to the display coordinates.

Input AX = 0300h
 ES = Segment from coordinate code management table
 DI = Offset from coordinate code management table

Output AH =0: Successfully completed

* Relationship between coordinate code management table and coordinate code



*** Coordinate Code Management Table Design**

The coordinate code management table manages positions of multiple coordinate code lists.

Number (n) of registered coordinate code lists	
Offset of 1st coordinate code list	
Segment of 1st coordinate code list	
Offset of 2nd coordinate code list	
Segment of 2nd coordinate code list	
⋮	
Offset of nth coordinate code list	
Segment of nth coordinate code list	

*** Coordinate Code List Design**

The coordinate code list determines which code is returned when the touch panel is pressed in a specific area. These coordinates specify the display coordinates.

Number (n) of registered coordinate codes
Display coordinate designation mode
Left side X coordinate of 1st area (X1)
Top side X coordinate of 1st area (Y1)
Right side X coordinate of 1st area (X2)
Bottom side X coordinate of 1st area (Y2)
Coordinate code of 1st area (code)
:
Left side X coordinate of nth area (X1)
Top side X coordinate of nth area (Y1)
Right side X coordinate of nth area (X2)
Bottom side X coordinate of nth area (Y2)
Coordinate code of nth area (code)

0400h Coordinate code input (unrestricted wait)

Returns coordinates of the area/position touched and coordinate code. Waits until data is entered.

- Input** AX = 0400h
- Output** AH = 0: Successfully completed
 BH = Y coordinate range in PL-386 compatibility mode (0 - 26)
 BL = X coordinate range in PL-386 compatibility mode (0 - 30)
 CX = Number of valid data sets in touch panel input buffers
 DX = Coordinate code



Note: To use function 0400h, it is necessary to first register the coordinate codes.

0401h Coordinate code input (immediate restore)

Returns coordinates of the area/position touched and coordinate code. Immediately restored after data is entered.

- Input** AX = 0401h
- Output** AH = 0: Input on ("1" when input is off)
 BH = Y coordinate range in PL-386 compatibility mode (0 - 26)
 BL = X coordinate range in PL-386 compatibility mode (0 - 30)
 CX = Number of valid data sets in touch panel input buffers
 DX = Coordinate code



Note: To use function 0401h, it is necessary to first register the coordinate codes.

0402h Coordinate code non-destructive input

Returns coordinates of the area/position touched. Does not update the touch panel input buffer.

Input AX = 0402h

Output AH = 0: Input on (“1” when input is off)
 BH = Y coordinate range in PL-386 family compatibility mode (0 - 26)
 BL = X coordinate range in PL-386 family compatibility mode (0 - 30)
 CX = Number of valid data sets in input buffers on touch panel
 DX = Coordinate code



To use function 0402h, it is necessary to first register the coordinate codes.

0500h Touch panel status detection

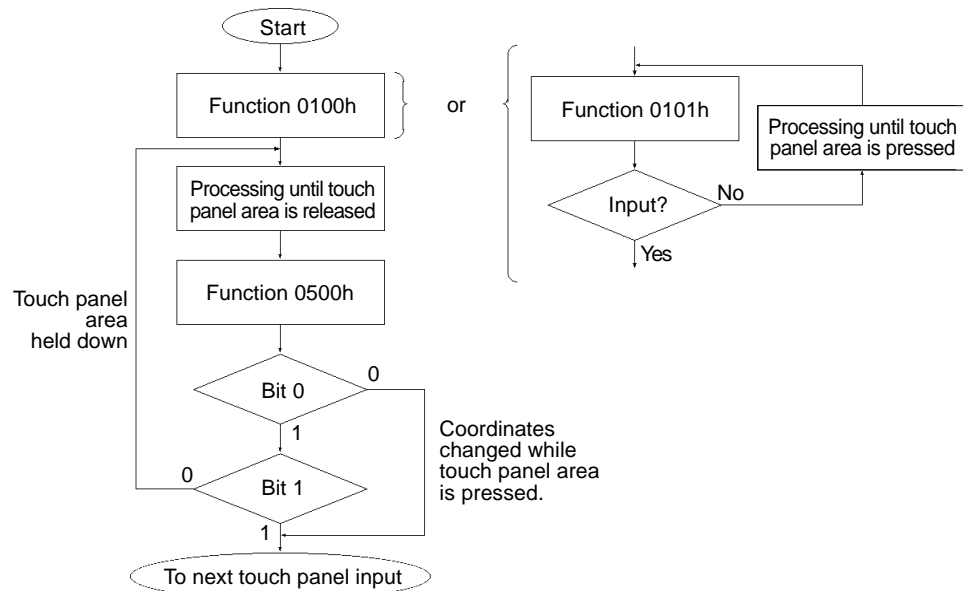
Returns the touch panel’s current status

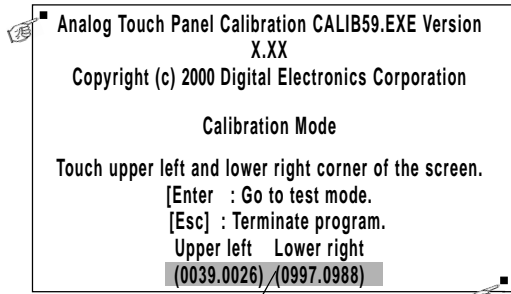
Input AX = 0500h

Output AH = Status in PL-386 compatibility mode

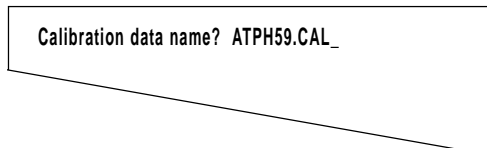
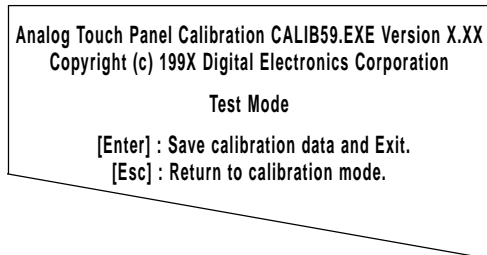
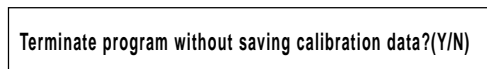
Bit 1	Bit 0	Description
0	0	Area pressed
0	1	Unchanged
1	0	Not available
1	1	Area released

How to use function 0500h





The measured value is displayed on the screen.



2) Touch each point, in the order it appears.



- Do not touch both points simultaneously.
- Touch the panel exactly on the lit up areas.
- The measured value is re-displayed if you touch the panel again.

The difference between the logic value and the measured value is obtained.



To quit programming, press the [Esc] key. Then, when the message shown on the left appears, press the [Y] key. The program will end without saving data. Here, pressing the [N] key will return you to the calibration mode.

3) Start up the “Test Mode” with the [↵] key.

This mode tests the calibrated value to determine if it is correct or not. The perimeter is OK if it is drawn along the path you traced by finger. Otherwise, return to the “Calibration Mode” and touch the lit up areas again.



You can return to the “Calibration Mode” with the [Esc] key.

4) If test results are OK, press the [Enter] key.

When the message shown at the left appears, input the data file name and press the [↵] key.



When specifying the data file name for the parameter (-C=[path name]) at the CALIB59.EXE start-up, the program ends without displaying the message shown on the left.

6.2.3 KEYEM_PL.EXE (Keyboard Emulator)

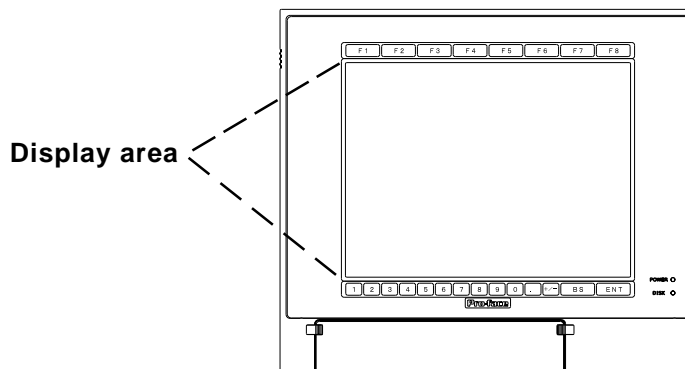
(Note: This program can only be used with the Japanese version of MS-DOS.)

This program graphically displays the keyboard on the screen, allowing keystroke operation with the touch panel using the mouse to perform keyboard-like data input. It also allows the user to define a key to any coordinates (external key definition).



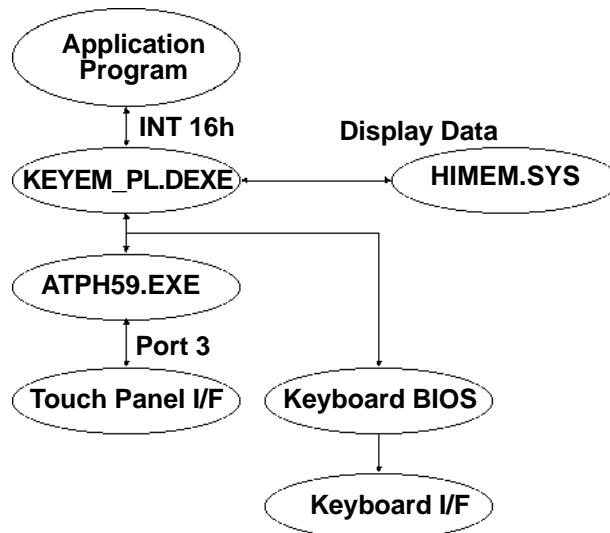
"External Key Definition" uses the touch panel coordinate mode compatible with Digital's family of PL-386 Panel Computers.

Please place the function label included in the package to enhance the usability of the Keyboard Emulator.



The structure and function of KEYEM_PL.EXE is as follows:

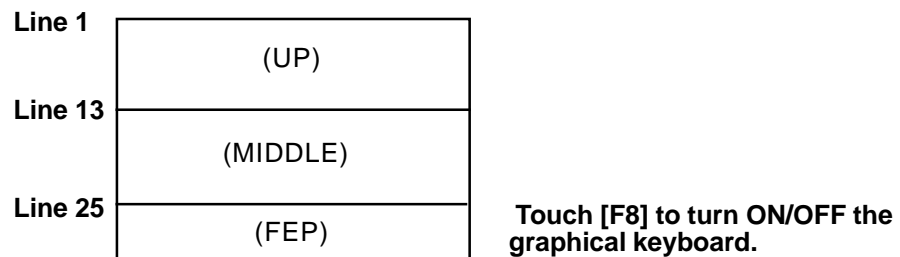
<The structure of KEYEM_PL.EXE>



- To use KEYEM_PL.EXE, HIMEM.SYS and ATPH59.EXE must be installed.
- Install the HIMEM.SYS file for the OS currently in use.

■ Screen Display

The screen is split into two as shown below and the graphical keyboard is displayed in the top or middle section (where the cursor is not residing).



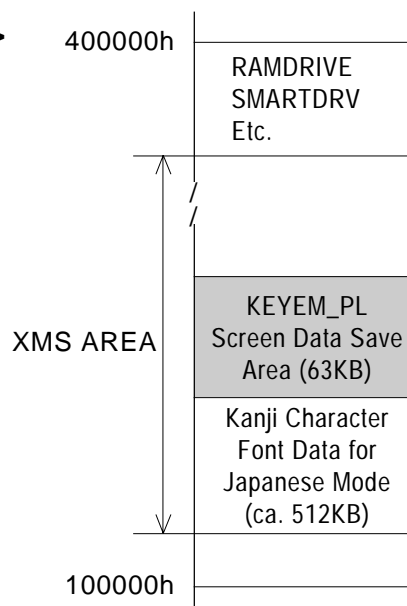
- **The display mode must be the DOS/V-compatible Japanese graphic mode (72h). The graphical keyboard display supports the AX standard Japanese keyboard only. For the actual keyboard display screen, refer to Appendix 5. "Keyboard Emulator Screens".**
- **This function cannot be used in conjunction with the NT-WIN mouse emulator for Windows®. Cancel the resident program before starting up Windows®.**

KEYEM_PL runs on top of ATPH59. To process touch input from ATPH59 with a user application, exclusive control is necessary. Use function A000h and A001h to control the keyboard emulator when key input is necessary. Do not perform touch input processes during key input.

■ Configurations

When the graphical keyboard is displayed, XMS memory is used to temporarily save the contents of the VRAM (63KB). If HIMEM.SYS is not installed, or if the KEYEM_PL screen data save area is not reserved, this program will not start up. When using this program in conjunction with programs that use expanded memory, be sure to reserve enough memory.

<Sample Memory Map>



Chapter 6 - OS Setup

■ Start-up

KEYEM_PL [Parameter] [↵] or KEYEM_PL-r [↵]

* Parameters

- 0[=][**External Key Definition File**] Specifies the external key definition.
- 2 Displays the graphical keyboard in 2-level mode.
- i<n> Sets the software interrupt vector number when calling up functions.
Hexadecimal, Default: n=59
- F Displays the graphical keyboard in 16-level mode.
- T[=]n Specifies the software interrupt vector number used for the Touch Panel function calling.
(Hexadecimal, Default: n=59)
- r Cancel the resident command.



• **Normally parameter specification is not necessary. (Use the default).**

At startup, the following message will appear on the screen.

```
Keyboard Emulator KEYEM_PL.EXE Version X.XX
Copyright (C) 2000 Digital Electronics Corporation
Stay resident.
```

After startup, these commands reside in memory.

■ Functions

KEYEM_PL.EXE includes the following functions and perform the function calls using the software interrupt (INT 16h).

<INT16h Function List>

Function Code	Contents
00h	Key input data read
01h	Key input data check
02h	Shift status read
05h	Keyboard data write
10h	Key input data read (AX keyboard)
11h	Key input data check (AX keyboard)
12h	Shift status read (AX keyboard)
A000h	Keyboard Emulation startup
A001h	Keyboard Emulation interrupt
FE00h	Resident Check

The following data details each function.

Function 00h	Key input data read
---------------------	----------------------------

Reads the input key data.

Input	AH= 00hA
Output	AL= Primary code (character code) AH= Secondary code (scan code)

Function 01h	Key input data check
---------------------	-----------------------------

Detects the data in the keyboard buffer.

Input	AH= 01h
Output	ZF= 0: Readable data in the keyboard buffer. 1: No readable data in the keyboard buffer. AL= Primary code (character code) AH= Secondary code (scan code)

Function 02h	Shift status read
---------------------	--------------------------

Returns the status information of the special keys.

Input	AH= 02h
Output	AL= Shift status Bit 7: Insert key Bit 6: Caps Lock key Bit 5: Num Lock key Bit 4: Scroll Lock key Bit 3: Alt key Bit 2: Ctrl key Bit 1: Shift Left key Bit 0: Shift Right key

Function 05h	The key-in data writing
---------------------	--------------------------------

Writes the data for the CX register settings to the keyboard buffer as input from the keyboard

Input	AH= 05h CL= Primary code (character code) CH= Secondary code (scan code)
Output	AL= Status 0: Successfully completed 1: Aborted (No available space in the keyboard buffer.)

Function 10h Key input data read (AX keyboard)

Reads the input key data. (The function is associated with the AX keyboard.)

Input AH= 10h

Output AL= Primary code (character code)
 AH= Secondary code (scan code)

Function 11h Key input data check. (AX keyboard)

Detects the data in the keyboard buffer.
 (Function is associated with the AX keyboard).

Input AH= 11h

Output ZF= 0: Readable data in the keyboard buffer.
 1: No readable data in the keyboard buffer.
 AL= Primary code (character code)
 AH= Secondary code (scan code)

Function 12h Shift status read (AX keyboard)

Returns the status of the special keys.

Input AH= 12h

Output AL= Shift status
 Bit 7: Insert key
 Bit 6: Caps Lock key (lamp status)
 Bit 5: Num Lock key (lamp status)
 Bit 4: Scroll Lock key (lamp status)
 Bit 3: Alt key
 Bit 2: Ctrl key
 Bit 1: Shift Left key
 Bit 0: Shift Right key
 AH= Shift status
 Bit 7: Alt+Sys key
 Bit 6: Caps Lock key (key status)
 Bit 5: Num Lock key (key status)
 Bit 4: Scroll Lock key (key status)
 Bit 3: Alt Right key
 Bit 2: Ctrl Right key
 Bit 1: Shift Left key
 Bit 0: Shift Right key

Function A000h Key emulation startup

Starts up the key emulation.

Input AX= A000h
 BL= 0: Clears the graphical keyboard
 1: Displays the graphical keyboard in the opposite section to the cursor location.
 2: Displays the graphical keyboard in the top section of the screen
 3: Displays the graphical keyboard in the bottom section of the screen

Output None



With the BL=2 and BL=3 status, the graphical keyboard is not cleared automatically by pressing the [Enter] key. When the cursor makes a vertical movement, the change to the key-icon display position and display scroll check are not performed. In this condition, the ON/OFF status of the key-icon display must be controlled by the application.

Function A001h Key emulation interrupt

Interrupts the key emulation.

Input AX= A001h
 BL= 0: Clears the graphical keyboard
 1: Clears the graphical keyboard (All keys are disabled.)

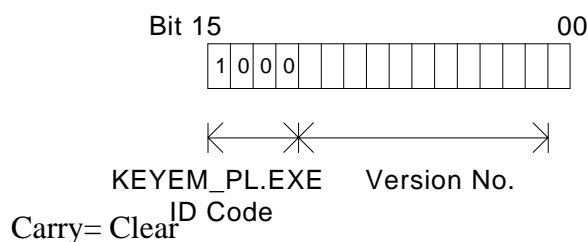
Output None

Function FE00h Resident check

When the KEYEM_PL.EXE application resides in memory, this function returns a fixed message and version information.

Input AX= FE00h

Output AH= 0: Successfully completed
 BL= "Y"
 BH= "C"
 CX= Version number



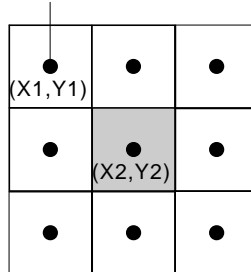
■ **The External Key Definition**

This section explains how to designate a key to arbitrary coordinates with the KEYEM_PL.EXE application.

(Left corner coordinate (X1), Upper corner coordinate (Y1), Right corner coordinate(X2), Lower corner coordinate(Y2))

= the 1st key code [, the 2nd key code [, ...]]; comment line

Touch Panel Coordinates

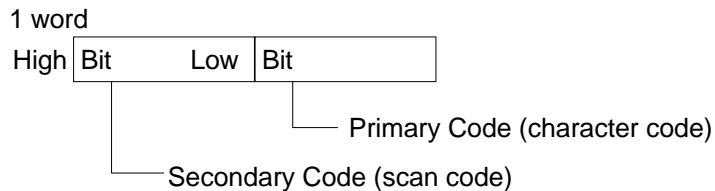


- Designate the values with the touch panel coordinate range in PL-386 compatibility mode (0,1) ~ (30,25).
- If the designated coordinates overlap, the one defined first overrides the other.

If more than two key codes are defined, they operate as if the input occurs in sequence when the coordinated are pressed.

The key code can be defined using the following two methods.

1. Define the key code with 1 word.



* The scan code can be omitted.

2. Define the key code with a character string surrounded by double quotes.



The scan code here is assumed omitted.



- The key codes used in the KEYEM_PL.EXE are as follows.

0x0000: no key input	0x0007: Shift key
0x0001: graphical keyboard ON/OFF	0x0008: Ctrl key
0x0002: reserved	0x0009: Num/Symbol key
0x0003: reserved	0x000A: Japanese/English key
0x0004: Ctrl-Alt-Del	0x000B: ACT key
0x0005: Print key	0x000C: +/- key
0x0006: Pause key	

6.2.4 DISP.EXE (Display ON/OFF Program)

This application turns the display, including the backlight, ON or OFF.

■ Start-up

DISP ON [↵] or DISP OFF [↵]

The command's execution result is set on the MS-DOS ERROR LEVEL. ERROR LEVELS are as follows.

ERROR LEVEL	Description
0	Successfully completed
1	Expansion BIOS (INT 5Fh) error
-1	Other (command parameter, etc.) error

6.2.5 BLSETEXE (Backlight Burnout Detection Program)

This application detects if the backlight has burned out.

■ Start-up

BLSETON [↵] or BLSETOFF [↵]

ON means the detection of the backlight burnout is enabled.

OFF means the detection is disabled.

For detection setting details, refer to Appendix 2 RAS Feature.

Memo

Chapter

7 Maintenance and Inspection

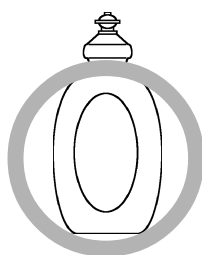
7-1 Regular Cleaning

7-2 Replacing the Backlight

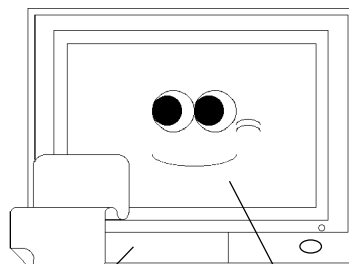
7-3 Periodic Maintenance Points

7.1 Regular Cleaning

7.1.1 Cleaning the Display

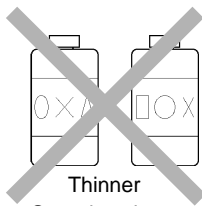


Neutral detergent

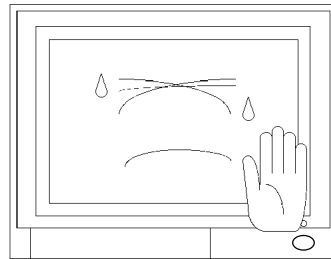


Maintenance panel Display

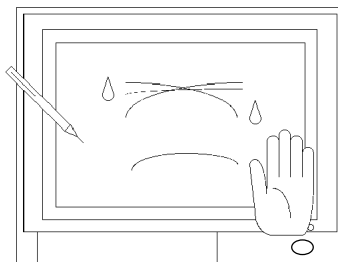
When the display surface or frame become dirty, use a soft cloth moistened with neutral detergent to wipe away any dust or stains.



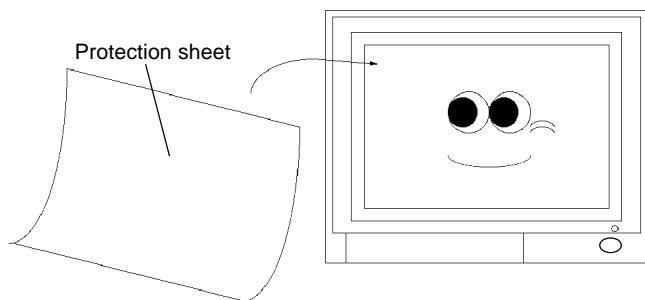
Thinner
Organic solvent
Strong acid



Do not clean the unit with thinner, organic solvents, or strong acids.



Do not use sharp or hard objects, such as a mechanical pencil or screwdriver, to push on the display. This could damage the unit.



Protection sheet

Use the screen protection sheet when using the PL in extremely dirty or dusty areas.

7.1.2 Replacing the Installation Gasket

The installation gasket protects the PL and improves its water resistance. For instructions on installing the PL's gasket.

Reference 4-2 *Installing the PL*



A gasket which has been used for a long period of time may have scratches or dirt on it, and could have lost much of its water resistance. Be sure to change the gasket periodically (or when scratches or dirt become visible).

7.2 Replacing the Backlight

The PL's backlight can be changed after it wears out. Follow the steps explained below.



Please use the following table to identify which backlight model number to use when ordering your backlight.

PL Type	Backlight Type
PL-5900T	GP577RT-BL00-MS
PL-5901T	

WARNINGS

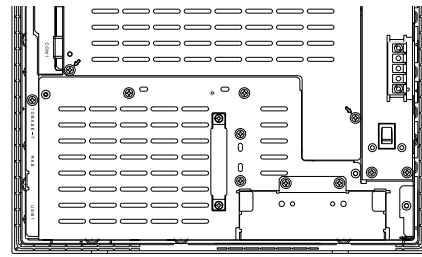
- **Whenever changing the backlight, be sure the PL's power cord has been disconnected and that the unit is cooled down.**
- **When the PL's power cord is connected and the PL is ON, high voltage runs through the wires in the backlight area—*do not touch them!***
- **When the PL's power has just been turned OFF, the backlight area is still very hot! Be sure to wear gloves to prevent being burned.**
- **Do not try to replace the backlight while the PL is installed in a cabinet or panel. Remove the PL first, then begin the backlight replacement procedures.**
- **Be careful when handling the backlight, since it is made of glass and very fragile.**

Follow the steps given below to change the PL's backlight. Be sure to wear cotton gloves when performing this work to prevent burns.

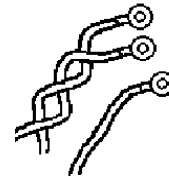
- 1) Unplug the PL's power cord from the main power supply and then disconnect the PL power cord terminals from the PL's power terminal block.



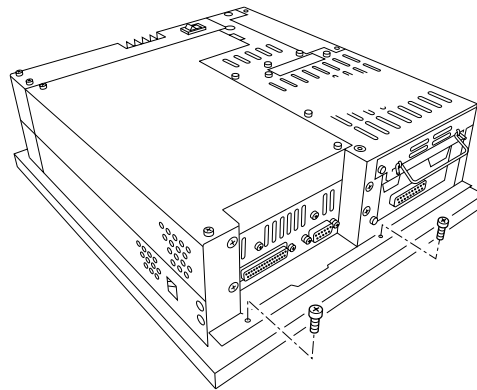
Be sure to perform the backlight changeover on a flat, level surface. This will prevent damage to the PL unit and the accidental cutting of any of its power cord terminals.



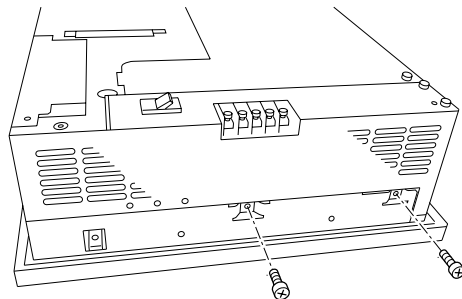
Power Cord



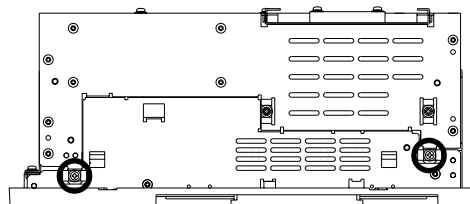
- 2) Remove the power cord.
- 3) Unscrew and remove the two (2) attachment screws from the right side of the PL.



- 4) Unscrew and remove the two (2) attachment screws from the left side of the PL.

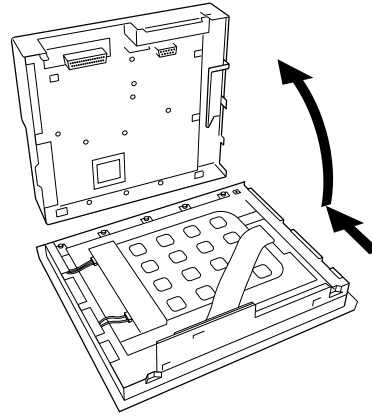


- 5) Unscrew and remove the two (2) attachment screws from the bottom of the PL.



Chapter 7 - Maintenance and Inspection

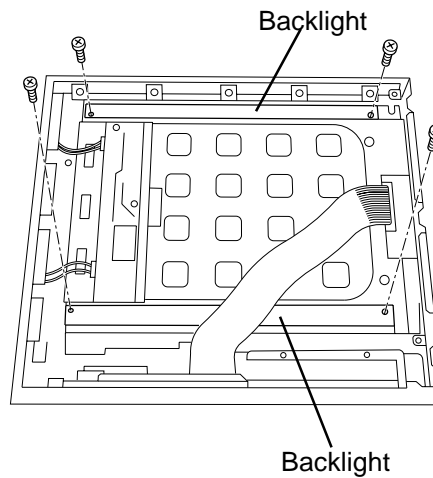
- 6) Slide the rear cover to the top side.
- 7) Lift up the rear face and remove it from the front face.



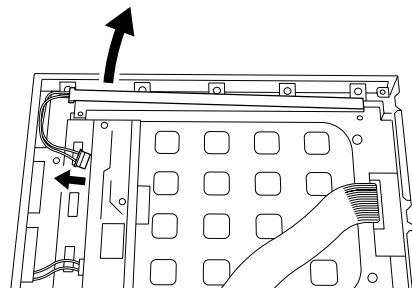
- 8) Unscrew and remove the four (4) attachment screws securing the backlight.



- **Use a “0” sized Phillips screwdriver to remove the backlight attachment screws.**
- **Be careful not to lose the screws.**
- **Be careful when removing the screws so that they do not fall inside the PL, since they may cause the unit to malfunction.**



- 9) Remove the connector from the inverter board.
- 10) Lift up the backlight and slowly pull the unit out of the PL.



- 11) Insert the replacement backlight by reversing the removal procedure. Secure the replacement backlight with the screws and insert the connector to the inverter board.



- ***The PL's backlights are installed at the top and bottom of the LCD panel. Whenever you change a backlight, be sure to change both backlights.***
- ***Be sure to insert the connector to the inverter board and push it until its rear connector is securely connected, or it may cause damage.***

12) Reattach the PL rear unit to the PL front unit, using the PL's guide slots, i.e. reverse the procedure use to separate them.

Be careful not to catch or cut any of the PL's internal cables while reattaching the two units.

13) Replace the four (4) attachment screws removed in step 1) and 2).

7.3 Periodic Maintenance Points

Check the PL periodically to ensure it is in good working condition.

Ambient environment check

- Is the ambient temperature within the specified range?
(0°C to 45°C - without HDD unit, 5°C to 45°C - with HDD unit)
- Is the ambient humidity within the specified range (30%RH to 85 %RH) ?
- Is the atmosphere free of corrosive gas ?

Electrical specifications check

- Is the voltage adequate (AC85V to AC132V, 50/60 Hz or DC19.2V to DC28.8V)?

Installation check points

- Is the connection cable firmly connected (not loose) ?
- Are any bolts or screws loose ?
- Are there any flaws or tears in the moisture resistant gasket ?

Display check

- Is the display bright enough ?



When the PL's Standard Display's backlight needs to be replaced, please contact your local PL distributor.



Appendices

- A-1 Hardware Configuration
- A-2 RAS Feature
- A-3 Serial Communication
- A-4 Touch Panel Handler Program
- A-5 BIOS List

A.1 Hardware Configuration

The following data explains the design of the I/O Map, Memory Map and Interrupt Map, as well as additional hardware design items including the RAS feature.

A.1.1 I/O Map

Address	AT System Device	System Device
0000H - 001FH	DMA controller (8237)	
0020H - 003FH	Interrupt controller (8259A)	
0040H - 005FH	System timer (8254)	
0060H - 006FH	Keyboard (H8/3332)	
0070H - 007FH	Real-time clock, NMI mask	
0080H - 009FH	DMA bank register	
00A0H - 00BFH	Interrupt controller 2 (8259A)	
00C0H - 00DFH	DMA controller 2 (8237)	
00F0H - 00FFH	Numeric data processor	
016CH - 016FH	Used by Main Board	
01F0H - 01FFH	Hard disk (IDE)	
0200H - 0207H	Game I/O *1	
0295H - 0296H	Used by Main Board	
02E8H - 02EFH	Serial Port 4 (COM4): Touch Panel	Touch Panel
02F8H - 02FFH	Serial port 2 (COM2) : General Use	
0378H - 037FH	Parallel port 2 (LPT2)	
03B0H - 03BBH	Video controller (VGA)	
03BCH - 03BFH	Parallel port 1 (LPT1) Printer	
03C0H - 03DFH	Video controller (VGA)	
03E8H - 03EFH	Serial port 3 (COM3): Reserved	RS-485
03F0H - 03F7H	Floppy disk controller	
03F8H - 03FFH	Serial port 1 (COM1) :General Use	

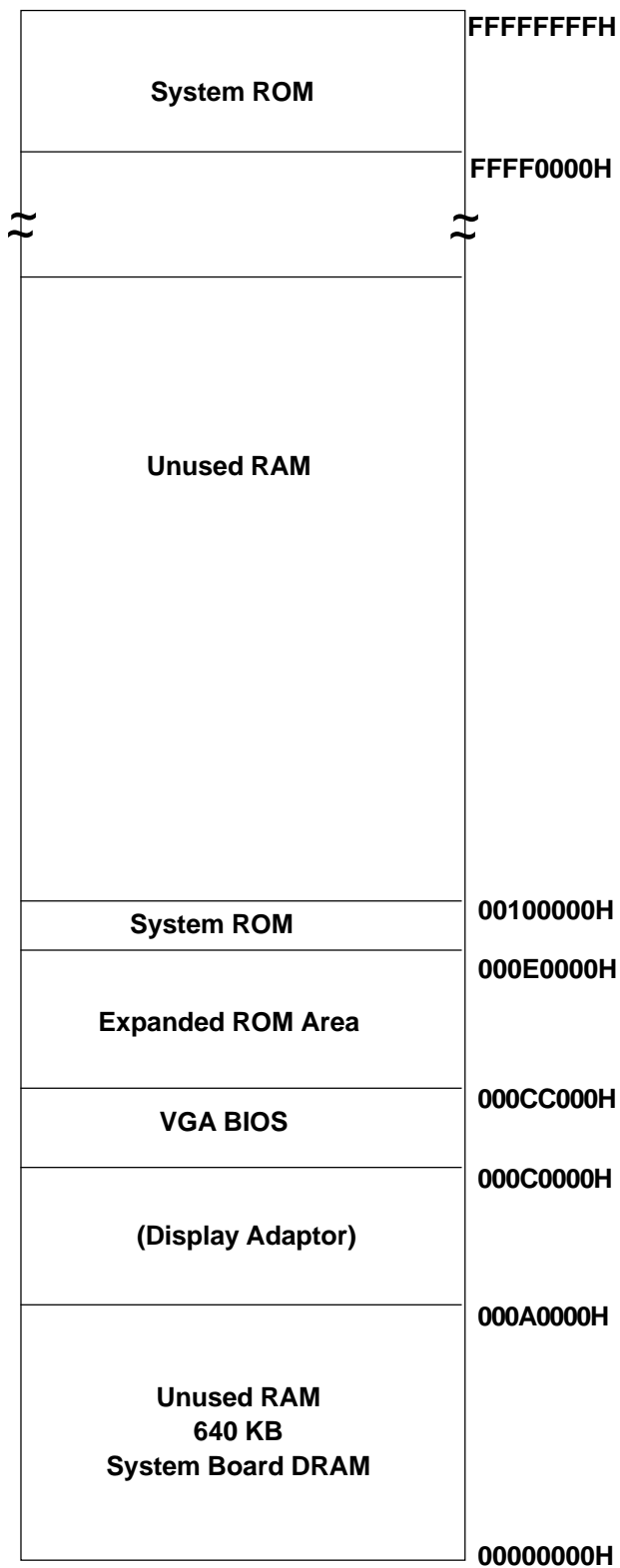
*1 This device is not supported by the system, but is reserved as standard.



Depending on the arrangement of any connected Plug-and-Play devices, these features perform different functions/actions.

Appendices

A.1.2 Memory Map



A.1.3 Interrupt Map

■ Hardware Interrupt List

	Description
NMI 0	Parity Error or I/O Channel Check
IRQ 0	Timer (in the Chipset)
IRQ 1	Keyboard
IRQ 2	Cascade from Controller 2
IRQ 3	Serial Port 2 (COM2): General Use Port
IRQ 4	Serial Port 1 (COM1): General Use Port
IRQ 5	Serial Bus Controller
IRQ 6	Floppy Disk Controller
IRQ 7	Parallel Port 1 (LPT1) : Printer Port
IRQ 8	Real Time Clock
IRQ 9	ACPI Controller
IRQ 10	Serial Port 4 (COM4): Touch Panel (for Standard monitor)
IRQ 11	Serial Port 3 (COM3): General Use Port
IRQ 12	Network Controller
IRQ 13	Numeric Data Processor
IRQ 14	Hard Disk (IDE)
IRQ 15	Available for users



Important

Depending on the arrangement of any connected Plug-and-Play devices, these features perform different functions/actions.

■ DMA Channel List

	Description	
DMA 0		For 8-bit transmission
DMA 1		
DMA 2	Floppy disk controller	
DMA 3		For 16-bit transmission
DMA 4	Cascade to controller 1	
DMA 5		
DMA 6		
DMA 7		

A.2 RAS Feature

A.2.1 PL's RAS Features

RAS, which stands for Reliability, Availability and Serviceability, is a device-level monitoring function that provides a variety of features to improve the reliability of your PL system.

Though the standard set of RAS features used will vary depending on the devices used, the following features are used to provide Alarm Monitoring and External Input Signal support.

Alarm Monitoring	Power Voltage Alarm Cooling Fan Alarm Internal Temperature Alarm Watchdog Timer Time Up Mirror Disk Alarm ^{*1} Backlight Burnout Detection Touch Panel Alarm
External Input Signal	Standard Signal Input (DIN 2 bit) Remote Reset Input ^{*2}

Also, when either the one of the above mentioned alarms occurs, or an external signal input is received, the following types of alarm processing output signals and features are supported.

External Output Signal	Standard Signal Output (DOUT 1 bit) Alarm Output (1 point) Lamp Output (1 point)
Types of Processing (all units)	LED Indicator (3-state display – 1 point) Pop-up Message Output Buzzer Output System Shutdown

Furthermore, using the PL's System Monitor feature ^{*3} (included in the PL's software utility disk), allows the easy setting and control (Enable/Disable) of the aforementioned Alarm Monitor and External Input Signals.

Last, the system monitor feature's use of an Application Link Library (API-DLL) allows it to also be used with other applications.

**1 When a Mirror Disk Alarm occurs and the standard RAS feature settings are used, the alarm output is limited to the Mirror Disk unit's LED indicator. (Alternately flashing orange and green)*

**2 The remote reset feature's input can be either enabled or disabled, the alarm output setting cannot be set to trigger a forced system reset.*

**3 For System Monitor Feature details, refer to the accompanying Driver and Utility disk.*

A.2.2 RAS Feature Details

■ Alarm Monitoring

◆ Power Voltage Alarm

Monitors the condition of the PL's internal and CPU power.

◆ Cooling Fan Alarm

Monitors the condition of the PL's internal power and CPU cooling fans.

◆ Internal Temperature Alarm

Monitors the PL's internal and CPU vicinity temperatures.

The degree of monitoring (3 levels) and the enabling or disabling of the above three items is performed via the System Setup Area's settings.

For detailed information about the monitoring level settings,

Reference *5.2.12 PC Health Status*

This utility can also be used to enable or disable the above mentioned features, as well as designate what type of processing is to be performed.

◆ Watchdog Timer Time Up

This feature alternately writes Time Up Count values from the CPU to the RAS feature's special programmable timer and then periodically clears them, which provides a means of monitoring the CPU's performance. If the clearing of this count value is stopped, the timer will overflow and an alarm will be detected. The System Monitor utility can be used to enable or disable this feature, as well as designate what type of processing is to be performed.

Reference *5-2-7 Power Management Setup*

◆ Mirror Disk Alarm

Whenever a disk crash, or other alarm event occurs to the optional Mirror Disk unit, this unit's LED indicator will flash (either orange or green) to indicate there is a problem.

This unit's error detection occurs independently of and cannot be set by the RAS feature.

◆ Backlight Burnout Detection

This feature allows you to detect when the PL's backlight burns out.

When this feature is enabled and a backlight burnout occurs, touch operation will be disabled and PL's front panel LED indicator will blink. The factory setting is "Enabled" and is recommended to prevent accidental touch panel operation. This setting is controlled via the MS-DOS utility BLSET.EXE.

◆ Touch Panel Alarm

This feature detects a Touch Panel alarm. When this alarm occurs, the PL unit's front panel LED indicator will blink.

Appendices

■ External Input Signal

The PL's RAS interface connector uses the following input signals.

Standard Signal Input (DIN)

This standard digital input is used for alarm detection in external devices. The input signal uses two bits.

The System Monitor utility can be used to enable or disable this feature, as well as designate what type of processing is to be performed once a signal is received.

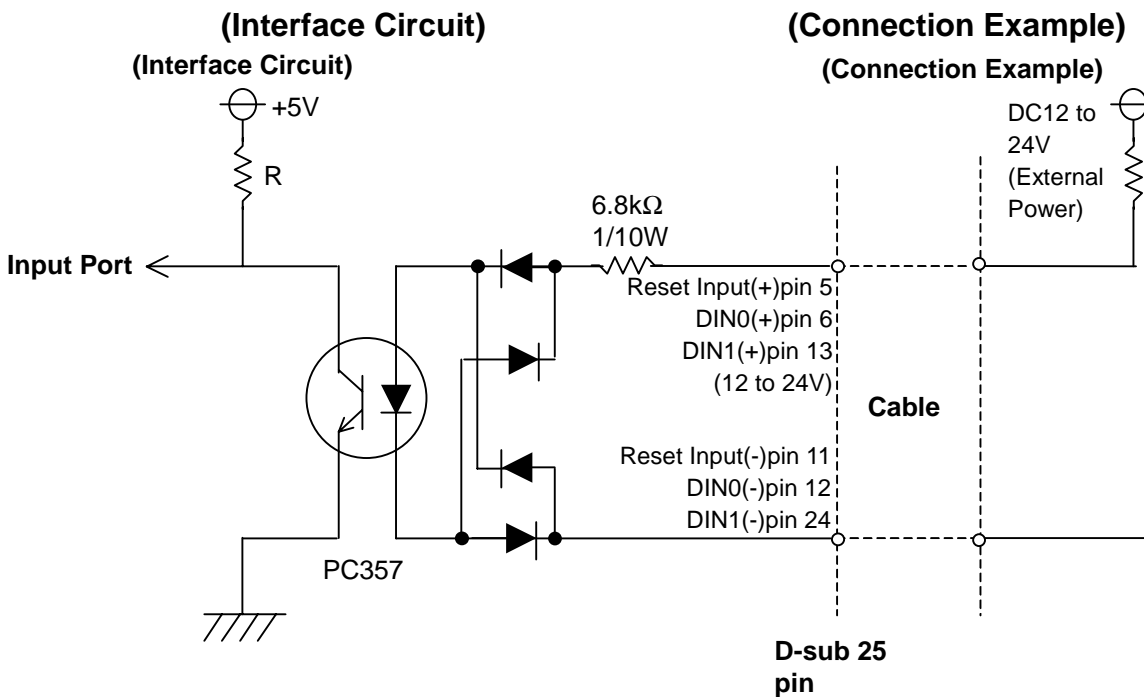
Remote Reset Input

This is the reset signal sent from an external device to the PL. When this signal is enabled, a forced reset of the PL is performed.

The System Monitor utility can be used to enable or disable this feature

External Input Signal (for both DIN and Remote Reset Input)

- External Power DC12V to DC24V connections are possible
- Input Protection Protection Diode
- Isolation Used (photo-isolation)



- The Power supply used for sink/source type input can use either polar or non-polar connection.

- For connection pin location details,

Reference 2.3.5 RAS Interface

■ External Output Signal

The PL's RAS interface connector uses the following output signals.

General Purpose Signal Output (DOUT)

This general purpose digital output signal provides system condition information to external devices.

The System Monitor's API-DLL are used by applications to control this signal.

Alarm Output (1 point)

Lamp Output (1 point)

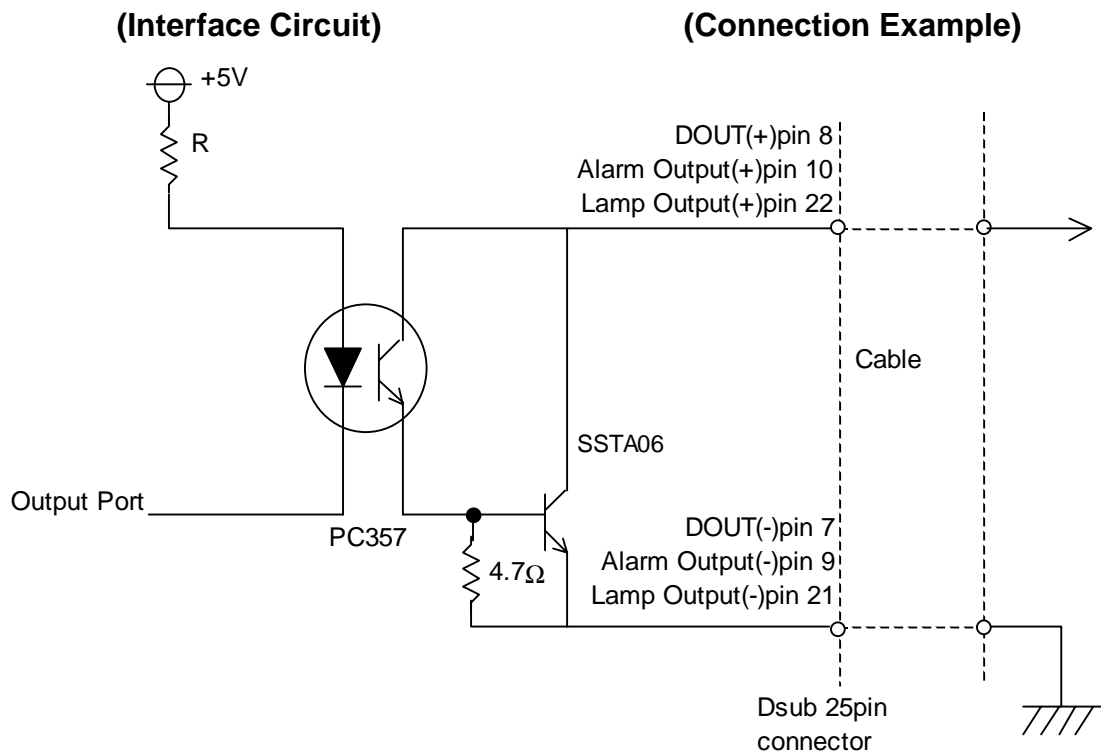
The above mentioned general purpose digital output signals provide system condition information to external devices.

The System Monitor utility can be used to enable or disable any of these output signals.

Also, when alarm output is enabled, the orange colored LED indicator will also blink.

External Output Signal (used for DOUT, Alarm Output, Lamp Output)

- Output Specification DC24V 100mA (MAX)
- Isolation Used (photo-isolation)



For connection pin location details,
Reference 2.3.5 RAS Interface

Appendices

■ Types of Processing (all units)

The PL provides system condition information via the following methods.

LED Indicator (3-state display – 1 point)

In addition to indicating if the unit's power is ON or OFF, the 3-state LED indicator (power lamp) provides the following system condition information.

Color	System Condition	Output Created
Green	Normal Operation (Power ON)	None
Orange	RAS has detected a system alarm.	The alarm output set in the system monitor is enabled.
Flashing Red/Green	Mirror Disk and Backlight alarms have occurred	Any TOOL settings are enabled.
Flashing Orange/ Green	Mirror Disk Alarm has occurred	None
Flashing Orange/Red	Backlight Alarm has occurred	Any TOOL settings are enabled.

Pop-up Message Output

This feature uses the Windows® system's pop-up message feature to indicate that an alarm has occurred.

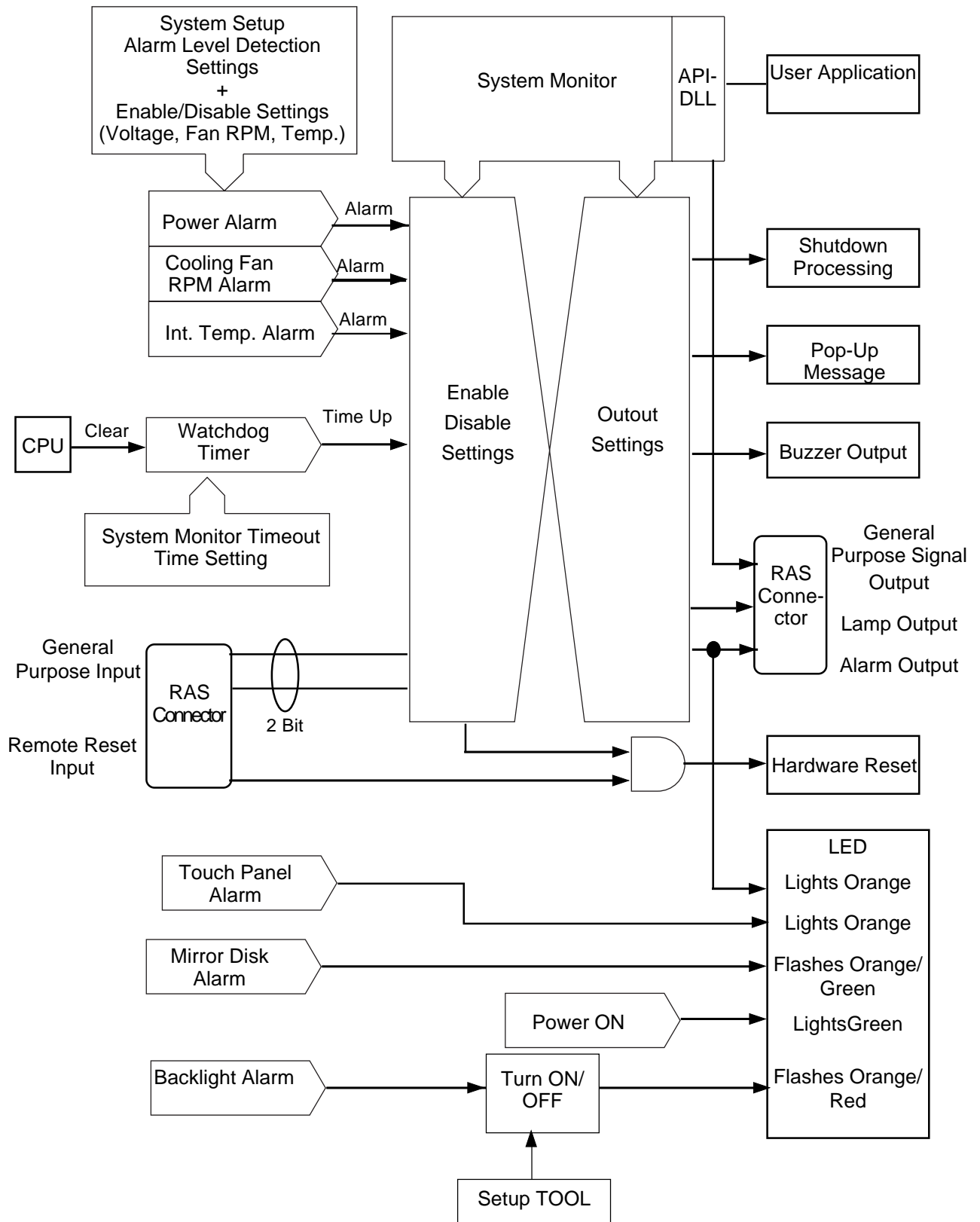
Buzzer Output

This feature uses the PL's internal speaker to indicate the system's condition.

System Shutdown

This feature shuts down the PL's OS (Windows® 95/ Windows® 98 Second Edition). The System Monitor utility can be used to enable or disable this feature.

A.2.3 RAS Feature Overview



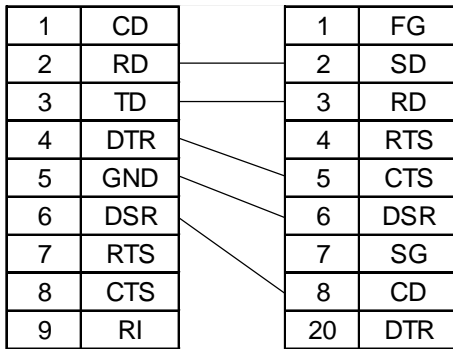
A.3 Serial Communication

This section explains how to perform serial communications with the PL.

■ RS-232C (COM1/COM2) Cable Connections

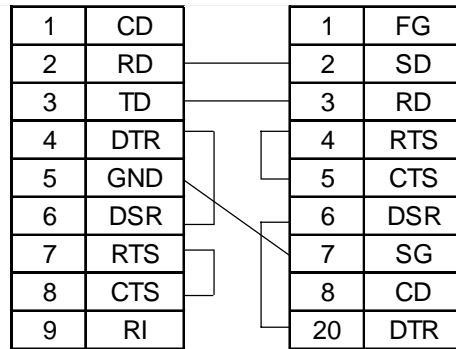
<Example 1>

PL Dsub 25-pin



<Example 2>

PL Dsub 25-pin



■ Sample output program

Below is a sample program for sending 1 character from the RS-232C connector.



Note:

Because the PL uses an AT-compatible BIOS, the serial communication BIOS (INT 14 h) does not support communications by interrupt. Therefore, install a reception interrupt function in the application.

```
#include <stdio.h>
#include <dos.h>

union    REGS    ir,or;

main( ){
    ir.h.ah    =    0x00 ;    /* Initialization */
    ir.h.al    =    0xe3 ;    /* 9600bps,8bit,NONE,1stop */
    ir.x.dx    =    0 ;    /* COM1 */
    int86 (0x14,&ir,&or) ;

    ir.h.ah    =    0x01 ;    /* 1 character output */
    ir.h.al    =    0x32 ;    /* '2' */
    ir.x.dx    =    0 ;    /* COM1 */
    int86 (0x14,&ir,&or) ;
}
```



Note:

Changing commands or parameters also changes function (mode setting, data reception, etc.).

A.4 Touch Panel Handler

The following sample program was created with the ATPH59.EXE (Touch Panel Handler) application.

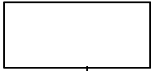
Sample Program made with the Touch Panel Handler

Compiler Method
cl sample.c

If not adding GRAPHICS.LIB to SLIBCE.LIB, add **/link graphics.lib**.

F1	F2	F3	F4	F5	F6	F7	F8
-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------

Please press one of the touch panel keys.
Pressing either "Z" or on the square shown to the right, will quit this program.



"Quit" key

1	2	3	4	5	6	7	8	9	0	.	+	BS	ENT
---	---	---	---	---	---	---	---	---	---	---	---	----	-----

Function Key area

This sample program is designed to perform processing based on the touch panel input received from either the upper or lower function keys, or the screen's designated Quit key area.

```

/* This sample program is used by the ATPH59.EXE touch panel handler.
 * Input can be performed by pressing on designated areas of the screen.
 * Before starting this program, be sure to start the ATPH59.EXE program
 */

```

```

#include <stdlib.h>
#include <stdio.h>
#include <dos.h>
#include <graph.h>
#include <conio.h>

```

Appendices

```
#define ATPH_SYS_CALL 0x59          /* ATPH System Call */
#define KEYBOARD_BIOS 0x16         /* Key Board BIOS */
#define WRITE_DATA 0x05           /* Key Board Input */
#define TP_IN_NOWAIT 0x8101       /* ATPH Input */
#define TP_CONDITION 0x8500       /*TouchPanelCondition*/

#define ZKEYCODE 0x7a             /* "Z" keycode */
#define DATA8254 0x40            /* Timer Data */
#define CTRL8254 0x43             /* Timer Controller */
#define CTRL8042 0x61             /* Buzzer ON/OFF */
#define BEEP_TIME 20000          /* Beep's ON period */

#define FALSE 0
#define TRUE 1

struct function_coordinate
{
    short sx;                     /* X coordinate (left,upper) */
    short sy;                     /* Y coordinate (left,lower) */
    short ex;                     /* X coordinate (Right Upper) */
    short ey;                     /* Y coordinate (Right,lower) */
    short key;                    /* Key Code */
}

tpcd [] =
{
    480, 40, 559, 80, 0x2c7a,     /* Square's display */

    1, -40, 79, -1, 0x1e61,      /* Function Sheet F1 */
    80, -40, 159, -1, 0x3062,    /* Function Sheet F2 */
    160, -40, 239, -1, 0x2e63,   /* Function Sheet F3 */
    240, -40, 319, -1, 0x2064,   /* Function Sheet F4 */
    320, -40, 399, -1, 0x1265,   /* Function Sheet F5 */
    400, -40, 479, -1, 0x2166,   /* Function Sheet F6 */
    480, -40, 559, -1, 0x2267,   /* Function Sheet F7 */
    560, -40, 639, -1, 0x2368,   /* Function Sheet F8 */
}
```

```

1, 479, 39, 519, 0x0231, /* Function Sheet 1 */
40, 479, 79, 519, 0x0332, /* Function Sheet 2 */
80, 479, 119, 519, 0x0433, /* Function Sheet 3 */
120, 479, 159, 519, 0x0534, /* Function Sheet 4 */
160, 479, 199, 519, 0x0635, /* Function Sheet 5 */
200, 479, 239, 519, 0x0736, /* Function Sheet 6 */
240, 479, 279, 519, 0x0837, /* Function Sheet 7 */
280, 479, 319, 519, 0x0938, /* Function Sheet 8 */
320, 479, 359, 519, 0x0a39, /* Function Sheet 9 */
360, 479, 399, 519, 0x0b30, /* Function Sheet 0 */
400, 479, 439, 519, 0x342e, /* Function Sheet . */
440, 479, 479, 519, 0x272b, /* Function Sheet + */
480, 479, 559, 519, 0x0e08, /* Function Sheet BS */
560, 479, 639, 519, 0x1c0d, /* Function Sheet ENT*/
0, 0, 0, 0, 0
};

```

struct key_code

```

{
    char keyname[3]; /* Touch Key Name */
    short keycode; /* Key Code */
}

kbcd[]=
{
    " Z ", 0x7a, /*Display Square */

    " A ", 0x61, /* Function Sheet F1 */
    " B ", 0x62, /* Function Sheet F2 */
    " C ", 0x63, /* Function Sheet F3 */
    " D ", 0x64, /* Function Sheet F4 */
    " E ", 0x65, /* Function Sheet F5 */
    " F ", 0x66, /* Function Sheet F6 */
    " G ", 0x67, /* Function Sheet F7 */
    " H ", 0x68, /* Function Sheet F8 */

```

Appendices

```
" 1 ", 0x31, /* Function Sheet 1 */
" 2 ", 0x32, /* Function Sheet 2 */
" 3 ", 0x33, /* Function Sheet 3 */
" 4 ", 0x34, /* Function Sheet 4 */
" 5 ", 0x35, /* Function Sheet 5 */
" 6 ", 0x36, /* Function Sheet 6 */
" 7 ", 0x37, /* Function Sheet 7 */
" 8 ", 0x38, /* Function Sheet 8 */
" 9 ", 0x39, /* Function Sheet 9 */
" 0 ", 0x30, /* Function Sheet 0 */
" . ", 0x2e, /* Function Sheet . */
" + ", 0x2b, /* Function Sheet + */
"B S", 0x08, /* Function Sheet BS */
"ENT", 0x0d, /* Function Sheet ENT*/
0, 0
};
```

```
union REGS inregs, outregs;
```

```
/*******/
/* BUZZER ON */
/*******/
void buzzer_on(void)
{
    int timer;

    outp (CTRL8253, 0xb6);
    outp (DATA8253+2, 0x33);
    outp (DATA8253+2, 0x05); /* Length of buzzer sounding */

    outp (CTRL8042, ((inp(CTRL8042) | 0x3) & 0xff));
    /* Buzzer On */

    for (timer = 0 ; timer<BEEP_TIME; timer++);
}
```

```

/*****/
/* BUZZER OFF */
/*****/

void buzzer_off(void)
{
    outp (CTRL8042, (inp(CTRL8042) & 0xfc));    /* Buzzer Off    */
}

/*****/
/* WAIT TOUCHPANEL OFF */
/*****/

void wait_touch_off(void)
{
    while(1)
    {
        inregs.x.ax = TP_CONDITION;
        int86(ATPH_SYS_CALL, &inregs, &outregs);

        if(outregs.h.ah == 3)                /* Touch Panel Off */
        {
            break;
        }

        else if(outregs.h.ah == 0)          /* Touch Panel On  */
        {
            inregs.x.ax = TP_IN_NOWAIT;
            int86(ATPH_SYS_CALL, &inregs, &outregs);
                                                    /* ATPH Function Call*/
        }
    }
}

```


Appendices

```

/*****
/* INPUT TUCHPANEL */
*****/

void touchpanel_on(void)
{
    int i, value;

    inregs.x.ax = TP_IN_NOWAIT;
    int86(ATPH_SYS_CALL, &inregs, &outregs);

    if(outregs.h.ah == 0)                /* Touch Panel On */
    {
        value=FALSE;
        for(i=0; tpcd[i].sx; i++)
        {
            if(                          /* Time in area */
                ((short)outregs.x.dx > tpcd[i].sx)&&
                ((short)outregs.x.bx > tpcd[i].sy)&&
                ((short)outregs.x.dx < tpcd[i].ex)&&
                ((short)outregs.x.bx < tpcd[i].ey))
            {
                inregs.h.ah = WRITE_DATA;
                inregs.x.cx = tpcd[i].key;
                int86(KEYBOARD_BIOS, &inregs, &outregs);

                buzzer_on();
                wait_touch_off();
                buzzer_off();
                value=TRUE;
                break;
            }
        }
    }
}

```

```

        if(value == FALSE)                /* time out (of) area    */
        {
            wait_touch_off();
        }
    }
}

/*****
/* KEYBOARD INPUT*/
*****/
int keyboard_on(void)
{
    int i, ky;

    if(kbhit())
    {
        ky=getch();
        for(i=0; kbcd[i].keycode; i++)
        {
            if(ky == kbcd[i].keycode)
            {
                printf("push key is [%s]. \r",kbcd[i].keyname);
                if(ky == ZKEYCODE)
                {
                    printf(" push [%s]key. finishprogram. \n",kbcd[i].keyname);

                    return(TRUE);        /* Program End    */
                }
                break;
            }
        }
    }
    return(FALSE);
}

```

Appendices

```
/******  
/* MAIN VARIABLES */  
/******  
void main(void)  
{  
    if(!(_setvideomode(_VRES16EXCOLOR)))  
    {  
        printf("error: can't set graphics mode ");  
  
        exit(1);                /* ERROR:Program End */  
    }  
    _rectangle(_GBORDER,tpcd[0].sx,tpcd[0].sy,tpcd[0].ex,tpcd[0].ey);  
                                /* MAKE A SCREEN FRAME    */  
    printf("please push touchpanel or key \n");  
    printf("End program by pressing [ Z ]key or screen. \n");  
  
    while(1)  
    {  
        touchpanel_on();  
        if(keyboard_on())  
        {  
            _setvideomode(_DEFAULTMODE);    /* RETURN TO VIDEOMODE */  
            exit(0);  
        }  
    }  
}
```

A.5 BIOS List

■ INT 5h Display Hard Copy

Operation	Input	Output
Screen hard copy		0050:0000h Print-screen flag 0: Hard copy function unused or completed successfully 1: Now printing -1: Error

■ INT 10h Video BIOS

Operation	Input	Output
Setting video mode	AH = 00h AL = Value of selected mode (Bits 0 to 6), Video RAM clear (Bit 7)	
Setting cursor shape	AH = 01h CG = Cursor start position and display CL = Cursor end position	
Setting cursor position	AH = 02h BH = Page No. DH = Value of specified line DL = Value of specified column	
Reading cursor position	AH = 03h BH = Page No.	CH = Cursor start position and display CL = Cursor end position DH = Current cursor line position DL = Current cursor column position
Reading light pen position	AH = 04h	AH = 0: Light pen switch is off. = 1: Light pen switch is on. BX = X coordinate (0 - 319, 639) CH = Y coordinate (0 - 199) CX = Y coordinate in new graphic mode (0, XXX) DH = Light pen line position in character units DL = Light pen column position in character units
Switching active page	AH = 05h AL = Page No.	
Scrolling up	AH = 06h AL = Number of lines to scroll up BH = Attribute of line to clear CH = Highest line in scroll up range CL = Farthest left column in scroll up range DH = Lowest line in scroll up range DL = Farthest right column in scroll up range	
Scrolling down	AH = 07h AL = Number of lines to scroll down BH = Attribute of line to clear CH = Highest line in scroll down range CL = Farthest left column in scroll down range DH = Lowest line in scroll down range DL = Farthest right column in scroll down range	

Appendices

Operation	Input	Output
Reading character/attribute at cursor position	AH = 08h BH = Page No.	AL = Character code AH = Attribute (In text mode)
Writing character/attribute at cursor position	AH = 09h AL = Character code BH = Page No. BL = Attribute CX = Number of characters to output	
Writing character at cursor position	AH = 0Ah AL = Character code BH = Page No. BL = Attribute (Effective only in graphic mode) CX = Number of characters to output	
Color Pallet Settings		
Setting overscan, background color, and display color brightness	AH = 0Bh BH = 00h BL = Color code	
Setting color group	AH = 0Bh BH = 01h BL = Color group	
Writing point in graphic mode	AH = 0Ch AL = Attribute BH = Page No. CX = X coordinate DX = Y coordinate	
Reading point in graphic mode	AH = 0Dh BH = Page No. CX = X coordinate DX = Y coordinate	AL = Attribute
Writing character/attribute at cursor position and move cursor	AH = 0Eh AL = Character code BL = Attribute (Effective only in graphic mode)	
Reading video data	AH = 0Fh	AH = Number of single lines AL = Video mode BH = Active page No.
Setting pallet register		
Setting pallet register	AH = 10h AL = 00h BH = Pallet code BL = Pallet register No.	
Setting overscan register	AH = 10h AL = 01h BH = Pallet code	
Setting pallet register and overscan register	AH = 10h AL = 02h ES:DX= 17-byte data address	
Setting attribute code intensity/blink	AH = 10h AL = 03h BH = 00h: Set attribute bit 7 to intensity function. = 01: Set attribute bit 7 to blink function.	
Reading basic pallet register	AH = 10h AL = 07h BL = Basic pallet register to read (0 - 15)	BH = Value read

Appendices

Operation	Input	Output
Setting pallet register		
Reading overscan register	AH = 10h AL = 08h	BH = Value read
Reading basic pallet register and overscan register	AH = 10h AL = 09h ES:DX = 17-byte buffer in which return value is located	
Setting expansion pallet register	AH = 10h AL = 10h BX = Selected expansion pallet register DH = Red value CH = Green value CL = Blue value	
Setting block in expansion pallet register	AH = 10h AL = 10h ES:DX = Color value table BX = First expansion pallet register to set CX = Number of blocks set in expansion pallet registers	
Selecting pallet page mode	AH = 10h AL = 12h BL = 00h BH = Pallet page mode = 00h: 4-pallet page mode = 01h: 16-pallet page mode	
Selecting pallet page	AH = 10h AL = 13h BL = 01h BH = Expansion pallet page No.	
Reading expansion pallet register	AH = 10h AL = 15h BX = Expansion pallet register to read	
Reading block in expansion pallet register	AH = 10h AL = 17h ES:DX = Buffer address of value to read BX = Expansion pallet address No. where to start reading CX = Number of registers to read	Buffer selected in ES:DX
Reading pallet page	AH = 10h AL = 17h	BL = Current pallet page mode = 0: 4-pallet page mode = 1: 16-pallet page mode BH = Current expansion pallet pagemode
Gray scale conversion	AH = 10h AL = 1Bh BX = First expansion pallet register CX = Number of expansion pallet registers to convert	
Font registration		
Font registration of user-defined character	AH = 11h AL = 00h BH = Number of vertical bits in character BL = Character generator bank No. CX = Number of characters to register DX = First character code to register ES:BP = Top address in user-defined table	

Appendices

Operation	Input	Output
Font registration		
8 x 14 dot font registration (PC character set, inside video BIOS ROM)	AH = 11h AL = 01h BL = Character generator bank No.	
8 x 8 dot font registration (PC character set, inside video BIOS ROM)	AH = 11h AL = 021h BL = Character generator bank No.	
Overwriting character map register	AH = 11h AL = 03h BL = Character map register value	
8 x 16 dot font registration (PC character set, inside video BIOS ROM)	AH = 11h AL = 04h BL = Character generator bank No.	
Font registration of user- defined character (Video controller auto set)	AH = 11h AL = 10h BH = Number of vertical bits in character (Horizontal fixed to 8 bits) BL = Character generator bank No. CX = Number of characters to register DX = First character code to register ES:BP = Top address in user-defined table	
8 x 14 dot font registration (PC character set, inside video BIOS ROM) [Video controller auto set]	AH = 11h AL = 11h BL = Character generator bank No.	
8 x 8 dot font registration (PC character set, inside video BIOS ROM) [Video controller auto set]	AH = 11h AL = 12h BL = Character generator bank No.	
8 x 16 dot font registration (PC character set, inside video BIOS ROM) [Video controller auto set]	AH = 11h AL = 14h BL = Character generator bank No.	
Font registration (CGA) in 0:7Ch (INT 1Fh)	AH = 11h AL = 20h ES:BP = Top address in font table	
Font registration (CGA) in 0:10Ch (INT 43h)	AH = 11h AL = 21h BL = 0: (Number of lines per DL register value) 1: 14 lines 2: 25 lines 3: 43 lines CX = Number of vertical bits per character DL = Number of screen lines (When BL = 0) ES:BP = Top address in font table	
8 x 14 dot font registration (PC character set, inside video BIOS ROM) [Graphics]	AH = 11h AL = 22h BL = 0: (Number of lines per DL register value) 1: 14 lines 2: 25 lines 3: 43 lines DL = Number of screen lines (When BL = 00h)	

Operation	Input	Output
Font registration		
8 x 8 dot font registration (PC character set, inside video BIOS ROM) [Graphics]	AH = 11h AL = 23h BL = 0: (Number of lines per DL register value) 1: 14 lines 2: 25 lines 3: 43 lines DL = Number of screen lines (When BL = 00h)	
8 x 16 dot font registration (PC character set, inside video BIOS ROM) [Graphics]	AH = 11h AL = 24h BL = 0: (Number of lines per DL register value) 1: 14 lines 2: 25 lines 3: 43 lines DL = Number of screen lines (When BL = 00h)	
Reading font table data	AH = 11h AL = 30h BL = 0: Return INT 1Fh (CGA font) entry address with ES:BP register. 1: Return INT 43h entry address with ES:BP register. 2: Return 8 x 14 font address with ES:BP register. 3: Return 8 x 8 font address with ES:BP register. 4: Return 8 x 8 font (80h) address with ES:BP register. 5: Reserved	CX = Number of vertical bits per DL = character ES:BP Number of lines per screen - 1 = Address of data specified in BH
Performance selection		
Reading video mode data (Color/B/W mode)	AH = 12h BL = 10h	BH = 0: Color mode 1: B/W mode (MDA mode) BL = Video RAM memory size CH = Reserved CL = DIP switch setting
Selecting video BIOS print-screen	AH = 12h BL = 10h	
Selecting vertical resolution	AH = 12h BL = 30h AL = Selected vertical resolution = 00h: 200 display lines = 01h: 350 display lines = 02h: 400 display lines	AL = 12h Successfully executed
Default pallet load enable/disable	AH = 12h BL = 31h AL = Load selection 0: Default pallet loading enabled 1: Default pallet loading disabled	AL = 12h Successfully executed
Video enable/disable	AH = 12h BL = 32h AL = 0: Video enabled 1: Video disabled	AL = 12h Successfully executed
Gray scale enable/disable	AH = 12h BL = 33h AL = 0: Gray scale enabled 1: Gray scale disabled	AL = 12h Successfully executed

Appendices

Operation	Input	Output
Performance selection		
Cursor emulator enable/disable	AH = 12h BL = 34h AL = Selection 0: Cursor emulator enabled 1: Cursor emulator disabled	AL = 12h : Successfully executed
Screen ON/OFF	AH = 12h BL = 6h AL = 0: Screen ON 1: Screen OFF	AL = 12h : Successfully executed
Character string output to screen		
Character output without cursor movement	AH = 13h AL = 00h BH = Page No. BL = Attribute CX = Length DH = Starting line position of first character in character string DL = Starting column position of first character in character string ES:BP = Top address in character string	
Character output with cursor movement	AH = 13h AL = 01h BH = Page No. BL = Attribute CX = Number of characters DH = Starting line position of first character in character string DL = Starting column position of first character in character string ES:BP = Top address in character string	
Character output and attribute selection without cursor movement	AH = 13h AL = 02h BH = Page No. CX = Number of characters DH = Starting line position of first character in character string DL = Starting column position of first character in character string ES:BP = Top address in character string	
Character output and attribute selection with cursor movement	AH = 13h AL = 03h BH = Page No. CX = Number of characters DH = Starting line position of first character in character string DL = Starting column position of first character in character string ES:BP = Top address in character string	
Display combination code		
Reading display combination code	AH = 1Ah AL = 00h	AL = 1Ah : Successfully executed BL = Active-display code BH = Nonactive-display code
Writing display combination code	AH = 1Ah AL = 01h BL = Active-display code BH = Nonactive-display code	AL = 1Ah : Successfully executed
Status information	AH = 1Bh BX = Implementation type ES:DI = Return information buffer	AL = 1Bh : Successfully executed

Operation	Input	Output
Video status save & restore		
Reading buffer size	AH = 1Ch AL = 00H CX = Request status Bit 0: Video hardware status Bit 1: Video BIOS data area Bit 2: Expansion pallet register save / restore	AL = 1Ch : Successfully executed BX = Buffer size in 64-byte units
Status save	AH = 1Ch AL = 01h CX = Request status Bit 0: Video hardware status Bit 1: Video BIOS data area Bit 2:Expansion pallet register save/ restore ES:BX = Address of data save area	AL = 1Ch : Successfully executed
Status save as	AH = 1Ch AL = 02h CX = Request status Bit 0: Video hardware status Bit 1: Video BIOS data area ES:BX = Bit 2: Expansion pallet register ssave / restore	

■ INT 11h Reading System Data

Operation	Input	Output
Reading system data		AX = System configuration data AX bit Bits 15 & 14 : Number of printer ports Bits 11, 10 & 9 : Number of RS-232C ports Bits 7 & 6 : Number of internal FDDs 0, 0 : 1 0, 1 : 2 Bits 5 & 4 : Screen mode 0, 1 : 40 x 25 line mode 1, 0 : 80 x 25 line mode Bit 1 : 80287 CPU yes/no 0 : No 1 : Yes Bits 13, 12, 8, 3, 2 & 0 : Reserved

■ INT 12h Reading Memory Size

Operation	Input	Output
Reading memory size		AX =Memory size in 1 K units

Appendices

■ INT 13 Disk BIOS

Operation	Input	Output																																																
Disk reset	AH = 00h DL = Drive No. (FDD:00h-01h;HDD:80h-81h)	CY = 0 : Successfully completed = 1 : Error AH = Status Fbppy disk status table <table border="1"> <thead> <tr> <th>Status</th> <th>Description</th> </tr> </thead> <tbody> <tr><td>00h:</td><td>Successfully completed</td></tr> <tr><td>01h:</td><td>Wrong command sent</td></tr> <tr><td>02h:</td><td>Cannot find address mark</td></tr> <tr><td>03h:</td><td>Attempted writing on protected disk</td></tr> <tr><td>04h:</td><td>Cannot find requested sector.</td></tr> <tr><td>06h:</td><td>Disk was changed.</td></tr> <tr><td>08h:</td><td>DMA overrun</td></tr> <tr><td>10h:</td><td>CRC error during diskette reading</td></tr> <tr><td>20h:</td><td>Crashed FDC</td></tr> <tr><td>40h:</td><td>Crashed during seek operation</td></tr> <tr><td>80h:</td><td>Timer overflowed</td></tr> </tbody> </table> Hard disk status table <table border="1"> <thead> <tr> <th>Status</th> <th>Description</th> </tr> </thead> <tbody> <tr><td>00h:</td><td>Successfully completed</td></tr> <tr><td>01h:</td><td>Wrong command sent</td></tr> <tr><td>02h:</td><td>Cannot find address mark</td></tr> <tr><td>04h:</td><td>Cannot find requested sector.</td></tr> <tr><td>07h:</td><td>Drive parameter error</td></tr> <tr><td>08h:</td><td>DMA overrun</td></tr> <tr><td>10h:</td><td>Error during reading</td></tr> <tr><td>20h:</td><td>Crashed HDC</td></tr> <tr><td>40h:</td><td>Crashed during seek operation</td></tr> <tr><td>80h:</td><td>Timer overflowed</td></tr> <tr><td>BBh:</td><td>Undefined error</td></tr> </tbody> </table>	Status	Description	00h:	Successfully completed	01h:	Wrong command sent	02h:	Cannot find address mark	03h:	Attempted writing on protected disk	04h:	Cannot find requested sector.	06h:	Disk was changed.	08h:	DMA overrun	10h:	CRC error during diskette reading	20h:	Crashed FDC	40h:	Crashed during seek operation	80h:	Timer overflowed	Status	Description	00h:	Successfully completed	01h:	Wrong command sent	02h:	Cannot find address mark	04h:	Cannot find requested sector.	07h:	Drive parameter error	08h:	DMA overrun	10h:	Error during reading	20h:	Crashed HDC	40h:	Crashed during seek operation	80h:	Timer overflowed	BBh:	Undefined error
Status	Description																																																	
00h:	Successfully completed																																																	
01h:	Wrong command sent																																																	
02h:	Cannot find address mark																																																	
03h:	Attempted writing on protected disk																																																	
04h:	Cannot find requested sector.																																																	
06h:	Disk was changed.																																																	
08h:	DMA overrun																																																	
10h:	CRC error during diskette reading																																																	
20h:	Crashed FDC																																																	
40h:	Crashed during seek operation																																																	
80h:	Timer overflowed																																																	
Status	Description																																																	
00h:	Successfully completed																																																	
01h:	Wrong command sent																																																	
02h:	Cannot find address mark																																																	
04h:	Cannot find requested sector.																																																	
07h:	Drive parameter error																																																	
08h:	DMA overrun																																																	
10h:	Error during reading																																																	
20h:	Crashed HDC																																																	
40h:	Crashed during seek operation																																																	
80h:	Timer overflowed																																																	
BBh:	Undefined error																																																	
Reading disk drive data	AH = 01h DL = Drive No. (FDD:00h-01h;HDD:80h-81h)	AH = Disk Drive Status																																																
Reading sector	AH = 02h AL = Number of sectors WithFDD CH = Track No. CL = Sector No. WithHDD CH = Cylinder No. CL = Insignificant 8 bits Sector No.(Bits 0 - 6) = Cylinder No. Significant 2 bits (Bits 7 - 8) DH = Head No. DL = Drive No. (FDD : 00h - 01h, HDD : 80h - 81h) ES BX = Buffer address	CY = 0 : Successfully completed = 1 : Error AH = Status																																																

Operation	Input	Output
Writing sector	AH = 03h AL = Number of sectors With FDD CH = Track No. CL = Sector No. With HDD CH = Cylinder No. Insignificant 8 bits CL = Sector No. (Bits 0 - 5) = Cylinder No. Significant 2 bits (Bits 6-7) DH = Head No. DL = Drive No. (FDD: 00h - 01h, HDD: 80h - 81h) ES:BX = Buffer address	CY = 0: Successfully completed = 1: Error AH = Status
Sector content check	AH = 04h AL = Number of sectors With FDD Track No. CH = Sector No. CL = Cylinder No. Insignificant 8 bits With HDD Sector No. (Bits 0 - 5) CH = Cylinder No. Significant 2 bits (Bits 6-7) CL = Head No. = Drive No. (FDD: 00h - 01h, HDD: 80h - 81h) DL =	CY = 0: Successfully completed = 1: Error AH = Status
Track/Cylinder format	AH = 05h AL = Track/Cylinder No. Insignificant 8 bits CL = Track/Cylinder No. Significant 2 bits DH = Head No. DL = Drive No. ES:BX = Top address in format data table	CY = 0: Successfully completed = 1: Error AH = Status
Reading drive parameters	AH = 08h DL = Drive No. (FDD: 00h - 01h, HDD: 80h - 81h)	CY = 0: Successfully completed = 1: Error AH = Status When FDD drive No. specified in DL ES:DI = Drive parameter starting address CH = Insignificant 8 bits in 10 bit value for max. number of tracks CL = Bits 7 & 6: Insignificant 2 bits in 10 bit value for max. number of tracks Bits 5 - 0: Max. number of sectors per track DH = Max. number of heads DL = Number of built-in floppy disk drives BL = Bits 3 - 0: CMOS valid drive type value Bits 7 - 4: Fixed to 0 When HDD drive No. specified in DL CH = Max. number of cylinders CL = Max. number of usable sectors and Significant bit in max. number of cylinders DH = Max. number of usable heads DL = Number of built-in hard disk drives

Appendices

Operation	Input	Output
Hard disk drive parameter initialization	AH = 09h DL = Drive No.	CY = 0: Successfully completed = 1: Error AH = Status
Hard disk seek	AH = 0Ch CH = Insignificant 8 bits in cylinder No. CL = Significant 2 bits in cylinder No. DL = Drive No. DH = Head No.	CY = 0: Successfully completed = 1: Error AH = Status
Hard disk drive reset	AH = 0Dh DL = Drive No.	CY = 0: Successfully completed = 1: Error AH = Status
Hard disk drive ready check	AH = 10h DL = Drive No.	CY = 0: Successfully completed = 1: Error AH = Status
Hard disk drive recalibration	AH = 11h DL = Drive No.	CY = 0: Successfully completed = 1: Error AH = Status
Disk type check	AH = 15h DL = Drive No.	CY = 0: Successfully completed = 1: Error CX:DX = Total number of sectors (HDD only) AH = 00h: No disk = 01h: Floppy disk unchanged = 02h: Disk was changed = 03h: Hard disk
Media change check	AH = 16h DL = Drive No.	AH = 00h: Disk unchanged = 01h: Inconsistent parameter = 06h: Disk was changed (Carry bit ON) = 80h: Drive not ready
Setting drive type for formatting	AH = 17h DL = Drive No. AL = 0: No disk 1: Use 2-sided disk on 2-sided drive. 2: Use 2-sided disk on high-density drive. 3: Use 2HD disk on high-density drive. 4: Use 720K disk on 720K-byte drive.	CY = 0: Successfully completed = 1: Error AH = Status
Setting media type for formatting	AH = 18h CH = Insignificant 8 bits in 10 bit value for max. number of tracks CL = Bits 7 & 6: 10 bit value for max. number of tracks Bits 5 - 0: Max. number of sectors per track DL = Drive No.	ES:DI = Address of drive parameter table for floppy disk type AH = 00h and CY =0: Supports tracks and number of tracks per sector. AH = 01h and CY =1: Cannot use function. AH = 00h and CY =1: Does not support tracks and number of tracks per sector.

■ INT 14h RS-232C

Operation	Input	Output
Setting RS-232C line mode	AH = 00h AL = Line mode/Parameter Bits 7, 6, 5: Baud rate 0, 0, 0: 110 Baud 0, 0, 1: 150 Baud 0, 1, 0: 300 Baud 0, 1, 1: 600 Baud 1, 0, 0: 1200 Baud 1, 0, 1: 2400 Baud 1, 1, 0: 4800 Baud 1, 1, 1: 9600 Baud Bits 4&3: Parity X, 0: No parity 0, 1: Odd parity 1, 2: Even parity Bit 2: Stop bits 0: 1 bit length 1: 2 bit length Bits 1&0: Word length 1, 0: 7 bits 1, 1: 8 bits DX = Port No.	
Sending 1-byte data	AH = 01h AL = Data to send DX = Port No.	AH = Line control status Bit 7: Time over error Bit 6: Transmission shift register empty Bit 5: Transmission hold register empty Bit 4: Break detected Bit 3: Framing error Bit 2: Parity error Bit 1: Overrun Bit 0: Data ready
Receiving 1-byte data	AH = 02h DX = Port No.	AL = Received data AH = Line control status
Reading communication port status	AH = 03h DX = Port No.	AL = Line control status AL = Modem status Bit 7: Carry detected Bit 6: Call signal received Bit 5: Data-set ready Bit 4: Transmission enabled (CTS) Bit 3 - 0: Not in use

■ INT 15h Other System Services

Operation	Input	Output
Wait time check	AH = 83h AL = 00h: Interval timer start 01h: Interval timer stop ES:BX = End flag address CX:DX = Wait time in 1 µsec units	CY = 0: Successfully completed = 1: Error

Appendices

Operation	Input	Output								
Joystick										
Reading button status	AH = 84h DX = 00h	AL = Button status 00h: Pressed 01h: Not pressed Bit 7: 2nd button status on 2nd joystick Bit 6: 1st button status on 2nd joystick Bit 5: 2nd button status on 1st joystick Bit 4: 1st button status on 1st joystick								
Reading resistance value	AH = 84h DX = 01h	AX = Resistance value of horizontal coordinate of 1st joystick BX = Resistance value of vertical coordinate of 1st joystick CX = Resistance value of horizontal coordinate of 2nd joystick DX = Resistance value of vertical coordinate of 2nd joystick								
Wait timer overwait	AH = 86h CX:DX = Wait time in μ sec units	CY = 0: Successfully completed = 1: Already triggered or not supported								
Transmitting memory block in protect mode	AH = 87h ES:SI = Top address in descriptor ES:SI = <table border="1" style="margin-left: 20px;"> <tr><td>Dummy (00h)</td></tr> <tr><td>GDT(00h)</td></tr> <tr><td>Source segment descriptor</td></tr> <tr><td>Destination segment descriptor</td></tr> <tr><td>BIOS C5 (00h)</td></tr> <tr><td>SS (00h)</td></tr> </table> CX = Number of words to transfer	Dummy (00h)	GDT(00h)	Source segment descriptor	Destination segment descriptor	BIOS C5 (00h)	SS (00h)	ZF = 1: Successfully completed CY = 1: Error AH = 00h: Successfully completed = 01h: RAM parity error = 02h: Not in protect mode		
Dummy (00h)										
GDT(00h)										
Source segment descriptor										
Destination segment descriptor										
BIOS C5 (00h)										
SS (00h)										
Starting protect mode	AH = 89h BH = Offset of insignificant (mask) interrupt vector address BL = Offset of significant (slave) interrupt vector address ES:SI = Top address in following table <table border="1" style="margin-left: 20px;"> <tr><td>CS dummy (00h)</td></tr> <tr><td>GDT</td></tr> <tr><td>IDT</td></tr> <tr><td>DS</td></tr> <tr><td>ES</td></tr> <tr><td>SS</td></tr> <tr><td>CS</td></tr> <tr><td>TEMP BIOS (00h)</td></tr> </table>	CS dummy (00h)	GDT	IDT	DS	ES	SS	CS	TEMP BIOS (00h)	CY = 0: Successfully completed AH = 00h CS = CS value specified in ES:SI table DS = DS value specified in ES:SI table ES = ES value specified in ES:SI table SS = DS value specified in ES:SI table CY = 1: Error AH = FFh
CS dummy (00h)										
GDT										
IDT										
DS										
ES										
SS										
CS										
TEMP BIOS (00h)										

■ INT 16h Keyboard BIOS

Operation	Input	Output
Reading data by key input	AH = 00h	AH = Secondary code AL = Primary code (Character code)
Data check by key input	AH = 01h	ZF = 0: Input data exists. = 1: Input data does not exist. AH = Secondary code AL = Primary code (Character code)
Reading shift status	AH = 02h	AL = Shift status
Setting repeat delay and repeat rate	AH = 03h AL = 05h BH = Delay time (Bits 0 & 1) BL = Primary code (Bits 0 - 4)	
Writing key data	AH = 05h CH = Secondary code CL = Primary code	AL = 00h: Successfully completed = 01h: No available space in buffer (CY =1)
Wiring data by key input (101/AXkeyboard compatible)	AH = 10h	AH = Secondary code AL = Primary code (Character code)
Data check by key input (101/AXkeyboard compatible)	AH = 11h	ZF = 0: Input data exists. = 1: Input data does not exist. AH = Secondary code AL = Primary code (Character code)
Reading shift status (101/AXkeyboard compatible)	AH = 12h	AL = Shift status 1 AH = Shift status 2

■ INT 17h Printer BIOS

Operation	Input	Output
1-character output	AH = 00h AL = Character code of character to output DX = output Device No.	AH = Printer status
Printer initialization	AH = 01h DX = Device No.	AH = Printer status
Status check	AH = 02h DX = Device No.	AH = Printer status

Appendices

■ INT 1Ah Setting/Reading Time and Date

Operation	Input	Output
Reading clock	AH = 01h	CX = Significant 16 bits of current clock data DX = Insignificant 16 bits of current clock data AL = Overflow flag on 24-hour system
Setting clock	AH = 01h CX = Significant 16 bits of clock data DX = Insignificant 16 bits of clock data	
Reading time	AH = 02h	CH = Hours (BCD) CL = Minutes (BCD) DH = Seconds (BCD) DL = Summertime option (0 or 1) CY = End status 0: Successfully completed 1: Error
Setting time	AH = 03h CH = Hours (BCD) CL = Minutes (BCD) DH = Seconds (BCD) DL = Summertime option (0 or 1)	
Reading date	AH = 04h	CH = Western calendar (Year given as 2-digit BCD, significant 2 bits: 19 or 20) CL = Year (BCD) DH = Month (BCD) DL = Day (BCD) CY = End status 0: Successfully completed 1: Error
Setting date	AH = 05h CH = Western calendar (Year given as 2-digit BCD, significant 2 bits: 19 or 20) CL = Year (BCD) DH = Month (BCD) DL = Day (BCD)	
Setting alarm	AH = 06h CH = Hours (BCD) CL = Minutes (BCD) DH = Seconds (BCD)	CY = End status 0: Successfully completed 1: Error
Clearing alarm	AH = 07h	