PREMIUM® HS
TECHNOLOGY OVERVIEW

Designed for
Microsoft
Windows 95
Windows NT

MMX
intel inside
pentium·II

AST®
COMPUTER

AST®
COMPUTER
Working for your business.™

The AST Premium® HS series high-performance server is designed for users requiring high performance, scalable growth, and high availability. The system provides the power and speed to run Novell® NetWare®, IntranetWare™, and Microsoft® Windows NT® Server operating systems.

In some cases the system and its accompanying documentation are updated after the documentation is printed or during the course of production. To receive updates to the documentation, go to the AST web site at http://www.ast.com

The AST Premium HS includes the following features:

- Dual microprocessor support using Intel® Pentium® II technology. These Pentium Pro-class microprocessors run at speeds up to 300 MHz and include 512 KB of second-level cache memory integrated into the microprocessor package.
- Peripheral Component Interconnect (PCI), a high-performance, 32-bit I/O bus that provides compatibility with PCI expansion cards. PCI provides plug and play capability and operates at speeds up to 33 MHz. The computer provides five PCI expansion slots, one of which is shared with an industry standard architecture (ISA) slot.
- ISA, a 16-bit I/O bus that provides compatibility with half-length 8-bit and 16-bit ISA expansion boards. Two ISA slots are provided to accommodate legacy cards. One of these slots is shared with a PCI slot.
- Upgradable basic input/output system (BIOS), called FlashBIOS, which enables you to upgrade the system BIOS easily from a floppy disk.
- A front panel display (128 x 64 pixels) that provides status messages, power-on self-test (POST) code display, system configuration display, and visual warning of over-voltage, over-temperature, disk failure, and display environment (video) failure.
- Front panel controls include indicator light emitting diodes (LED) for hard drive access, temperature warnings, over-voltage warnings, main power, and local area network (LAN) activity.
- Front panel switches include power, reset, test, and intrusion alarm.
- Up to 512 MB of synchronous dynamic random access memory (SDRAM) or extended data output (EDO) RAM supported by four 168-pin dual inline memory module (DIMM) slots. These slots can support a wide variety of DIMMs, including mixed EDO and SDRAM DIMMs and different sized DIMMs in each slot. (Maximum capacities cannot be achieved using mixed DIMM types.)
- A chassis lock to prevent unauthorized opening of the system coupled with an audible intrusion alarm.
- One 3.5", 1.44 MB floppy drive.
- Integrated Intel EtherExpress PRO/100 Server Adapter.
- Three-channel, active-terminated, small computer systems interface (SCSI) backplane that supports up to 12 hot-swappable, Ultra/Wide SCSI hard drives. The backplane incorporates single connector attachment (SCA)-II technology to allow hot-swapping of failed drives with sequenced signal connection to guarantee a safe swap. The backplane also includes digital thermal sensors with memory, pre-configured SCSI IDs for each channel, and tachometer controlled fans for cooling the drive chamber.
- Three channel, Ultra/Wide SCSI redundant array of inexpensive drives (RAID) controller that supports RAID levels 0, 1, 3, 5, 10, 30, and 50.
- IDE compact disc, read-only memory (CD-ROM) drive.
- Rack mount solution. The system is designed to fit in a standard 19" rack.

The power supply is a three-module supply providing a hot backup in case one of the two working modules fails. Like a failed hard drive, the power supply module can be replaced without powering down the system. However, if a second module fails before the failed module is replaced the system must be powered down to await repair. Keeping a cold spare can prevent downtime due to lost power supply modules.

Fan modules are inexpensive items that are required to keep the system at an acceptable operating temperature. The system should not be run at all unless all fan modules are functioning to prevent other components from overheating. If a single fan module fails, the system must be powered down to replace it. By keeping a spare fan module in house, you can minimize downtime and protect other, more expensive, components.

Partners in the program supply:

- SCSI controllers
- Tape backup systems
- Network interface cards
- Uninterruptible power supplies
- External expansion chassis
- Video adapter cards
- Glass houses
- CD towers
- Software applications

For details and a complete list of the partners and their products contact the AST web site at http://www.ast.com

SUPPORT/SPARES

This section describes the support levels and possible spares that you may want to keep on hand to ensure the reliability of the server. Examples provided show the options and concerns that will influence the level of service purchased and the spares kept on hand for self-service situations. For complete information on support costs visit the AST web site at http://www.ast.com/support/warranty/upgrade.html

SUPPORT

AST offers the following service plans:

- The basic warranty is a three-year limited warranty. Service is provided by a third party maintenance (TPM) company. The service provider receives a Pronto Pro CD-ROM every other month which contains all of the up to date data required to support all AST products, including specifications and part numbers. The basic warranty includes on-site warranty service for three years.
- Guardian Care℠ guarantees 4-hour on-site response, 24 hours per day, seven days per week. Guardian Care provides the best service possible for your servers. Guardian Care is available in the US only.

SPARES

Depending on your budget, your in-house support capability, and your needs, you may want to keep some spares on hand in the event of an emergency. These spares will probably be limited to low cost, critical components. Items to consider are hard drives, power supply modules, and fan modules.

Hard drives are a common item. AST recommends that you maintain at least one hot spare in your RAID setup. In the event of a drive failure, the hot spare is immediately incorporated into the array and data is restored from redundancy information on the other drives to complete the array. A cold spare can then be installed without powering down the system and established as a hot spare. This process ensures that a minimum amount of time is spent in degraded mode and also minimizes the possibility of losing data due to a second drive failure occurring before the spare is loaded with restored data.

- High-availability features, such as an N+1 redundant,hot-swappable, 990W power supply system, error-correcting memory, thermally controlled fans with tachometer based speed setting, and voltage monitoring.
- Power conservation features including monitor power-down that allows the system to reduce its power consumption during periods of inactivity.

The system provides these built-in peripheral connectors:

- Two standard serial ports, one high-speed bidirectional parallel port, one LAN connector, two universal serial bus (USB) ports, one video port, one keyboard port, and one mouse port.
- A floppy drive controller that supports up to two floppy drives.
- One UltraDMA-33 direct memory access (DMA) integrated drive electronics (IDE) connector which supports up to two standard or UltraDMA-33 IDE devices.

The system also includes these software features:

- The System Setup program configures special features such as a system password and default boot device.
- Password protection to prevent unauthorized use of the system.
- Automatic server recovery monitors the server for evidence that the system is hung, attempts to wake up the system, and reboots the system in the event that it cannot restart the computer.
- Embedded diagnostics can be activated from the front panel controls and performs an extensive hardware test to determine the source of any error with a minimum of troubleshooting effort and delay.
- The advanced diagnostic program to test and diagnose AST Computer™ system hardware.

This guide provides information you will need before you receive the AST Premium HS computer. You should read this guide thoroughly before purchasing the system.

AST supports the following options that you can install in the AST Premium HS system:

- Additional boards; two ISA expansion boards, and up to five PCI expansion boards. One ISA slot and one PCI slot share space limiting the total number of add-in boards to six.
- Additional DIMMs on the system board allowing you to expand main memory up to 512 MB using SDRAM or 1 GB using EDO DIMMs.
- Up to twelve one-third-height (1") or half-height (1.6"), 3.5-inch form-factor, Ultra/Wide SCSI hard drives in the cabinet.
- Up to two half-height, 5.25" devices such as digital audio tape (DAT) drives or other tape backup devices or a 5.25" floppy drive in addition to the CD-ROM drive provided with the system. These devices can be either SCSI or IDE.

EDO (Extended Data Output) RAM

A RAM specification that does not use error checking and instead relies on the dependability of modern memory devices. Because error checking is not used, EDO memory provides faster access than most other memory types.

FlashBIOS (Basic Input/Output System)

RAM that retains data even when the computer is turned off. The BIOS resides in write-protected flash memory on EEPROM chips. The BIOS in flash memory can be changed with an electrical burst. Flash memory enables you to update the BIOS from a floppy disk or over a network.

Hot swap

A procedure that allows a failed component to be removed from the system and a replacement inserted into the system without powering down the computer. The AST Premium HS supports hot swapping of SCSI hard drives and power supply modules.

Industry Standard Architecture (ISA)

An open-architecture standard for I/O buses. ISA provides a 16-bit data path, maintaining compatibility with existing PC and AT-compatible add-in boards.

IIO (Intelligent Input/Output) board

Also called I_2O board. A combined circuit board that includes both the ethernet and the RAID controllers on the same circuit board.

LAN (Local Area Network)

A network that connects systems in the same building or facility. A local area network does not include systems that are too far separated to connect on standard network cables.

Maximum configuration

A system that is maximally configured, in terms of the amount of power required to run the system, contains two microprocessors, four DIMMs, one ISA expansion board, five PCI expansion boards, twelve SCSI hard drives, three 5.25" devices, and the 3.5" floppy drive.

Minimum configuration

A system that is minimally configured contains one microprocessor, one DIMM, no expansion boards of either type, one SCSI hard drive, the CD-ROM drive, and the 3.5" floppy drive.

AST has developed a Premium Partner program to identify vendors who provide quality products that you may need to complete your computing solution. AST's Premium Partners sell a wide range of products. AST has tested these products, or the manufacturer has tested their products with AST systems, and certifies that they are compatible with AST systems and that they are manufactured to the highest standards for service and reliability. To become an AST Premium Partner, a peripheral manufacturer must meet the following criteria, among others:

- Have the necessary operating and diagnostic procedures to work effectively in a networked environment.
- Provide AST with their testing methodology.
- Provide AST with worldwide sales personnel contacts.
- Provide AST with worldwide service personnel contacts.
- Test their products with AST systems and allow AST to test their products with our systems.
- Train AST service and support personnel on the technical aspects of their products and its uses in a networking environment.

The Premium Partner program assures you top quality, ease of installation, compatibility with your AST computers, and reliability. The program also provides the flexibility to select the brand you prefer and allows you to arrange your own purchases. By certifying these peripherals without reselling them ourselves, we eliminate one of the middlemen and help keep costs down.

AST's Premium Partners include:

• #9	• 3Com
• Accton	• Acculogic
• Adaptec	• AMD
• AMI	• APC
• Arcada	• ATI
• Cheyenne	• Cogent
• D-Link	• Deltec
• Digital Equipment Corp.	• DPT
• IBM	• Initio
• Intel	• LinkSys
• Madge	• Matrox
• Maxtech	• Microdyne
• Mylex	• National Semiconductor
• nStor	• Olicom
• Onboard	• Orchid
• Plextor	• Proteon
• Racal	• SMC
• Sony	• Stac
• STB	• Storage Dimensions
• Tecmar/Wang	• Thomas-Conrad
• UltraStor	• Western Digital
• ZNYX	

MICROSOFT WINDOWS NT 4.0 SER   VER

Microsoft Windows NT 4.0 Server supports the following file systems:

FAT — FAT stands for file allocation table and is the standard filing system used by DOS and DOS applications. Its primary advantage is that it is common and can be accessed by most applications. However, it suffers from limitations in block size and efficiency. If the server will be running older applications or DOS-based applications, you may need to use the FAT file system.

NTFS — NTFS stands for NT file system. NTFS is a high-performance file system developed for the Windows NT operating system. NTFS avoids most of the limitations of the FAT file system, but only Windows NT applications can access files stored on disks formatted with NTFS. Older applications or DOS-based applications cannot access these files. Other advantages of the NTFS include automatic data compression and security features which can be set at either the directory or file level.

DFS — DFS stands for distributed file system and is one of the planned upgrades for Windows NT 5.0. The primary advancement of DFS is the ability to treat multiple volumes, including some on other machines, as a single logical volume. For more information on DFS and Windows NT 5.0, contact the Microsoft corporation.

NETWORK INTERFACE CARDS

The Premium HS includes an integrated intelligent Intel EtherExpress PRO/100 Server Adapter in the basic configuration. However, large networks and those with extensive traffic may require additional bandwidth to support the load. This section describes some of the concerns which will influence the decision to add networking capability through add-in network interface cards (NICs).

If the system is running, check the performance monitors and determine if the network is fully utilized. If network usage is up at or near 100% most of the time, additional network capability may be required.

If the system is not yet running, you can assume that each network card running at 10 Mb/s supports up to 16 users per hub on average. Increased network usage reduces this number and applications that require little network access increase this number. The 100 Mb/s ethernet will support proportionately more users.

Simply adding NICs may not solve the network bottleneck. Other network components may produce a more effective solution. A network analysis may be necessary to determine your exact networking needs. The server can support additional NICs to the capacity of its add-in board slots.

Note that some NICs do not work well in conjunction with others. Compatibility issues between cards must be addressed on a card by card basis. AST tests the cards offered by its Preferred Partners for compatibility with AST servers. Compatibility between cards is the responsibility of the card manufacturers.

Peripheral Component Interconnect (PCI)
A high-performance, 32-bit I/O bus that provides compatibility with PCI expansion cards. PCI provides plug-and-play capability and operates at speeds up to 33 MHz.

Power-On Self-Test (POST)
The power-on self-test is a series of basic functional tests that are automatically run whenever the system is powered on or reset. POST does not provide extensive or configurable test options and performs basic troubleshooting.

Small-Computer Systems Interface (SCSI)
An open-architecture standard for a class of intelligent peripherals, such as disk, tape, and DAT drives, and CD-ROM devices, that share a common bus with a disk array controller (DAC). Each DAC can support up to 16 SCSI devices.

SCA-II (Single Connector Attachment)
A standard for interfacing SCSI drives that combines power and data connections in the same connector. SCA-II specifies pin arrangements that connect signals in the order of ground, power, and data to ensure safe connections in the event of a hot swap.

SDRAM (Synchronous Dynamic Random Access Memory)
A RAM specification that uses synchronous communication to shorten data transfer timing. Synchronous communication eliminates much of the overhead by providing pre-specified timing, rendering much of the handshaking unnecessary. SDRAM includes error checking and correction to ensure data integrity.

UltraDMA-33 (Direct Memory Access) IDE (integrated drive electronics)
An upgrade to the enhanced IDE specification that allows all of the advantages of EIDE and also doubles the rate of data exchange to 33 MB/s. UltraDMA-33 IDE is fully backward compatible with EIDE and IDE devices.

Universal Serial Bus (USB)
USB is a new serial communication standard that allows up to 127 devices to be "daisy-chained" together on a single channel. USB was designed to simplify the connection of standard peripheral devices and to reduce the cost and resources necessary to support standard I/O functions.

ENVIRONMENT AL SPECIFICA TIONS

This section provides the environmental variables you need to consider when selecting and preparing the system's site. Variables include space requirements, acceptable temperature ranges, and relative humidity guidelines.

AST Premium HS System Environmentals
The following values are representative of a standard system and are provided for planning purposes only. These values will change based on the exact configuration of the server and its peripherals.

Dimensions
- Width   17.5" (448.7 mm)
- Height   17.5" (448.7 mm)
- Depth   24.0" (615.4 mm)

Weight
- Minimum configuration   92.8 lbs (42.2 kg)
- Maximum configuration   110 lbs (50.0 kg)

Temperatur e
- Operating   50-95˚F (10-35˚C)
- Nonoperating   32-122˚F (0-50˚C)

Humidity
- Operating
  10%-90% at 95˚F (35˚C) non-condensing
- Nonoperating
  5-95% at 95˚F (35˚C) non-condensing

Altitude
- 0–8,000 ft (0–2.4 km)

BTU output
- Maximum configuration 2800 BTU/hr

This section provides information concerning the power requirements of the AST Premium HS. The values presented here are representative of systems using common add-in cards and peripherals. The exact power requirements will depend on the specific configuration of the server.

POWER CONSUMPTION

A 15-ampere (A) dedicated circuit will support a maximally configured computer, monitor, and uninterruptible power supply (UPS). If you are attaching any other peripheral to the AST Premium HS system, make sure it is plugged into a separate circuit.

AST recommends that you use an AC socket with an isolated ground.

A standard power cord cannot meet the power needs of the AST Premium HS. Use only the power cord that accompanies the system.

SYSTEM POWER

The exact power requirements of the system will vary depending on the configuration. Power is supplied by a 990W three-module redundant power supply. Each power-supply module delivers 330W. Two power-supply modules are required. The additional module is for redundancy. If a single module fails, it can be replaced without powering down the system. Table 1 identifies the power drawn by the major system components and the configurable hardware components.

Table 1. System Power Requirements by Component

COMPONENT	+3.3V	+5V	+12V	-12V
System board	7.10 A	1.50 A	0.10 A	0.00 A
I$_2$O board	2.50 A	7.00 A	0.10 A	0.00 A
SCSI backplane	0.00 A	2.28 A	0.03 A	0.00 A
Control panel	0.00 A	0.10 A	0.00 A	0.20 A
Riser card	0.00 A	3.00 A	0.00 A	0.00 A
DIMM (active)	2.60 A	0.00 A	0.00 A	0.00 A
DIMM (standby)	0.40 A	0.00 A	0.00 A	0.00 A
Microprocessor w/ VRM	0.00 A	0.00 A	4.08 A	0.00 A
Fan	0.00 A	0.00 A	0.20 A	0.00 A
Keyboard	0.00 A	0.20 A	0.00 A	0.00 A
Mouse	0.00 A	0.20 A	0.00 A	0.00 A
Floppy drive	0.00 A	0.20 A	0.00 A	0.00 A
CD-ROM drive	0.00 A	0.40 A	0.32 A	0.00 A
5.25" user-accessible drive	0.00 A	1.00 A	1.00 A	0.00 A
Hard drive	0.00 A	0.84 A	1.48 A	0.00 A
PCI add-in card	0.30 A	3.00 A	0.30 A	0.01 A
ISA add-in card	0.30 A	2.00 A	0.30 A	0.01 A

The VRMs that provide the final microprocessor core voltage can draw power from either +5V or +12V sources. Because the system uses most of the +5V power available, the power for the microprocessors is drawn from the +12V supply.

RAID 30 is most useful in environments where non-interactive applications process large files sequentially, requiring fault tolerance and high speed. RAID 30 requires a minimum of 6 drives to complete the array.

RAID LEVEL 50

RAID 50 combines levels 5 and 0. Rotating parity arrays are established and then combined into a striped array, without additional parity data. This scheme increases the performance and efficiency of the RAID 5, but does nothing to improve the data redundancy.

RAID 50 requires at least 6 drives to function and provides only slight improvements in performance over RAID 5. RAID 50 provides improvements in performance and efficiency, while still providing fault tolerance.

RAID 50 is most useful in environments where performance, efficiency, and security are of equal importance.

There are several formatting options available for hard disk storage depending on the operating system used. This section provides a description of the benefits and drawbacks of the options subdivided by operating system. Examples of situations in which each option may be the most advantageous are provided.

NOVELL NETWARE

Novell NetWare 4.11 supports the following file systems:

FAT   FAT stands for file allocation table and is the standard filing system used by DOS and DOS applications. Its primary advantage is that it is common and can be accessed by most applications. However, it suffers from limitations in block size and efficiency. If the server will be running older applications or DOS-based applications, you may need to use the FAT file system.

HCSS   NetWare's high-capacity storage system provides automatic data compression, which operates as a background task to avoid affecting server performance, and block sub-allocation, which allows you to use allocated, but unused, storage space for other files. Between these two functions, disk storage requirements can be reduced by as much as half. Because IntranetWare is an extension of NetWare 4.11, HCSS is used in both versions.

NOVELL INTRANETWARE

Novell IntranetWare supports the following file systems:

FAT   FAT stands for file allocation table and is the standard filing system used by DOS and DOS applications. Its primary advantage is that it is common and can be accessed by most applications. However, it suffers from limitations in block size and efficiency. If the server will be running older applications or DOS-based applications, you may need to use the FAT file system.

HCSS   NetWare's high-capacity storage system provides automatic data compression, which operates as a background task to avoid affecting server performance, and block sub-allocation, which allows you to use allocated, but unused, storage space for other files. Between these two functions, disk storage requirements can be reduced by as much as half. Because IntranetWare is an extension of NetWare 4.11, HCSS is used in both versions.

RAID 3 is vulnerable to the loss of the parity drive in the array. Since all parity information is kept on a single drive, the loss of this drive results in an extended period of degraded performance while all records on the remaining drives are read and the parity data is regenerated. RAID 3 also fails to provide peak performance in multi-user environments and those with many small files.

RAID 3 functions best in environments where only one user is accessing data at a time and the file sizes are large. Systems with a large number of users or those with many small files will experience only a minor performance increase over independent drives. Spindle synchronized drives are required to prevent the loss of performance with small files. RAID 3 requires at least three drives to complete the array.

RAID LEVEL 5

Sometimes called a rotating parity array, RAID 5 uses record striping and saves parity data like RAID 3. However, it stores the parity data on each drive in turn so that no one drive is dedicated entirely to parity storage. RAID 5 allows both reads and writes to be overlapped, increasing performance. Since RAID 5 also provides parity data, redundancy is maintained and data can be restored fairly quickly whichever drive fails.

RAID 5 has few weaknesses, however, it is also a compromise between the more extreme RAID levels. RAID 0 offers superior performance and efficiency, but does not provide the redundancy of RAID 5. RAID 1 offers superior redundancy and therefore superior data integrity, but does not provide the ability to overlap write commands. RAID 5 also provides superior storage efficiency to RAID 1. RAID 5 can use a large number of drives and sacrifice space equivalent to only one drive for parity data.

Because RAID 5 stores parity data for redundancy, that data must be updated at every write. The necessity of regenerating parity data at every write keeps RAID 5 performance below that of RAID 1 in most cases. Like RAID 3, RAID 5 also requires a minimum of three drives to function.

RAID LEVEL 10

RAID 10 is a combination of levels 1 and 0. RAID 10 pairs drives and then stripes data across the pairs as if each pair was a single drive. This combination provides great data redundancy and takes advantage of the performance and efficiency of data striping.

However, RAID 10 suffers from the same high cost as RAID 1. Each disk is mirrored providing 100% data redundancy, but requiring twice the number of physical drives as a pure RAID 0. RAID 0 striping increases the overall efficiency and performance of the array but does not necessarily equal a smaller array or another level.

RAID 10 is best used in environments where data redundancy is critical, but performance and efficiency cannot be entirely sacrificed.

RAID LEVEL 30

RAID 30 is a combination of levels 3 and 0. Redundant arrays, each with a dedicated parity drive, are arrayed together and striped. RAID 30 makes use of the parity information of the dedicated parity drive and lessens the danger of losing that drive by striping the parity data across all of the dedicated parity drives.

Multi-user environments that require multiple simultaneous reads and writes do not do well under RAID 30. Small files are also a problem for this RAID level and result in less spectacular performance.

The minimum configuration of the AST Premium HS and the power required to support it are described in Table 2 below. All values in the table are in amperes, except for the quantity column.

Table 2. Minimum Configuration Power Requirements

COMPONENT	+3.3V	+5V	+12V	-12V	QTY.	+3.3V TOTAL	+5V TOTAL	+12V TOTAL	-12V TOTAL
System board	7.10	1.50	0.10	0.00	1	7.10	1.50	0.10	0.00
I$_2$O board	2.50	7.00	0.10	0.00	1	2.50	7.00	0.10	0.00
SCSI backplane	0.00	2.28	0.03	0.00	1	0.00	2.28	0.03	0.00
Control panel	0.00	0.10	0.00	0.20	1	0.00	0.10	0.00	0.20
Riser card	0.00	3.00	0.00	0.00	1	0.00	3.00	0.00	0.00
DIMM (active)	2.60	0.00	0.00	0.00	1	2.60	0.00	0.00	0.00
DIMM (standby)	0.40	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Microprocessor w/ VRM	0.00	0.00	4.08	0.00	1	0.00	0.00	4.08	0.00
Fan	0.00	0.00	0.20	0.00	2	0.00	0.00	0.20	0.00
Keyboard	0.00	0.20	0.00	0.00	1	0.00	0.20	0.00	0.00
Mouse	0.00	0.20	0.00	0.00	0	0.00	0.00	0.00	0.00
Floppy drive	0.00	0.20	0.00	0.00	1	0.00	0.20	0.00	0.00
CD-ROM drive	0.00	0.40	0.32	0.00	1	0.00	0.40	0.32	0.00
5.25" user-accessible drive	0.00	1.00	1.00	0.00	0	0.00	0.00	0.00	0.00
Hard drive	0.00	0.84	1.48	0.00	1	0.00	0.84	1.48	0.00
PCI add-in card	0.30	3.00	0.30	0.01	0	0.00	0.00	0.00	0.00
ISA add-in card	0.30	2.00	0.30	0.01	0	0.00	0.00	0.00	0.00
TOTAL	—	—	—	—	—	12.20	15.52	6.31	0.20

The VRMs that provide the final microprocessor core voltage can draw power from either +5V or +12V sources. Because the system uses most of the +5V power available when fully loaded, the power for the microprocessors is drawn from the +12V supply.

The maximum configuration of the AST Premium HS and the power required to support it are described in Table 3 below. All values in the table are in amperes, except for the quantity column.

Table 3. Maximum Configuration Power Requirements

COMPONENT	+3.3V	+5V	+12V	-12V	QTY.	+3.3V TOTAL	+5V TOTAL	+12V TOTAL	-12V TOTAL
System board	7.10	1.50	0.10	0.00	1	7.10	1.50	0.10	0.00
I$_2$O board	2.50	7.00	0.10	0.00	1	2.50	7.00	0.10	0.00
SCSI backplane	0.00	2.28	0.03	0.00	1	0.00	2.28	0.03	0.00
Control panel	0.00	0.10	0.00	0.20	1	0.00	0.10	0.00	0.20
Riser card	0.00	3.00	0.00	0.00	1	0.00	3.00	0.00	0.00
DIMM (active)	2.60	0.00	0.00	0.00	1	2.60	0.00	0.00	0.00
DIMM (standby)	0.40	0.00	0.00	0.00	3	1.20	0.00	0.00	0.00
Microprocessor w/ VRM	0.00	0.00	4.08	0.00	2	0.00	0.00	8.16	0.00
Fan	0.00	0.00	0.20	0.00	2	0.00	0.00	0.40	0.00
Keyboard	0.00	0.20	0.00	0.00	1	0.00	0.20	0.00	0.00
Mouse	0.00	0.20	0.00	0.00	1	0.00	0.20	0.00	0.00
Floppy drive	0.00	0.20	0.00	0.00	1	0.00	0.20	0.00	0.00
CD-ROM drive	0.00	0.40	0.32	0.00	1	0.00	0.40	0.32	0.00
5.25" user-accessible drive	0.00	1.00	1.00	0.00	2	0.00	2.00	2.00	0.00
Hard drive	0.00	0.84	1.48	0.00	12	0.00	10.08	17.76	0.00
PCI add-in card	0.30	3.00	0.30	0.01	5	1.50	15.00	1.50	0.05
ISA add-in card	0.30	2.00	0.30	0.01	1	0.30	2.00	0.30	0.01
TOTAL	—	—	—	—	—	15.20	43.96	30.67	0.26

The VRMs that provide the final microprocessor core voltage can draw power from either +5V or +12V sources. Because the system uses most of the +5V power available when fully loaded, the power for the microprocessors is drawn from the +12V supply.

For a system that is maximally configured, with a monitor, you should use a UPS rated at 1000 va or greater. A UPS of this size should provide approximately five minutes runtime in the event of a power outage. If the system is not maximally configured, you may be able to use a smaller UPS, but support times will decrease. For more information on power conversion, UPSs, and similar topics, visit the American Power Conversion (APC) web site at http://www.apcc.com

There are several aspects of UPS selection that you should consider:
- Less than 5% let-through on IEEE 6000V surge tests. A rating of this type ensures that the UPS will reduce even worst case surges to something the server can handle.
- More than five minutes runtime at full load. Most utility disturbances last for less than five minutes. The larger the UPS capacity the longer the system can run during a power outage.
- Intelligent serial and SNMP communications between the UPS and the server allows the server to monitor the UPS and helps you anticipate problems.

This section describes several special topics which you may need to consider before you order your servers. These topics include considerations that significantly affect performance, price, and reliability. Because each installation has its own requirements, the following paragraphs identify the characteristics and concerns that will affect the performance of the system, but do not make any recommendations in favor of a particular configuration.

RAID CONFIGURATION PERFORMANCE

The 3-channel RAID controller provides a wide array of options for RAID support and control. This section describes the characteristics of the various RAID levels and gives examples of cases in which a particular RAID level may prove the most advantageous.

RAID LEVEL 0

Level 0 RAID provides block striping across multiple drives, but provides no data redundancy. Because the data is striped across all drives in the array, any drive access of sufficient size will be read from all drives simultaneously. Therefore the data will be retrieved much faster than if it were all on the same drive. RAID 0 offers significant performance and storage efficiency improvements over individual drives.

However, RAID 0 offers no data redundancy and therefore no protection against loss of data. In fact, if a file is distributed across several drives, the failure of any one drive in the array renders the file irretrievable.

RAID 0 should be used only in time or space critical applications where data redundancy is not required and maximum performance is required. Any situation where data integrity is an issue should not use RAID 0. Spindle synchronized drives are helpful in RAID 0 environments.

RAID LEVEL 1

Level 1 RAID is also called drive mirroring. Drives are paired and all data is written to both drives in the pair simultaneously. RAID 1 offers maximum security because a complete, up-to-the-minute hot backup is available at all times. Mirroring is only susceptible to the loss of both drives in a pair simultaneously. Writes to a RAID 1 must write to both drives, but reads can access the drives independently. Therefore read time can be halved using a RAID 1 array though write times remain unchanged.

Because RAID 1 offers no striping, there is little performance improvement over using individual, independent drives. Each data read accesses only the two drives of the pair and can only double read time, while leaving write times unchanged.

RAID 1 is most useful in applications where the expense of purchasing twice the number of drives is acceptable and performance in relation to independent drives is not an issue. Applications that require extreme data integrity benefit from the security of RAID 1. RAID 1 can provide the best performance of any redundant array type in multi-user environments.

RAID LEVEL 3

Level 3 RAID stripes data across groups of drives with one drive in the array dedicated to storing parity information. Much like RAID 0, RAID 3 arrays provide increased read performance because records can be read from all drives simultaneously. However, all writes must access both the data drives and the parity drive, which prevents overlapping writes and inhibits performance. Data security is provided by the drive containing the parity data, which allows reconstruction of data stored on a failed drive.

This section assists in determining the amount of memory and storage space you will need to operate this system under Windows NT Server 4.0.

M E M O R Y   R E Q U I R E M E N T S

The minimum memory required to run Microsoft Windows NT Server 4.0 is 16 MB. 32 MB is recommended as a base. If any applications identify a minimum memory requirement, use that as a base and add additional memory based on experience. If you are converting to the Windows NT operating system, talk to your reseller regarding memory requirements for Windows NT.

Because memory cannot be configured in 1 MB increments, you will need to find the next larger legal configuration supported by the system beyond any calculated values for memory requirements.

M I C R O P R O C E S S O R   R E S O U R C E S

The number of users that the Intel Pentium II microprocessor can support when running Windows NT is dependent on the applications being run and the amount of processing that is required to support user activity. If the server is running, you can check the performance monitor. If the system consistently runs at 90% processor usage, you need a second processor in the server.

If the server is not running yet, you will have to rely on calculated values. Check the requirements and capabilities of the applications you run to verify that they can use a second processor if one is available.

S T O R A G E   R E Q U I R E M E N T S

The base disk space requirement for NT 4.0 is 150 MB. Add the values of known application storage requirements and data files. In addition, 5 MB of disk space per user is normally adequate for swap space and temporary files.

In some environments common use applications and data files can easily exceed the standard 5 MB/user value. If you know the size of these data and applications, use those values for your calculations. Additional storage requirements for temporary files and swap space should conform to the space/user value specified above, but you may want to check the documentation for individual applications for additional information.

- Voltage regulation between +5% and -12%.
- Voltage boost and trim to maximize battery usage by using transformer circuitry to do some of the work.
- Output wave with 1.2-1.4 peak-to-RMS voltage waveform ratio. Square wave outputs can stress the server and cause premature component failure.
- Common mode and normal mode filtering in excess of 20db ensure that the UPS can filter even abnormal interference and keep it within harmless ranges.
- Tests for site wiring faults allow you to determine if there are unsafe wiring conditions before they adversely affect the server.
- UL-approved battery replacement procedures.
- Environmental monitoring just like that provided in the server.
- Intelligent battery management to extend the life of the batteries, speed recharge times, and provide warning of imminent battery failure.

D E T E R M I N I N G   E X P A N S I O N   R E Q U I R E M E N T S

This section provides information on how to determine the amount of memory, processor resources, and storage space you will need, based on the operating system and the number of users.

Guidelines in this section are based on standard operating-system vendor recommendations. These values are representative only and must be adjusted to accommodate non-standard usage and storage patterns.

N O V E L L   N E T W A R E

This section assists in determining the amount of memory and storage space you will need to operate this system under Novell NetWare.

M E M O R Y   R E Q U I R E M E N T S

To determine the amount of memory you will need, perform the following calculations:

1. Determine the amount of memory required for cache memory, using the following formula:

   $M_1 = 1$ MB + (total disk space (in MB) x 5 KB)

   $M_1 =$ memory required for cache

2. Determine the amount of memory required for the Media Manager, using the following formula:

   $M_2 = 150$ KB + (total disk space (in MB) x 0.2 KB)

   $M_2 =$ memory required for the Media Manager

3. Determine the amount of memory required for user connections, using the following formula:

   $M_3 = 2$ KB x number of users

   $M_3 =$ memory required for user connections

4. Determine the amount of memory required for packet receive buffers, using the following formula:

   $M_4 = 2.3$ KB x number of buffers

   $M_4 =$ memory required for packet receive buffers

5. Determine the amount of memory required for directory cache buffers, using the following formula:

   $M_5 = 4.3$ KB x number of buffers

   $M_5 =$ memory required for directory cache buffers

6. Determine the amount of memory required for service processes, using the following formula:

$M_6 = 9.0$ KB x number of service processes

$M_6 =$ memory required for service processes

7. Convert all values to MB and add all calculations arrived at in steps 1 through 6.

$M_s = M_1 + M_2 + M_3 + M_4 + M_5 + M_6$

$M_s =$ subtotal of memory required for cache, Media Manager, buffers, user connections, and service processes

8. Add 0.25 MB to the figure arrived at in step 7 for file compression.

9. RAM requirements for volumes with file compression and block sub-allocation enabled are calculated on a volume-by-volume basis. FAT tables occupy approximately 0.1% of the total space in the volume, block sub-allocation requires approximately 0.08% of the total volume space, and directory entries occupy approximately 0.03% of the total volume space. The resulting total is approximately 0.21% of the total volume space. Dreq = total volume space x 0.0021

10. Add the memory required for each NLM that you will need.

Assume CLIB.NLM (500 KB), INSTALL.NLM (600 KB), and PSERVER.NLM (200 KB) = 1.3 MB

11. Add all values:

$M_t = M_s + 0.25$ MB + Dreq + NLMs

$M_t =$ total memory required

12. Round the number from step 8 to the next higher legal memory configuration.

The amount of memory you will need is the total from step 9.

Assuming the total drive space is 9 GB, the number of users is 500 - the number of buffers of each type is 100, the number of service processes is 20. If all volumes have file compression and block sub-allocation enabled, and the three NLMs mentioned in step 10 above are all that are used, the following results would apply:

$M_1 = 46.08$ MB
$M_2 = 01.99$ MB
$M_3 = 01.00$ MB
$M_4 = 00.23$ MB
$M_5 = 00.43$ MB
$M_6 = 00.18$ MB
$M_s = 49.91$ MB
$M_t = 70.81$ MB

Rounding M_t to the next higher legal memory configuration yields a total memory requirement of 80 MB. For more information about configuring memory under Novell NetWare, see the NetWare Installation manual or the Novell web site.

MICROPROCESSOR RESOURCES

The number of users that the Pentium II microprocessor can support when running Novell NetWare is dependent on the applications being run and the amount of processing that is required to support user activity. If the server is running, you can check the performance monitor. If the system consistently runs at 90% processor usage, you need a second processor in the server.

If the server is not running yet, you will have to rely on calculated or estimated values. Your Reseller or IS administrator can assist you in estimating the processor requirements of your server. Check the requirements and capabilities of the applications you run to verify that they can use a second processor if one is available.

STORAGE REQUIREMENTS

The operating system itself will usually fit comfortably into a 100 MB volume. In addition, 5 MB of disk space per user is generally adequate if there are no private applications on the system. If private applications are required, determine the amount of storage required by the applications and any anticipated data files.

In some environments common use applications and data files can easily exceed the standard 5 MB/user value. If you know the size of these data and applications, use those values for your calculations. Additional storage requirements for temporary files and swap space should conform to the space/user value specified above, but you may want to check the documentation for individual applications and the operating system for additional information.

NOVELL INTRANETWARE

This section assists in determining the amount of memory and storage space you will need to operate this system under Novell IntranetWare.

MEMORY REQUIREMENTS

Novell IntranetWare is an expansion of the NetWare 4.x operating system. To calculate the memory requirements of IntranetWare, first determine the memory requirements for NetWare 4.x and add additional RAM for the FTP services and for Novell Internet Access Server 4. For detailed information on the memory requirements of these products see the Novell web site.

Remember to round up to the next legal memory configuration supported by the system.

MICROPROCESSOR RESOURCES

The number of users that the Pentium II microprocessor can support when running Novell IntranetWare is dependent on the applications being run and the amount of processing that is required to support user activity. If the server is running, you can check the performance monitor. If the system consistently runs at 90% processor usage, you need a second processor in the server.

If the server is not running yet, you will have to rely on calculated values. Check the requirements and capabilities of the applications you run to verify that they can use a second processor if one is available.

STORAGE REQUIREMENTS

NetWare 4.x itself will usually fit comfortably into a 100 MB volume. In addition, Novell Internet Access Server 4 requires 60 MB, on-line documentation requires approximately 20 MB, and the DynaText viewer requires at least 6 MB. For swap space, 5 MB of disk space per user is generally adequate if there are no private applications on the system. If private applications are required, determine the amount of storage required by the applications and any anticipated data files.

In some environments common use applications and data files can easily exceed the standard 5 MB/user value. If you know the size of these data and applications, use those values for your calculations. Additional storage requirements for temporary files and swap space should conform to the space/user value specified above, but you may want to check the documentation for individual applications and the operating system for additional information.