Intel Corporation

Professional Workstation

Technical Product Summary

Models LP486SX/20E, LP486SX/25E,
LP486/33E & LP486DX2/50E

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INTEL PROFESSIONAL WORKSTATION TECHNICAL PRODUCT SPECIFICATION

This document outlines the features and specifications for the Intel Professional Workstation Microcomputer product line. A basic understanding of the Professional Workstation will be provided by detailing the features, capabilities, and benefits of the product. Detailed technical information is provided in the appendices for those users who would like to know more about how to interface additional hardware with the Professional Workstation.

I.   INTRODUCTION

The Professional Workstation product family delivers excellent, cost effective performance in a low-profile chassis. Incorporating SCSI, LAN, and Video controllers on the motherboard, the Professional Workstation provides a number of on-board resources that would otherwise require the use of add-in I/O expansion cards. This integration delivers increased functionality, increased reliability, and increased performance while reducing the system power requirements and the need for a large number of expansion slots. Integration tasks by the OEM are simplified, system reliability is increased, and a consistent set of functions and options are provided to the end user, improving system compatibility. A range of price/performance options is provided by offering a choice of 4 different i486-based CPUs. A performance upgrade socket allows for easy upgrades in the field. Additionally, two EISA compatible expansion slots deliver high performance expandibility.

The Professional Workstation will excel in networked business workstation and CAD/CAM applications, in office automation applications requiring multi-function client systems, and as a high performance integrated PC platform.

II.   PROFESSIONAL WORKSTATION SYSTEM FEATURES

A.   CPU

The Professional Workstation allows for a choice of four different i486-based CPUs: the LP486SX/20E uses a 20 MHz i486SX, the LP486SX/25E uses a 25 MHz i486SX, the LP486/33E uses a 33 MHz i486DX and the LP486DX2/50 uses a 50 MHz i486DX2. Thei486DX2/50 embodies the latest "clock doubling" technology from Intel. This component has been created with an internal clock that runs twice as fast as the external clock i.e the system still runs @ 25 MHz but the internals of the CPU run at 50 Mhz. The wide range in system performance that this engenders allows the OEM to select the price/performance option appropriate for his application.

The Professional Workstation supports all the i486 CPU functionality. Common features of the three CPUs include backward compatibility with the 8086, 80286, and 386 CPUs, burst mode bus cycles, and an on-chip 8 Kbyte cache. The cache is 4-way set associative and uses a write-through policy. The cache can be disabled via either software or hardware. The i486DX CPU contains an on-chip numeric coprocessor to increase the speed of floating point operations. This coprocessor is backward code compatible with 387DX and 387SX math coprocessors and complies to ANSI/IEEE standard 754-1985.

B.   OverDrive Processor Socket

  A socket is provided that allows users to upgrade the CPU performance of their systems. An i486SX based Professional Workstation can be upgraded in two ways by installing an i487SX component in the OverDrive socket or by adding an OverDrive processor This improves system performance by either adding a numeric coprocessor to speed floating point calculations or by increasing the maximum internal CPU speed capability. The upgrade path for i486DX based systems also takes the OverDrive processor path although the numeric coprocessor is not an option. The Table below shows the choices of upgrade processors available and their relative socket. There is a Jumper block (J10) on the motherboard that allows for upgrade CPU speed selection, see Section G in the attached Appendices for more details.

Primary Socket (U20)	OverDrive Socket (U36) may house any of the following.
i486SX-20	i487SX-20, OverDrive-40, OverDrive-50* or OverDrive-66*
i486SX-25	i487SX-25, OverDrive-50 or OverDrive-66*
i486DX-33	OverDrive-50* or OverDrive-66
i486DX2-50	OverDrive-66*
i486DX2-66	No Upgrade Available

* - Jumper (J10) change required

C.   Cache Memory Option

In addition to the i486's internal cache, the Professional Workstation provides a socket for an optional external cache, the Intel 485 TurboCache Module. The socket allows three additional price/performance configurations: no external cache, 64 KByte cache, or 128 KByte cache. Presence of the cache module is automatically detected, no software or hardware changes are required to take advantage of the external cache. The external cache is enabled/disabled in conjunction with the internal i486 cache, both are either on or off together.

The module consists of an Intel 82485 cache controller and either 4 or 8 custom SRAM'S, depending on the cache size. The module implements a 2-way set associative, write-through cache architecture, and provides full burst mode support for the i486. Cache accesses occur at zero wait states. There is also an option in the BIOS Setup program allowing selected memory addresses to be designated as non-cacheable.

Notes: Due to an errata on the 82359 DRAM Controller, the TurboCache module will not work correctly with only one SIMM installed. A label has been attached to the socket to warn users of this potential limitation. This errata will be corrected in the next stepping of the 82359, expected in late Q2 92.

The current version of the Turbocache has an errata that may cause system malfunction in a multitasking environment i.e Netware386. It is important that the system be fitted with the latest version of the TurboCache that has had the errata removed.

D.   System BIOS

The system BIOS is stored in two Intel FLASH EEPROM (28F001BT) devices, providing a total of 256 KByte of program code space via a paged ROM memory scheme. The Professional Workstation uses Phoenix Technologies 80486 ROM BIOS PLUS Version 1.00 01.S0 In addition to the Phoenix BIOS, the FLASH memory also contains the SETUP utility, Power-On Self-Tests (POST), video BIOS, SCSI BIOS, Ethernet address, EISA configuration memory, EISA board ID, a 8-KByte user definable region, and update recovery code. For improved system performance, the Professional Workstation supports system BIOS shadowing, allowing the BIOS to execute from 32-bit on-board write-protected DRAM instead of the slower 8-bit FLASH devices.

The increased functionality of the BIOS required more memory space than the standard 128 KByte region reserved for system BIOS. A unique page ROM memory scheme (patent pending) was implemented to include the enhanced functionality while ensuring compatibility with standard PC architecture. Not all the ROM is accessible at once, page registers control which two 64 KByte pages are available at any one time. During normal operation, the 64 KByte page at E0000-EFFFF always contains the video BIOS, while the 64 KByte page located at F0000-FFFFF swaps between one of three pages: POST, SETUP, and run-time BIOS.

Further information on BIOS functions can be found in the documents listed below:

- IBM PS/2 and Personal Computer BIOS Technical Reference.
- CBIOS for IBM PS/2 Computers and Compatibles.
- ABIOS for IBM PS/2 Computers and Compatibles.

The first document is published by IBM and the second and third documents are part of the Phoenix Technologies' Technical Reference Series and are available at most technical bookstores.

1. BIOS Upgrades

FLASH memory brings new opportunities for distributing BIOS upgrades. Installing a new version of BIOS will no longer require removal of the system cover and the replacement of EPROM'S. Instead, the upgrade can be done completely from a floppy diskette. Easy access to BIOS upgrades will be available through down-loadable files on the iPAN bulletin board.

Security is provided in two ways. First, the FLASH upgrade utility insures the upgrade BIOS matches the target system to prevent accidentally installing a BIOS for a different type of system. Second, security to prevent unauthorized changes to the BIOS is provided via a write protect jumper on the motherboard. The default setting is to allow BIOS upgrades. A recovery jumper is provided to recover from the unlikely event of an unsuccessful BIOS upgrade. It forces the ROM decode to access an 16 KByte block of write protected code in the FLASH device that facilitates recovery. The default value for this jumper is for "normal" mode (note: this jumper is not changed during normal BIOS updates, it is used only if a problem is encountered).

2. BIOS Setup Program

The BIOS SETUP Program has been enhanced and provides several new options to take advantage of the Professional Workstation's new features. New options include:

On-board LAN -- enable/disable

On-board SCSI -- enable/disable.

Lan Media type -- Twisted pair or AUI.

On-board IDE -- enable/disable

800x600 Mode Refresh Rate -- 56/60/72Hz. Allows the user to set the refresh rate appropriate to his monitor to obtain the sharpest display.

1024x768 Mode Refresh Rate -- Interlaced @ 44-88Hz / Non-interlaced @ 60Hz / Non-interlaced @ 70Hz/ Non-interlaced @ 72Hz. Allows the user to set the refresh rate appropriate to his monitor (less expensive interlaced or high resolution non-interlaced) to obtain the sharpest display.

On-board Mouse Port -- Enable/Disable. Disabling the mouse port frees up an interrupt line.

Parallel Port -- Enable/Disable, Bi-directional/Output only, LPT1/LPT2.

Cache Block Disable -- Enable/Disable. When enabled, allows specified blocks of memory to be designated as non-cacheable.

I/O Bus Performance -- Standard/Enhanced. Changes the refresh timing characteristics of the system to enhance performance. The system will enable a function called FAST VIDEO if this setup parameter is ENABLED. This will improve the video performance by a factor of approximately 2. Expansion cards that make use of the bus refresh signal may not work correctly with this parameter set to enhanced mode.

Shadow Memory Options -- Allows specified 16 KByte blocks of memory from C0000 to DFFFFH to be shadowed to on-board DRAM. Primarily used to shadow expansion card ROM.

System Information -- Displays information on several aspects of system configuration, such as Ethernet address, BIOS version, processor type, LAN media type, etc.

The SETUP program is accessed by pushing the F1 key following a reboot of the system. For security purposes, access to SETUP can disabled via a jumper on the motherboard.

E.   Keyboard Controller

An Intel 8742 surface mount micro controller contains the Phoenix Technologies PS/2 compatible keyboard/mouse controller code. PS/2 style keyboard and mouse connectors are located on backpanel of the system. The micro controller code supports Power-On/Reset (POR), network, and keyboard password protection. Network and keyboard passwords require programs contained on the utility disk that ships with the system, the POR password is set via the SETUP program. In addition, the keyboard controller provides for the following "HOT" key sequences:

- CTRL-ALT.-DEL.:   System software reset.
  This sequence performs a software reset of the system by jumping to the beginning of the BIOS code and running the POST operation, excluding memory tests.
- CTRL-ALT-1 and CTRL-ALT-2:   Turbo mode selection*.
  These two sequences can be used to toggle between turbo and de-turbo modes. CTRL-ALT-1 sets the system into de-turbo mode (emulates an MHz 80286 CPU using wait states) and CTRL-ALT-2 sets the system into turbo mode (its normal operation at 33MHz).
- CTRL-ALT-+ and CTRL-ALT--: Keystroke Click Sound level selection.
  This adjusts the speaker level for the click sounds made when a key is depressed. The level of sound may be adjusted from not audible to loud with 7 levels in between.

*Note: Changing the Turbo mode may at times be prohibited by an operating system or application software.

F.   System Memory

The Professional Workstation provides four 36-bit wide SIMM sites for memory expansion. The memory array is controlled by an Intel 82359 DRAM controller, data buffering is provided by two Intel 82353 Advanced Data Path devices. The four SIMM sites support 256K x 36, 512K x 36, 1M x 36, and 2M x 36 SIMM modules, and will support 16M x 36 and 32M x 36 modules as they become available (see the Appendix for a complete list of possible memory configurations). Maximum current memory size, using four 2M x 36 SIMM modules is 32 MBytes. Memory timing is designed for 80 ns fast page devices, faster DRAMs will operate in the board but will provide no performance improvement. Parity generation/checking is provided for each 8-bit byte. Systems initial shipped by Intel had two 2 MByte SIMM installed. The current configuration includes one 4 MByte SIMM.

SIMMs may be installed in combinations of one, two or four modules and each SIMM must be of the same memory size (see the Appendix for a complete list of combinations). These restrictions allow the memory design to be optimized for the best possible performance. The best memory performance is achieved when all four SIMM sites are populated. This allows for 4-way interleaving of the DRAM, supporting n-1-1-1 type burst cycles from the i486. If only two SIMMs are present the DRAM will be 2-way interleaved. The slowest memory accesses occur when only one SIMM site is populated.

There are no jumper settings required for the memory size configuration, the System BIOS automatically sizes memory and initializes the 82359 DRAM controller for appropriate DRAM configuration and interleave factor.

G.   EISA Bus Interface

The interface to the EISA bus is controlled by the Intel 82350DT chip set. The chip set consists of a 82358DT EISA Bus Controller (EBC), a 82357 Integrated System Peripheral (ISP), a 82359 DRAM controller, two 82353 Advanced Data Path buffers, and two 82352 EISA Bus Buffers (EBB) (one in data buffer mode, the other in address buffer mode).

1. 82359 DRAM Controller

The 82359 provides all control signals necessary to drive the DRAM array, including multiplexed address signals. It also controls system access to memory and generates snoop controls to maintain cache coherency.

2. 82358DT EISA Bus Controller (EBC)

The 82358DT is a superset of the original 82358 and includes a mode compatible with the 82359 Buffered Bus. The EBC controls all EISA bus cycles, including DMA transfers, EISA and ISA bus master cycles, and Host EISA cycles. The EBC also controls any byte swapping and byte assembly required.

3. 82357 Integrated System Peripheral (ISP)

The 82357 integrates seven 32-bit DMA channels, five 16-bit timer/counters, two eight-channel interrupt controllers, NMI logic, refresh address generation, and EISA bus arbitration circuitry together onto the same device.

4. 82353 Advanced Data Path (ADP)

The two 82353 ADPs provide data paths between the Host Bus, the DRAM array, and the system interface. Each ADP provides 16-bits of host data, one for even bytes, one for odd bytes. Both the Host and system interfaces are 32-bits wide, the interface to the memory array is 128-bits wide.

5. 82352 EISA Bus Buffer (EBB)

The 82352 EBBs provide address and data buffering to the EISA bus. One EBB is used for address buffering, the second EBB is used to buffer the 32 data bits.

H.   EISA Expansion Slots

The Professional Workstation motherboard contains one EISA compatible connector. This connector is used to support a riser card that contains two horizontal EISA bus master expansion slots. These expansion slots support 8- or 16-bit ISA compatible expansions cards as well as any EISA compatible expansion cards. The EISA expansion cards are oriented parallel to the motherboard, rather than perpendicular. This parallel orientation makes the low profile chassis outline possible. The riser card is limited to a maximum of two EISA expansion slots by electrical constraints of the motherboard as well as physical constraints of the system chassis.

I.   LAN Subsystem

1. 82596CA LAN Controller

The on-board LAN controller is an Intel 82596CA operating at 33MHz and is IEEE 802.3 compliant. The controller resides on the Buffered bus of the 82358DT EISA Bus Controller (for more information on the Buffered Bus, see the 82358DT data sheet). The 82596CA shares memory space in main memory with the i486 processor. A 64-byte transmit FIFO and a 128-byte receive FIFO is contained in the 82596CA. When the transmit FIFO reaches a predetermined threshold level, network transmission begins. When the receive FIFO reaches its threshold level, the 82596CA arbitrates for control of the Buffered Bus and transfers the contents of the FIFO into main memory.

2. Ethernet Address

Each system has its own unique 6-byte Ethernet address as specified by the IEEE 802.3 standard. This address is stored in the FLASH EPROM on the system board. The Ethernet address area in FLASH memory is write protected to prevent accidental erasure. Software can access this address via a BIOS INT15 call, the user can display both the ethernet address and the interrupt being used by the 82596CA from the System Information screen accessed via the SETUP program.

3. LAN Media Connections

The Professional Workstation supports both the Attachment Unit Interface (AUI) and Twisted Pair (10BaseT) network connections. Only one interface can be active at any one time, and only one cable should be connected to the Professional Workstation at any one time to prevent possible loading issues on the inactive interface. The active interface is selectable via the SETUP program.

AUI is specified in Chapter 7 of the IEEE 802.3 Ethernet specification. Connection is via a 15-pin D-sub connector located on the back panel of the system. The AUI connection provides a 12 V source, a one amp fuse on the motherboard provides overcurrent protection. An external Medium Attachment Unit (MAU) may be connected to interface to other network mediums, such as Cheapernet (10Base2).

10BaseT is specified in the IEEE 802.3 supplement, Section 14. Connection to the LAN is via an RJ-45 connector located on the back panel of the system.

4. LAN Drivers

DOS LAN drivers are included in the Base Software Kit which is shipped with the system. Two protocols are supported, IPX for Novell and NDIS for Microsoft compatible networks. Microsoft compatible networks include Microsoft LANMAN, BANYAN Vines, DEC Pathworks, and IBM LAN server.

The required boot disks and LAN driver for SCO UNIX V.3.2 are included in the optional Unix Software Accessory kit (LPUNIXKIT). The LAN driver supplies an LLI compliant interface that is compatible with SCO's TCP/IP software.

The LAN driver for OS/2 is included in the Intel OS/2 Operating System Package.   The driver supports an NDIS compatible interface. Compatible networks include Microsoft's LANMAN and IBM's LAN server.

LAN drivers for a Novell server are included in the optional Novell Server Kit (part # LPNOVLSKIT).

Please see the Appendix for a complete matrix of driver information.

J.   SCSI Subsystem

1.   NCR 53C700 SCSI I/O Processor (SIOP)

The on-board SCSI I/O processor is a NCR 53C700. This component has internal FIFOs on the SCSI and host data busses, 32-bit address and data busses, and an internal SCRIPTS processor capable of fast DMA. A custom ASIC is used to convert the 386-like bus interface of the NCR 53C700 to the asynchronous strobed interface required by the 82359 DRAM Controller. The SIOP runs at 33 MHz, the maximum theoretical data transfer rate is 66 MBytes/sec across the Buffered Bus, and 8.25 MBytes/sec across the SCSI bus.

2.   SCSI Physical Interface

The SCSI Physical Interface consists of the SCSI connectors for the internal hard drive, the external SCSI port, the termination's at each end of the SCSI bus, and the SCSI termination power circuitry.

A riser card is used to connect the baseboard SCSI bus to the SCSI hard drive. The Power Workstation supports only the single ended SCSI mode. A short ribbon cable with standard 3M type connectors and power cable are used to connect the drive to the riser card.

A fine pitch 50-pin connector located on the back panel of the system is used for the external SCSI interface. When an internal SCSI drive is installed, up to six additional SCSI devices can be connected via the external connector. This number can be increased to seven when no internal SCSI drive is installed.

The SCSI standard requires termination at each end of the bus. Termination for the internal drive is soldered into the riser card. Therefore, internal drives must not have termination resistors installed. Termination at the external end of the bus consists of an ext ernal removable termination block. This termination block is available from both AMP and

FOXCON. The AMP part number is 749535-2. This terminator is not required when an internal IDE drive is implemented. Termination power is routed to the termination resistors through a 1.0 Amp fuse. Termination power can be disabled via a jumper on the motherboard for applications where a different SCSI device is supplying termination power.

3. SCSI Drivers

SCSI drivers for DOS are shipped with the system. No drivers are required for DOS if Protected Mode of the CPU is not used i.e. memory mangers or Windows 3.0 is NOT used, and the only peripheral devices installed are one or two SCSI hard disks using the onboard SCSI controller: All functions are taken care of by the SCSI BIOS. All other situations, such as multiple host adapters, mixture of SCSI and IDE drives, booting from a SCSI device other than a hard drive, use of an extended memory manager (such as QEMM, EMM386 or Windows 3.0), etc., require installation of the (4) supplied SCSI drivers.

Unix SCSI drivers for SCO V.3.2 are included in the Unix Software Accessory Kit, SCSI drivers for OS/2 are included in the Intel OS/2 Release 1.3 Operating system package. Please see the Appendix for a complete matrix of driver information.

K.   Video Subsystem

1. Western Digital WD90C30 Graphics Controller

The Professional Workstation incorporates an Extended VGA video solution onto the system board using a Western Digital WD90C30 chip-set. Intel's patent pending circuitry can speed graphics performance by up to 50% over standard designs. The WD90C30 is fully compatible with the MDA, CGA, Hercules Graphics, EGA, and VGA video standards. Standard configuration comes with 512 KBytes of installed video DRAM. This allows for resolutions up to 800 x 600 x 256 colors or 1024 x 768 x 16 colors. The video memory can be increased to a total of 1 MByte by adding four 256K x 4 fast page mode 60 ns DRAMs to the four DIP sockets on the system board. With 1 MByte of Display Ram installed, the Professional Workstation will support a maximum resolution of 1024 x 768 x 256 colors. The Professional Workstation supports non-interlaced as well as interlaced monitors even at the higher resolutions. The Display Ram is paged into 128 KBytes of RAM located between A0000H and BFFFFH.

2. Western Digital Video BIOS

Video BIOS from Western Digital has been incorporated into the system BIOS. The BIOS supports the normal VGA modes (0,1,2,3,4,5,6,7,D,E,F,10,11,12,13)[1] and also supports several enhanced video modes (See the appendix for the complete list). To allow for the use of other add-in video adapter cards, the on-board video BIOS can be disabled using a hardware jumper.

3. Video Connectors

A standard PS/2 15-pin analog VGA connector is provided on the I/O backpanel. A VESA compliant 8514/A Feature Connector is provided on the baseboard. This is typically used as a VGA pass through connector when an auxiliary video subsystem is installed in one of the expansion slots, such as an 8514/A compatible video card or DVI board set.

4. Video Drivers and Utilities

Video drivers and utilities for DOS and WINDOWS 3.0 are shipped with the Professional Workstation system. Included on the diskettes are enhanced mode drivers for common MS-DOS software applications such as AutoCAD, AutoShade, Cadvance, Framework, GEM, Generic Cadd, PCAD, VersaCAD, WordPerfect, WordStar, Ventura and Lotus 123 & Symphony. These come in a compressed form and are extracted by using a utility called "install" located on the diskette. Several video utilities such as a screen saver and VGA mode switch routine are also included with the drivers.

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[1] Video modes 8, 9, A, B and C are not supported. Modes 8 & 9 are for PCjr systems and modes A, B and C are used by systems using an EGA BIOS. Modes are listed in hex.

Video drivers for SCO UNIX should be obtained from the respective UNIX distributor. Please see the Appendix for a complete matrix of driver information.

L.   EISA Configuration Utility

An EISA Configuration Utility (ECU) is shipped with the system. The ECU performs the setup and programming of the system's EISA Non-Volatile Memory (NVM). A section of FLASH memory is used to store the EISA configuration information. EISA and ISA boards are added and removed with the ECU to complete the specific system configuration. The configuration is stored into FLASH memory and the system is rebooted. The contents of the EISA NVM and ISA CMOS memory are used by system BIOS at boot time to configure EISA boards and determine system policies. The goal of the set up program for this system was that the ECU should not need to be used if there are no EISA boards installed in the system and default interrupts are used for the onboard resources. Refer to the information contained in the ECU HELP facility for more information.

M.   Western Digital WD16C552 Serial/Parallel Controller

The Professional Workstation uses a WD16C552 to integrate one parallel and two serial ports on the motherboard. Standard AT-type connectors are available on the back panel of the system. The serial ports include 16-byte FIFOs and are capable of operation up to 56K Baud. Either serial port can be programmed as COM1, COM2, COM3, COM4, or disabled. The parallel port can be configured via the SETUP program as LPT1, LPT2, or disabled, and can be set as bi-directional or output only.

N.   Real Time Clock, Battery-Backed CMOS RAM and Battery

The Real Time Clock (RTC) is implemented using a Dallas DS1287 device. The DS1287 is accurate to within 13 minutes/year and requires no external support (the battery and oscillator are integrated into the device). The component is socketed and can be replaced if the internal battery loses its charge (the internal battery has an estimated lifetime of ten years).

The RTC can be set via the BIOS SETUP Program. CMOS memory supports the standard 64-byte battery-backed RAM, fourteen bytes for clock and control registers, fifty bytes of general purpose non-volatile CMOS RAM. All CMOS RAM is reserved for BIOS use. The CMOS RAM can be set to specific values or cleared to the system default values using the BIOS SETUP program. Also, the CMOS RAM values can be cleared to the system defaults by using a hardware jumper.

O.   Speaker

The on-board speaker has been integrated into the power supply to improve manufacturability and reduce unnecessary cabling. The speaker may be enabled or disabled using the BIOS SETUP program and may also be programmed using I/O port 61H. The speaker provides error code information during POST if the system cannot use the video interface (see the appendix for beep code information).

P. System Peripherals

1. Peripheral Bays

The Professional Workstation supports 2 built-in peripheral bays in a single peripheral carrier assembly. The bays included are:

- 1- Half-Height, 3.5" wide, Internal bay
  Mounting hardware supports standard 3.5" hard disk drives form factor.
  Connections for either SCSI or IDE.
- 1- Third-Height, 3.5" wide, Externally accessible bay
  Connection for custom "docking" 3.5" floppy drive (see Floppy Drive Interface below).

The carrier assembly is easily removed for access and serviceability. A riser card is used to route the control, data and power signals for the floppy and hard drive from the motherboard to the peripheral carrier. The peripheral riser card connects to the motherboard via a 132-pin card-edge connector and is attached to the peripheral carrier by two mounting brackets. Internal SCSI termination resistors are always present on the peripheral riser card.

2. Floppy Drive Interface

An on-board AT compatible floppy interface is provided by an Intel 82077AA-1 Floppy Controller. The Professional Workstation supports only a single 3.5" 1.44 MByte floppy drive. The drive uses a custom docking connector, allowing the drive to connect directly to the peripheral riser card. This eliminates the need for power and data cables, improving reliability, serviceability and EMI characteristics. The floppy drive can be enabled or disabled via the BIOS SETUP program. An option for increased security disables writes to the floppy drive via a jumper on the motherboard.

3. Mass Storage Devices

The Professional Workstation supports one internal 3.5" half height mass storage device using either the SCSI-2 or standard 40-pin IDE interface. Cable length is reduced to a minimum by using a peripheral riser card to route the control and power signals up to the drive bay. This improves the serviceability and reduces EMI emissions. The hard disk drive can be enabled or disabled via the BIOS SETUP program. Selection between the SCSI or IDE interface is also done via SETUP.

Q. Front Panel

The front panel includes the reset and power-on/off switches for easy access. Hard Disk active, floppy active, and power-on LED indicators are also provided. All the LED indicators are green.

R. System Chassis

The Professional Workstation is housed in a low profile chassis. The enclosure consists of a sheet metal base, sheet metal top cover, and drop-in peripheral carrier. There are four color keyed plastic pieces: the front bezel and top/side cover snap onto the metal top cover, the back panel and bottom snap onto the sheet metal base. Access to the inside of the system is obtained by removing one screw and lifting off the top cover.

S. Security

1. Physical Security

A standard hasp style lock (not provided by Intel) can be used to retain the top cover. This prevents undesired access to the internal compartment of the Professional Workstation where the CMOS Password Clear jumper is located. In addition, it prevents someone from removing or modifying add-in cards or peripherals. The hasp lock can also be used to cable the Professional Workstation to a fixed object, preventing theft of the system.

2. Network Security

The Professional Workstation was designed with several features to make it an especially secure system in a network environment. A CMOS-based password during Power-on/Reset can be enabled. If the password jumper is set to "keep" and a valid password has been entered from the BIOS SETUP program, the system will prompt for a password every time the system is rebooted. The system will prompt for a password until the password is cleared at power-up or the password jumper is moved to "clear". The password can be cleared or changed when the system prompts for the password by following the steps below:

1) To remove a password at the "Enter password:" prompt type the current password followed by a forward slash character. Example, "Enter password: current_password/<cr>", will remove the current password.

2) To change a password at the "Enter password:" prompt, type current password, forward slash, new password, forward slash, new password, carriage return. Example, "Enter Password: current_password/new_password/new_password<cr>".

Other security features include a jumper to disable access to the BIOS SETUP program to prevent unauthorized modifications, and a jumper to disable the floppy write capability to prevent downloading of proprietary software or confidential data.

T. Power Supply

The Professional Workstation uses a custom power supply with auto-ranging AC input and an approximate total power output of 142 watts. The power supply is a totally self-contained module that connects directly to the motherboard via a custom connector, eliminating all power cables in the system. In addition to the normal power supply circuitry, the module also houses the on/off and reset switches, front panel LED's, the speaker, external AC receptacles, and thermostatically controlled cooling fans. All minimum load requirements for the power supply are met by the minimum configuration motherboard.

A female auxiliary AC power outlet is provided at the rear of the system so that, with the right adapter, the system monitor can be plugged into the Professional Workstation. This simplifies the power-on sequence by turning the monitor on or off with the base system. The voltage output from the auxiliary power connector corresponds to the system's input AC voltage.

III. PROFESSIONAL WORKSTATION DIFFERENTIATORS

The following list high-lights a few of the Professional Workstation's differentiators. For a more complete description of differentiators and potential applications, refer to the Professional Workstation Marketing Position Paper.

- Highly integrated motherboard for high performance and reliability.
- CPU scalability for accelerated time-to-market.
- Built-in Ethernet for ease of network integration.
- Built-in SCSI-2 for peripheral expandability.
- On-board high resolution/high speed graphics to support graphical user interfaces.
- More flexible system configuration due to enhanced, yet simplified, BIOS SETUP program.
- Easier system integration and serviceability due to new peripheral mounting hardware and improved chassis design.
- Added features including VESA compatible feature connector, bi-directional parallel port, network and keyboard passwords, PS/2 keyboard and mouse ports, chassis case lock, on-board speaker, up to 32MB of 80 nsec on-board RAM and higher resolution video modes (1024x768).
- European local language kits.
- Industry leading technical service provided by IntelTechDirect and NSD.

IV.   PROFESSIONAL WORKSTATION PRELIMINARY BENCHMARKS

Preliminary benchmark results comparing the Professional Workstation to other 486 33MHz machines indicate the system is very competitive and delivers an unmatched price/performance ratio. Graphics in particular is a clear standout.

To achieve top performance, one of the components on the board, an ASIC device, requires a stepping revision. This change has been made in systems that have a PBA number 515338-004 or greater   A more complete benchmark report will be available in late Q2 92.

PC MAG Benchmarks Ver. 5.6	80486 Instr. Mix	Float.-Point w/o Math	Conv. Memory	DOS File Access (Sm Rec)	DOS File Access (Lg Rec)	BIOS Disk Seek	Direct to Screen	Video BIOS w/o Scroll	Video BIOS w Scroll	Bus Type
Zeos 486/33 w/ Mylex SCSI	1.12	1.81	*0.14	*1.97	0.37	1.13	0.94	0.16	0.77	EISA
Wedge 486/33	1.17	1.87	0.16	62.35	3.87	15.13	2.03	0.22	1.1	EISA
Twinhead Superset 600/433	1.12	1.87	0.19	55.20	5.26	15.98	2.31	0.55	1.48	EISA
Tri-Star Flash Cache 486	1.08	*1.75	0.25	53.62	4.09	15.65	0.94	0.17	1.21	EISA
Tangent Model 433e w/Mylex SCSI	1.09	1.76	0.17	1.99	0.36	1.12	0.94	0.16	0.71	EISA
Tangent 433i	1.12	1.87	0.20	53.78	3.92	16.29	0.88	0.17	0.71	EISA
Tandon 486/33 w/ Mylex SCSI	1.14	1.81	0.16	2.01	*0.35	1.11	1.1	1.04	1.81	EISA
Syst. Integration Assoc SIA 486/33	1.08	1.82	*0.14	51.48	3.69	16.46	3.46	0.33	1.49	ISA
SAI-486/33 w/WD1007	1.11	1.81	0.22	55.30	5.05	15.71	2.69	0.22	1.32	ISA
SAI 486/33 w/Adaptec 1742B	1.15	1.87	0.19	32.35	4.04	*1.01	0.76	*0.11	*.66	EISA
Proteus 486/33	1.1	1.81	0.17	34.64	3.18	1.12	1.1	0.17	0.88	EISA
PC Pros/Touche 5550T/486 33	1.13	1.82	0.16	33.66	2.64	1.12	1.1	0.16	0.82	EISA
PC Pros/Touche 486-33 Model 5550	1.08	1.81	0.17	51.10	3.75	15.76	1.59	0.22	1.04	ISA
PC Brand 486/33	1.09	1.87	0.19	54.31	3.84	15.51	0.99	0.27	0.88	ISA
Northgate Elegance 486/33	1.09	1.82	0.25	53.60	4.07	15.54	0.93	0.16	0.83	ISA
National Micro Systems Flash 486-33	1.21	1.81	0.22	33.48	2.72	1.05	0.98	*0.11	0.77	EISA
Micro Express ME 486/33	1.12	1.86	0.22	52.92	4.53	13.97	0.88	0.17	0.77	ISA
Intel Model 403E w/64K cache	1.1	1.81	0.16	47.35	2.21	15.6	2.26	0.22	1.16	EISA
Intel Professional Workstation w 105 SCSI	**1.1**	**1.82**	**0.16**	**42.02**	**4.84**	**21.14**	***0.55**	***0.11**	***0.66**	**EISA**
IBM Model 95 w/o cache	1.11	1.81	0.17	39.38	4.5	30.32	1.21	0.28	1.04	MCA
IBM Model 95 w/ 256k cache	1.18	1.82	0.16	55.52	4.75	16.09	1.16	0.22	0.82	MCA
Fortron NetSet 486/33	1.09	1.81	0.17	53.74	3.09	14.38	2.03	0.27	1.1	EISA
Eltech Model 486-33	1.08	1.82	*0.14	62.79	5.51	17.13	1.32	0.22	1.04	ISA
Dynamic Decisions Dynex 486	1.08	1.76	0.17	55.87	5.15	15.98	2.80	0.28	1.43	ISA
Compaq SystemPro 486/33E	1.11	1.81	0.22	37.80	3.81	15.29	0.94	0.27	0.99	EISA
Compaq 486/33L	1.13	1.82	0.16	45.47	3.61	16.24	0.87	0.16	0.82	EISA
Bus 486/33	1.13	1.81	0.16	32.69	3.92	1.14	0.93	*0.11	0.83	EISA
ACMA 486/33 Eng Workstation	1.08	1.81	*0.14	61.64	6.43	17.78	1.60	0.22	1.10	ISA

* - Best in catagory.

V. APPENDICES

A. Product Codes and Standard System Configurations

Market Order Code (MOC)	Description
LP486DX250E4F	50MHz i486DX2 System, 4 MB memory, floppy
LP486DX33E4F	33 MHz i486DX System, 4 MB memory, floppy
LP486SX25E4F	25 MHz i486SX System, 4 MB memory, floppy
LP486SX20E4F	20 MHz i486SX System, 4 MB memory, floppy
LPUNIXKIT	UNIX Kit (LAN, SCSI, Video drivers for SCO V3.2)
LPNOVLKIT	Novell Server Kit (Netware 286/386 LAN drivers)
LPSWSUPTSKIT	OEM S/W kit: PUNIXKIT, PNOVLSKIT, system S/W

B. Professional Workstation Literature

Product Guide: 512828-001
Fact Sheet: 281376-001
Marketing Position Paper
Benchmark Report
Video Tape

C. User Installable Components

OverDrive Processor Socket: Intel i487SX Coprocessor or OverDrive Processors
External Cache Socket: Intel i485 TurboCache (64 or 128 KByte)
SIMM Memory:
      256K x 36 (Single-sided, 1 MByte/SIMM):   Toshiba THM362500ASG-80
      512K x 36 (Double-sided, 2 MByte/SIMM):   Toshiba THM365120ASG-80
      Texas Instruments TM512LBK36B-80
      NEC MC-42512A36F-80

      1M x 36 (Single-sided, 4 MByte/SIMM):   Toshiba THM361020SG-80
      2M x 36 (Double-sided, 8 MByte/SIMM): Toshiba THM362020SG-80

Video Memory: 256Kx4, 60 ns, DIP   Toshiba TC514256BP-60
      Matsushita MN41C4256AS-06

D. Software Driver Matrix

	Base S/W Kit	LPUNIXKIT	LPSWSUPTKIT	LPNOVLSKIT	OS/2 V1.3 Operating System
DOS/Windows					
Video	Rel. 3.1 - includes hi-res drivers for Win3.0, GEM, Lotus 1-2-3, Autocad and other DOS S/W.		Rel. 3.1 - includes hi-res drivers for Win3.0, GEM, Lotus 1-2-3, Autocad and other DOS S/W.		
SCSI	BIOS - supports basic DOS functions. SDMS Ver 1.6 - supports DOS 5.0, Win3.0, extended memory managers, multiple SCSI hosts, SCSI CD-ROMs, etc.		BIOS - supports basic DOS functions. SDMS Ver 1.6 - supports DOS 5.0, Win3.0, extended memory managers, multiple SCSI hosts, SCSI CD-ROMs, etc.		
LAN	NDIS driver - supports Microsoft compatible networks: Lanman, Banyan client, etc. Novel IPX driver support.		NDIS driver - supports Microsoft compatible networks: Lanman, Banyan client, etc. Novel IPX driver support.		
OS/2					
Video			High Res' Drivers for OS/2 1.21		Standard VGA drivers supplied for V1.3.
SCSI			SCSI Drivers for OS/2 1.21 & 1.3* (Non-Laddr only)		SDMS Ver 1.6 - support for OS/2 v1.3 (non-LADDR driver)
LAN			NDIS driver for OS/2 1.21 & 1.3		NDIS driver - support for OS/2 v 1.3.
SCO UNIX V.3.2 R2 & ODT V1.1					
Video Support via ODT from SCO.					
SCSI		Boot Diskette supplied for R2. SDMS Ver 1.6 drivers	Boot Diskette supplied for R2. SDMS Ver 1.6 drivers		
LAN		LLI Streams driver, SCO TCP/IP compatible.	LLI Streams driver, SCO TCP/IP compatible.		
Novell Server					
SCSI				Netware 386 driver	
LAN				Netware 386 IPX/ODI driver	
SYTOS for DOS					
SCSI	SCSI tape driver		SCSI tape driver		

* - OS/2 System developers kit is also required to integrate SCSI driver support into Microsoft OS/2 V1.3.

E.   Supported Peripherals

The following devices have been qualified by Intel as being compatible with the Professional Workstation product line:

IDE: Quantum LPS 105AT (Quantum LPS120AT is under qualification)
SCSI: Quantum 105S
            Maxtor LXT437S (Maxtor LXT535S is under qualification)

The following SCSI devices have been certifed by NCR as being compatible with the NCR 53C700 SCSI controller:

Disk Drives:	Brand Technology	BT9170
	Conner Peripherals	CP3180
		CP3100
		CP3200F
	Fujitsu	M2263SA
	M2249SA	
	Hitachi	DK515C-78
	Maxtor	LXT340
		LXT437S
	Quantum	LP52S
		LP105S
		LPS10x
		LPS425S
		P40S
		P80S
		Q280
		120S
		170S
		210S
		425S
	Rodime	RO3057S
	Seagate	ST225N
		ST296N
		ST157
		ST138
		ST1096N
		ST1239N
		ST2383N
		ST4767N
	Toshiba	MK234FB-I

| Removabl Media Drives: | | |
| | Tandon | DataPac |

CD ROM Drives:	Hitachi	CDR3650
	NEC	BFU35
	Sony	1140
		CDU541
	Toshiba	XM3201B

Tape Drives:	Archive	2150S
		4420T DAT
	Cipher ST1505	
	Exabyte	8mm tape

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JVC   DAT XM5442A
Sankyo   Cp525
Wangdat   DAT 1300

1. Physical Dimensions

System Dimensions	US Measurements	Metric
Height	3.0 inches	7.62 cm
Width	15.5 inches	39.37 cm
Depth	15.25 inches	38.74 cm
Weight (w/o peripherals)	20 lbs.	11.36 kg

2. Power Supply Current Ratings

Voltage	Maximum Continuous Current	Peak Surge for 15 seconds
+5 Volts	20.0 Amps	-
-5 Volts	0.4 Amps	-
+12 Volts	3.0 Amps	4.5 Amps
-12 Volts	0.4 Amps	-

3. System Current Usage

The table below lists the current required by the different subsystems and the maximum system current requirements.

System Power Usage	+5 Volts Current Usage	-5 Volts Current Usage	+12 Volts Current Usage	-12 Volts Current Usage
Baseboard	5.7 A (max) 2.6 A (typical)		0.5 A (max)	0.02 Amps (max)
Keyboard	0.5 Amps (max)			
Mouse			0.01 Amps (max)	
i487SX Coprocessor	0.8 Amps (max)			
i485 TurboCache Controller	1.2 Amps (max)			
SIMMs (4 modules)	2.0 Amps (max)			
3.5" 1.44Meg TEAC Floppy	0.7 Amps (max)			
Hard disk drive	0.75 Amps (max)		2.1 Amps Peak 0.80 Amps (max)	
2 EISA Expansion Slots	6 Amps (max)	.3 Amps (max)	2 Amps (max)	.3 Amps (max)
Maximum System Current Usage	17.65 Amps (max)	.3 Amps	2.1 Amps Peak 3.31 Amps Max.	0.32 Amps

4. Regulatory Standards

The Professional Workstation will meetsor exceed the following regulatory requirements:

Ergonomics:

Europe	IEC 380

Safety:

U.S.	UL 1950
Canada	CSA C22.2 No. 950-M89
Europe	TUV EN 60950
	ZH1/618
	IEC 950
	NEMKO EMKO-TUE(74-SEC) 203 T/90
Australia	AS3260-1988

EMI/RFI:

U.S.	FCC Class B CFR 47 Part 15, Subpart B
Canada	DOC CRC c.1374 Class B
Europe	VDE 0871/6.78 Class B
	Vfg 1046/1984 Limit B
	CISPR 22/85 Class B
Japan	VCCI Class 2 ITE

F. Environmental Specifications

Environmental Parameter	Condition	Specification
Temperature		
	Non-Operating	-40°C to +70°C
	Operating	+10°C to +40°C
Humidity		
	Non-Operating	95% Relative Humidity max. @ 40°C
	Operating, no hard disk	85% RH max.
	Operating, w hard disk	Not to exceed 26°C wet bulb
Altitude		
	Non-Operating	50,000 feet (15,240 meters)
	Operating	10,000 feet (3048 meters)
ESD		
	1.0kV	No Errors
	2.5kV	No Errors
	5.0kV	5% Soft Errors, 0% Hard Errors, No physical damage
	7.5kV	10% Soft Errors, 0% Hard Errors, No physical damage
	10.0kV	25% Soft Errors, 5% Hard Errors, No physical damage
	12.5kV	50% Soft, 10% Hard, No physical damage
	15.0kV	100% Soft, 25% Hard, No physical damage
	25.0kV	100% Soft, 100% Hard, No physical damage
Shock		
	Non-Operating	30.0G, 11ms, 1/2 sine
Acoustical Noise		
	Operator's Position	Less than 40 dB max.
	1 meter, peripherals idle	Less than 35 dB max.

G. Baseboard Jumpers

Name	Options	Location	Remove	Add
Floppy Write Protect	Enable Write Protect	J3	4-6	2-4
	*Allow Write to Floppy		2-4	4-6
SCSI Termination Power	Inactive	J5	3-5	1-3
	*Active		1-3	3-5
FLASH Write-Protect	*Allow Write to Flash	J5	4-6	2-4
	Write-Protect		2-4	4-6
Slot 1 EISA/ISA	ISA Compatible Decode	J5	12-14	10-12
	*EISA Compatible Decode		10-12	12-14
Video Memory Size	*512 Kbyte Installed	J19	3-5	1-3
	1 Mbyte Installed		1-3	3-5
Video Enable	*Enable On-bd Video	J19	4-6	2-4
	Disable On-bd Video		2-4	4-6
SETUP Access	*Enable Access to SETUP	J21	3-5	1-3
	Disable Access to SETUP		1-3	3-5
Password	Clear Password	J21	4-6	2-4
	*Keep Password		2-4	4-6
CMOS	Set CMOS memory to default parameters	J21	11-13	9-11
	*Keep Current CMOS memory parameters		9-11	11-13
FLASH EEPROM Operation	*Normal Mode	J21	12-14	10-12
	Recovery Mode		10-12	12-14

* Factory default configuration.

Primary CPU	OverDrive CPU	Jumper Block	Jumper Positions
i486SX/20		J10	3-5 , 4-6, 11-13, 12-14
	OverDrive-40	J10	3-5 , 4-6, 11-13, 12-14
	OverDrive-50	J10	3-5, 4-6, 11-13, 10-12
	OverDrive-66	J10	3-5 , 4-6, 9-11, 12-14
i486SX/25		J10	3-5, 4-6, 11-13, 10-12
	OverDrive-50	J10	3-5, 4-6, 11-13, 10-12
	OverDrive-66	J10	3-5, 4-6, 9-11, 12-14
i486DX/33		J10	1-3, 2-4, 9-11, 12-14
	OverDrive-50	J10	1-3, 2-4, 11-13, 10-12
	OverDrive-66	J10	1-3, 2-4, 9-11, 12-14
i486DX2/50		J10	1-3, 2-4, 11-13, 10-12
	OverDrive-66	J10	1-3, 2-4, 9-11, 12-14
i486DX2/66		J10	1-3, 2-4, 9-11, 12-14

A diagram of the jumper locations and functions is included on the inside of the chassis top cover.

Note: No jumper changes are required for the addition of a i487SX numeric co-porcessor.

H.   Baseboard Connectors

J2 - Power Connector

Type: Single Row Header Style (Male)
Pinout: 1   RAWST
      2   +5
      3   +12
      4   -12
      5   GND
      6   GND
      7   GND
      8   GND
      9   -5
      10   +5
      11   +5
      12   +5
      13   +5
      14   +5
      15   GND
      16   GND
      17   -12
      18   HD Active
      19   Front Panel Reset
      20   Speaker Data

J4 - Dual Serial Port Connector

Type: Stacked Dual 9-Pin D-sub (Male)
Pinout: PC AT standard

J6A - Parallel Port

Type: 25-pin Centronics type (Female)
Pinout: PC AT standard

J6B - External SCSI Port Connector

Type: Fine pitch, 50 pin SCSI-2 (Female)

Pinout:

Pin	Signal	Pin	Signal
1	GND	26	Data 0
2	GND	27	Data 1
3	GND	28	Data 2
4	GND	29	Data 3
5	GND	30	Data 4
6	GND	31	Data 5
7	GND	33	Data 6
8	GND	34	Data 7
9	GND	35	Data Parity
10	GND	35	GND
11	GND	36	GND
12	GND	37	GND
13	N/C	38	Terminator Power
14	GND	39	GND
15	GND	40	GND
16	GND	41	SCSI Attn
17	GND	42	GND
18	GND	43	SCSI Busy

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29	GND	44	SCSI Ack
20	GND	45	SCSI Rst
21	GND	46	SCSI Msg
22	GND	47	SCSI Sel
23	GND	48	SCSI CD
24	GND	49	SCSI Req
25	GND	50	SCSI IO

J8 - PS/2 Mouse Connector

Type:	PS/2 (Female)	
Pinout:	1	Data
	2	N/C
	3	GND
	4	+5
	5	Clock
	6	N/C
	7	GND
	8	GND
	9	GND

J15 - PS/2 Keyboard Connector

Type: PS/2 (Female)
Pinout: 1   Data
          2   N/C
          3   GND
          4   +5
          5   Clock
          6   N/C
          7   GND
          8   GND
          9   GND

J16 - VGA Video Connector

Type: 15-pin minature D-sub (Female)

GND	N/C	Blue	Green	Red

GND	N/C	GND	GND	GND

N/C	Vert. Sync.	Horiz. Sync.	N/C	N/C

J17 - Twisted Pair Ethernet Connector

Type: RJ-45 (Female)
Pinout: 1   TX+
          2   TX-
          3   RCV+
          4   N/C
          5   N/C
          6   RCV-
          7   N/C
          8   N/C

J18 - AUI Ethernet Connector

Type: 15-pin D-sub (Female)

GND	N/C	GND	DI-A	GND	DO-A	CI-A	GND

N/C	GND	VFAUI	DI-B	GND	DO-B	CI-B

J20 - VESA Video Pass-thru Connector

Type: 3M style, double row header, 26 pin (Male)

Data 0	Data 1	Data 2	Data 3	Data 4	Data 5	Data 6	Data 7	DOTC	BLANK	VBHSR	VBVSR	GND
GND	GND	GND	DEN	SYNCEN	DOTCEN	N/C	GND	GND	GND	GND	N/C	N/C

I. Default CMOS Parameters

When the clear CMOS jumper is used, the following settings are loaded into CMOS memory:

BIOS SETUP Field	Default Setting	Comments
Page 1 Settings		
System Time	NA	Not affected by the Clear CMOS jumper.
System Date	NA	Not affected by the Clear CMOS jumper.
Onboard Floppy	Enabled	
Diskette	3.5", 1.44 MB	
Onboard IDE	Disabled	
Hard Drive	Not Installed	
User Definable Drives	48 and 49	
Onboard SCSI	Enabled	
Onboard LAN	Disabled	
LAN Media Type	Twisted Pair	

BIOS SETUP Field	Default Setting	Comments
Page 2 Settings		
Video Card	VGA/EGA	
800x600 Mode Refresh Rate	56 Hz	
1024x768 Mode Refresh Rate	Interlaced @ 44/88 Hz	
Onboard Video Controller	Primary	
Keyboard	Not Installed	
Numlock On At Boot	No	
Password	Not Installed	
Page 3 Settings		
Base Memory Above 512K	Enabled	
Base Memory	640 KByte	Not user definable, size detected by BIOS
Extended Memory	? (depends on amount of installed memory)	Not user definable, size detected by BIOS
Speaker	Enabled	
Onboard Mouse	Enabled	
Parallel Port	Base Addr 0378H: Compatible	
Serial Port 1	Enabled	
Serial Port 2	Enabled	
Console Redirection - Serial Port 1	Disabled	
Console Redirection - Serial Port 2	Disabled	
Page 4 Settings		
CPU Speed	Fast	
Cache	Disabled	
Cache Block Disable	Disabled	
I/O Bus Performance	Standard	ENHANCED Mode will enable Fast cycle video and reduce the EISA bus refresh rate
On-bd Video BIOS mapping	To E0000H	Alternate is to C0000 AND E0000
Shadow C0000H to C3FFFH	Disabled	
Shadow C4000H to C7FFFH	Disabled	
Shadow C8000H to CBFFFH	Disabled	
Shadow CC000H to CFFFFH	Disabled	
Shadow D0000H to D3FFFH	Disabled	
Shadow D4000H to D7FFFH	Disabled	
Shadow D8000H to DBFFFH	Disabled	
Shadow DC000H to DFFFFH	Disabled	

Note: When off-board BIOS is shadowed, it is copied into read only RAM.

J. Video Modes

Mode#	Resolution	Colors	Font	Clock	Vertical Refresh
21/54H	132col x 43rows	16	9x9	44.9MHz	
41H	80col x 34rows	16	9x9	44.9HHz	
47H	132col x 28rows	16	8x16	44.9MHz	
55H	132col x 25rows	16	8x16	44.9MHz	
56H	132col x 43rows	4 (mono)	9x9	44.9MHz	
57H	132col x 25rows	4 (mono)	8x16	44.9MHz	
58/6AH	800 x 600	16	8x8	36MHz 40MHz 50MHz	56Hz 60Hz 72Hz
5AH	1024 x 768	2	8x16	44.9MHz 65MHz 75MHz 80MHz	Interlaced Non-interlaced @ 60Hz Non-interlaced @ 70Hz Non-interlaced @ 72Hz
5CH	800 x 600	256	8x8	36Mhz 40MHz 50MHz	56Hz 60Hz 72Hz
5DH	1024 x 768	16	8x16	44.9MHz 65MHz 75MHz 80MHz	Interlaced Non-interlaced @ 60Hz Non-interlaced @ 70Hz Non-interlaced @ 72Hz
5EH	640 x 400	256	8x16	25MHz	
5FH	640 x 480	256	8x16	25MHz	
60H	1024x768	256	8x16	44.9MHz 65 MHz 75MHz 80MHz	Interlaced Non-interlaced @ 60Hz Non-interlaced @ 70Hz Non-interlaced @ 72Hz

1. System Resources

2. SIMM Configuration Guide (note 1)

J14	J13	J12	J11	Memory Size	Comments
256 K	-	-	-	1 MB	
256 K	256k	-	-	2 MB	
256 K	256k	256k	256k	4 MB	
512 K	-	-	-	2MB	
512 K	512 K	-	-	4 MB	Initial System Configuration
512 K	512 K	512 K	512 K-	8 MB	
1 M		-	-	4 MB	Current System Configuration
1 M	1 M		-	8 MB	
1 M	1 M	1M	1M	16 MB	
2 M			-	8 MB	
2 M	2 M			16 MB	
2 M	2 M-	2 M-	2 M-	32 MB	
4 M		-	-	16 MB (Note 2)	
4 M	4 M		-	32 MB (Note 2)	
4 M	4M	4 M-	4 M-	64 MB (Note 2)	
8 M			-	32 MB (Note 2)	

| 8 M | 8 M | | | 64 MB (Note 2) | |
| 8 M | 8 M | 8 M- | 8 M- | 128 MB (Note 2) | Maximum System Capacity |

Table: DRAM SIMM Configuration

Notes:
1) 36-bit SIMM modules required.
2) 4 M x 36 and 8 M x 36 SIMMs are not yet available, the Professional Workstation is design to accept these when they become available.

3. System Memory Map

Memory Offset of Starting Address	HEX Address Range	Size	Usage or Function
4G-128K	FFFE-0000 -> FFFF-FFFF	128K	Sytem BIOS Alias area
128M	0800-0000 -> FFFD-FFFF	~3968M	EISA Expansion Area
1M	0010-0000 -> 07FF-FFFF	127M	Extended Memory / EISA Expansion Area
960K	000F-0000 -> 000F-FFFF	64K	System BIOS Operating Area
944K	000E-C000 -> 000E-FFFF	16K	System BIOS Recovery Area *
936K	000E-A000 -> 000E-BFFF	8K	OEM Flash Area *
928K	000E-8000 -> 000E-9FFF	8K	EISA Configuration Data Area ***
896K	000E-0000 -> 000E-7FFF	32K	Video BIOS Area *
820K	000C-D000 -> 000D-FFFF	76K	Unused (Note only the upper 64KBytes of this area is available for expansion card memory if SCSI BIOS is installed see note below)
800K	000C-8000 -> 000C-CFFF	20K	On-bd SCSI BIOS (Unused if SCSI disabled)**
768K	000C-0000 -> 000C-7FFF	32K	Unused (Video ROM BIOS Alias area if enabled)
640K	000A-0000 -> 000B-FFFF	128K	Video Display RAM
639K	0009-FC00 -> 0009-FFFF	1K	Extended BIOS data segment(usually relocated by EMM386 or other memory managers)
512K	0008-0000 -> 0009-FBFF	127K	Base Memory (Unused if disabled, available for expansion card memory)
0K	0000-0000 -> 0007-FFFF	512	Base Memory

Notes:

• Above 512 Kbyte Baseboard memory, Video BIOS aliasing, and SCSI can be enabled/disabled via SETUP.

• The option of re-mapping the video BIOS to 0C-0000H is provided for applications that require the video BIOS at that location. If you are not sure if that your application requires the video BIOS to be located at 0C-0000H (most do not) then do not enable this option in SETUP. Not enabling video mapping to 0C-0000H saves 32K of memory. In any case, the on-board video BIOS will always be located at 0E-0000H.

• Not all video modes are normally used at the same time. Some memory may be saved by defining which video modes are to be used. Typically 0B-0000 to 0B-7FFFH is only used when a monochrome monitor is attached to the sytem, while both the text and graphics VGA modes are often used when a VGA monitor is attached.

• The BIOS SETUP program provides for shadowing off-board ROM BIOS into onbard RAM on 16K boundaries. This is available in memory located between 0C-0000H and 0D-FFFFH.

* Under certain circumstances these areas of memory may be included into the memory pool used by a memory manager i.e EMM386

** The memory consumed by the SCSI BIOS is only 20K bytes long but the system will shadow a 32KByte range of memory due to the granularity of the hardware shadowing system.. With the SCSI BIOS installed the area from 0CD000 to 0CFFFF cannot be used for add-in boards but can be used by a memory manager i.e EMM386. The memory manager will include this area by default.

*** Inclusion of this area into the memory pool of a memory manager like EMM386 may cause malfunction in the use of both onboard networking and SCSI devices and off board EISA add-in boards.

4. System I/O Address Map

I/O Address (Hex)	Function	I/O Device
0CC0-0CFF	SCSI control registers	NCR 53C700
0CB8-0CBF	Reserved	
0CB0-0CB7	LAN control registers	82596CA
0C80-0C83	System board ID bytes (read only)	
0C26-0C27	CLASIC registers (optional location, see 0026-0027)	CLASIC
0C03	CLASIC control port C	CLASIC
0C02	CLASIC control port B	CLASIC
04F4-04FF 04E0-04EF	DMA controller stop registers	82357
04D4-04D7	DMA controller 2 extended registers	82357
04D0-04D1	Interrupt edge/level control	82357
04C2-04CF	DMA controller 2 extended registers	82357
0480-048F	DMA high page register	82357
0464-0465	Last Bus Master granted (read only)	82357
0462	Software NMI register (write only)	82357
0461	Extended NMI and Reset control register	82357
0400-040F	DMA controller 1 extended registers	82357
03F8-03FF	Serial port 1	WD 16C552
03F0-03F7	Floppy disk controller	82077AA
03E8-03EF	Serial port 3	Exp. Card
03B0-03DF	Onboard video controller	WD 90C30
0378-037F	Parallel port 1	WD 16C552
0370-0377	Secondary Floppy disk controller	Exp. card
02F8-02FF	Serial port 2	WD 16C552
02F8-02E8	Serial port 4	Exp. card
0278-027F	Parallel port 2	Exp. card
01F0-01F7	IDE interface ports	IDE drive
00F8-00FF 00F0	Numerics coprocessor	i486/i847SX
00C0-00DF	DMA controller 2	82357
00A0-00A1	Interrupt controller 2	82357
0092	CLASIC control port A	CLASIC
0080-008F	DMA low page register	82357
0078	CLASIC BIOS counter	CLASIC
0070-0071	Real-time clock	DS 1287
0070	NMI enable register (write only)	82357
0061	NMI status register	82357
0060, 0064	Keyboard/mouse controller	8742
0048-004B	Interval timer 2	82357
0040-0043	Interval timer 1	82357
0026-0027	CLASIC indexed registers (relocatable to 0C26-0C27)	CLASSIC
0022-0023	DRAM controller registers	82359
0020-0021	Interrupt controller 1	82357
0000-000F	DMA controller 1	82357

Classic Control Port B. (0C02H)

Bit #	Functional Description
7	Used to Enable the LAN controller after NMI has disables it.
6	LAN Select: Twisted pair when high. AUI when low
5	Speaker enable
4	EBC posted write enable
3	Makes slot 1 look like an ISA slot
2	Parallel Port Uni/Bidirectional
1	Indicates video type
0	Fast Video Enable

Classic Control Port C. (0C03H)

Bit #	Functional Description
5	Low when LAN fused 12V line is active
4	Low when LAN +5V is active
3	Low when SCSI terminator power is active
2	High when no SIMM's installed
1	Video enable jumper
0	Flash recovery jumper

5. System Interrupts

The following table and text identifies how each interrupt on the Professional Workstation is used.

Interrupt Request	System Only	EISA Bus Pin
NMI	Parity Error	
0	Reserved, Interval Timer	
1	Reserved, Keyboard buffer full	
2	Reserved, Cascade interrupt from slave PIC	
3	On-bd Serial Port 2	119
4	On-bd Serial Port 1	118
5	User available	117
6	On-bd Floppy	116
7	On-bd Parallel Port	115
8	RTC	
9	Optional SCSI/LAN	98
10	Optional SCSI/LAN (default LAN)	128
11	Optional SCSI/LAN (default SCSI)	129
12	On-bd Mouse Port if enabled, else user available	130
13	Reserved, Math coprocessor	
14	IDE Interrupt	132
15	Optional SCSI/LAN	131

Notes:
1) IRQ 9, 10, 11, and 15 can be set via the ECU for user available, on-board LAN, or on-board SCSI.

2) IRQ 0, 1, 2, 8, and 13 cannot be used by an add-in card. In PC-XT compatible systems, IRQ 2 was available for use on the XT-Bus. In PC-AT compatible systems, IRQ 2 is not available for use on the bus. Some older ISA expansion boards have an option to use IRQ 2. This should not be selected when such a board is installed in a Professional Workstation system.

K.   Predicted Reliability and MTBF Specifications

At the present time, only a calculated Mean Time Between Failures is available. The MTBF for a Professional Workstation with floppy, Maxtor LXT437S hard drive, and 8 MByte of memory is 20,311 hours @ 40°C. The predicted Mean Time To Repair is less than thirty minutes.

L.   Customer Support

This product is backed by Intel's industry leading support groups including Network Services Division (NSD) and IntelTechDirect. NSD can help with many of your network integration and service needs including providing world wide network integration and system repair services. IntelTechDirect provides the following 3 major services:

- iPAN (Intel Product Assistance Network)
  An electronic Bulletin board with current product information, demo software and more...
  Accessible via a 1200 or 2400 BAUD modem. Call iPALS for further information.

- iPUB (Intel Product Update Bulletin)
  A monthly publication containing product specific information.

- iPALS (Intel Phone Action Line Support)
  A direct telephone support line backed by highly qualified and well trained technical personnel.

For further information about IntelTechDirect please contact your local Intel Sales Representative.

VI.   GLOSSARY

Baseboard: System PBA including BIOS, RAM and jumpers, also known as motherboard

BIOS: Basic Input/Output System

Cache: A small amount of high speed RAM used to store copies of memory locations found in slower system memory. This is used to improve system performance.

Cache Coherency: A cache memory location is said to be coherent when it contains an exact copy of the data found in the system memory location that it corresponds to. When the cache is coherent a flag (the cache tag bit) is set.

Cache Tag Bit: A flag used to determine if a cache location contains a valid copy of the system memory location it corresponds to.

CAD/CAM: Computer Automated Design/Computer Automated Manufacturing

CGA: Color Graphics Adapter, an IBM video standard

CHMOS: Complementary High-Performance Metal Oxide Semi-conductor

CMOS: Complementary Metal Oxide Semi-conductor

CoProcessor: An additional processor that works with the main CPU and extends its instruction set, typically for math operations, the Intel 80387Sx is a math CoProcessor.

CPU: Central Processing Unit, Typically the 386SX and its support circuitry

CSA: Canadian Standards Association

DAC: Digital to Analog Converter, used to display analog VGA video signal

DCD: Desktop Computer Division, Intel group responsible for the 300SX-20

DRAM: Dynamic RAM

EGA: Enhanced Graphics Adapter, an IBM video standard

EMI: Electro-Magnetic Interference

EPLD: Electrically Programmable Logic Devices

EPROM: Erasable Programmable ROM

FCC: Federal Communications Commission

FPU: Floating Point Unit, typically the 80387SX CoProcessor

IC: Integrated Circuit

IDE: Intergrated Drive Electronics, A hard disk drive interface for AT compatible systems. Intgrates drive and controller

ISA: Industry Standard Architecture, PC-AT interface for add-in cards

LIM EMS: Lotus-Intel-Microsoft Expanded Memory System, paged memory support under 1M

MCGA: Multi-Color Graphics Adapter, an enhanced CGA mode supported by some Hercules adapters

MDA: Monochrome Display Adapter, an IBM video standard (Does not support graphics)

MGA: Monochrome Graphics Adapter, an industry term used for graphic monochrome video subsystems

MOC: Market Order Code, System identification number found in Intel Product Catalog

MTBF: Mean Time Between Failures, a measure of system reliability

Motherboard: System PBA including BIOS, RAM and jumpers

NMI: Non-Maskable Interrupt, system parity or I/O channel check error interrupt

NSD: Network Systems Division, Intel's Service organization (used to be called ASD)

OEM: Original Equipment Manufacturer

PBA: Printed Board Assembly, tracked by identifying number and revision included on board label

PC-AT: Personal Computer - Advanced Technology

PC-XT: Personal Computer - eXtended Technology

PFP: Plastic Flat Pack, an IC packaging style

PLCC: Plastic Leadless Chip Carrier, an IC packaging style

POR: Power On Reset, caused by either a power-up or front panel reset

POST: Power-On Self-Test

PQFP: Plastic Quad Flat Pack, an IC packaging style

RAM: Random Access Memory

RFI: Radio Frequency Interference

ROM: Read Only Memory

SIMM: Serial In-line Memory Module

Super VGA: 800x600x16 enhancement to VGA, VESA Standard

SRAM: Static RAM

TSR: Terminate and Stay Resident, a DOS application that stays loaded in RAM

UL: Under-writers Laboratories

VESA: Video Electronics Standards Association, developed Super VGA standard
VGA: Video Graphics Array, an IBM video standard
VLSI: Very Large Scale Integration