HP e3000 9x9KS Precision Architecture Servers

The HP e3000 9x9KS Precision Architecture Servers are a family of high performance, highly reliable, midrange computers offering superior value and ease of use for their performance class. These servers take advantage of HP Precision Architecture RISC (PA-RISC), symmetrical multiprocessing and powerful VLSI technology to set new standards for cost effective, high performance computing. Offering a range of processor performance, packaging, and user license options; these servers allow you to purchase for your needs today yet grow easily into tomorrow. Since these servers are compatible with other HP e3000 Precision Architecture Servers, a multitude of business solutions including World Wide Web/Internet connectivity are available making them ideal computing servers for any business, department or remote office location.

The entire HP e3000 9x9KS Server including CPU, memory, disk, removable media drives, power protection, operating system and optional HP databases comes preconfigured from the factory in a single, integrated package that fits easily into any office environment. The server, along with external peripherals and uninterruptible power supplies, can also be rack mounted in compact 1.6- and 1.96-meter cabinets.

These HP e3000 9x9KS Servers are driven by a robust operating system, MPE/iX, designed to handle a variety of business critical, on-line transaction processing and client-server applications. MPE/iX offers powerful system management utilities, high availability options, tools for performance measurement and monitoring, and built-in features to ensure data integrity.

Features

- Symmetrical multiprocessing (SMP) up to four way (six processors for 989KS/x00 and 989KS/x50 Servers)
- Single-chip CMOS CPU with five-stage instruction pipelining
- Large high-speed 2048 Kbyte instruction and 2048 Kbyte data caches (989KS/x00 and 989KS/x50)
- 1024 Kbyte instruction and 1024 Kbyte data caches (929KS/030, 939KS/030, and 979KS)
- High-performance floating point integrated on the CPU chip
- 128 Mbyte to 8 Gbyte error correcting memory expandable in 128, 256 or 512 Mbyte increments
- Enhanced, high-speed bus structure and memory mapped file system optimized for I/O intensive relational database management applications
- Robust operating system, MPE/iX, designed for a wide variety of business critical, OLTP (On-Line Transaction Processing) applications with support for leading industry standards
- Bundled ARPA /Internet networking services
All HP e3000 Precision Architecture Servers are complemented by a full range of high quality HP peripherals, industry standard networking, a rich set of application development facilities, high performance database management solutions, and advanced PC and Desktop integration products.

**HP Precision Architecture-RISC**

All HP e3000 Precision Architecture Servers use HP Precision Architecture RISC (PA-RISC) technology to achieve high performance and reliability at a low cost (see Table 1). The HP e3000 9x9KS Servers are based on Hewlett-Packard’s powerful 64-bit PA-RISC PA-8200 (989KS/x00 and 989KS/x50) or PA-8000 (979KS, 939KS/030, and 929KS/030) processors.

PA-RISC is built upon Reduced Instruction Set Computing (RISC) principles, a design approach that delivers greatly simplified computers that are optimized to provide the highest performance for a given integrated circuit technology. The inherent simplicity of PA-RISC implies that computer systems can be implemented with fewer components to achieve vastly superior reliability when compared to older Complex Instruction Set Computer (CISC) systems.

At the core of PA-RISC is an instruction set containing 140 carefully selected, fixed format, hard-wired instructions. Hard-wiring eliminates microcode and the necessity to decode complex instructions. This allows the processor to operate at maximum performance.

PA-RISC utilizes a load/store design and register-to-register operations to reduce the number of memory accesses. To further enhance performance, optimizing compilers schedule instructions and manage the instruction pipeline. With hard-wired control, a load/store design, and optimizing compilers, one to four instructions can be executed on virtually every clock cycle. PA-RISC also incorporates many other extensions to RISC which greatly enhance its functionality such as extended addressing and memory mapped I/O.

As one of the first major vendors to deliver a RISC-based server, Hewlett-Packard is the leading manufacturer of RISC-based computers today.

- Integrated Multi-Function I/O card containing:
  - Fast/wide differential SCSI-2 I/O
  - Single ended SCSI-2 I/O
  - On-board 300/1200/2400/9600/14400 baud, MNP 3/4 modem for remote support
  - RS-232 ports for console, support and uninterruptible power supply control
  - IEEE 802.3/Ethernet Local Area Network I/O

- Up to 144 Gbytes of integrated fast/wide SCSI-2 disk storage and greater than 10 Tbytes of total disk storage with external disk drives

- Integrated Digital Data Storage tape backup unit

- Optional integrated DVD device (for reading CD-ROMs)

- Support for a wide offering of high quality external high-speed disks, disk arrays, tapes, printers and other peripheral devices connected by HP fast/wide SCSI-2 or HP SCSI-2

- Power protection in the case of power failure for at least 15 minutes via an HP PowerTrust uninterruptible power supply

- Air-cooled design for low power and cooling requirements

- Standard office power and cooling requirements

- Pre-loading of the HP e3000 MPE/iX operating system, HP subsystem software and optional HP databases
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1External HP-PB Card Cages are supported on MPE/iX 5.5 PowerPatch 5.
2Memory sizes about 3.75 Gbytes requires MPE/iX Release 6.5 or later.
VLSI Technology Leadership
PA-RISC was designed to provide user benefits independent of the particular semiconductor technology implementation. Hewlett-Packard’s use of submicron CMOS Very Large Scale Integration (VLSI) technology allows the entire CPU, Translation Lookaside Buffer, prefetch-miss cache and floating point coprocessor to be integrated onto a single chip. Reduced complexity allows fewer components and higher reliability, and a resulting lower cost.

Server Packaging and Expandability

Server Packaging
All HP e3000 9x9KS Precision Architecture Servers are available in a common compact, attractive cabinet. This 641 mm high and 440 mm wide air cooled cabinet has been uniquely designed to hold an entire modular system including CPUs, memory, I/O interfaces, disk storage, an optional DVD device, and a digital data storage drive. When required, the server cabinet can be easily racked with other system components in a 1.25, 1.6 and 1.96 meter cabinet. Racked 9x9KS Servers have an attractive dark gray front bezel that complements the light gray color of the cabinet and other racked peripherals.

Disk Subsystem
The HP e3000 9x9KS Servers take advantage of state-of-the-art disk storage devices by integrating from one to four, 9, 18 or 36 Gbyte, 3.5-inch disk drives into the server and supporting up to 9148 Gbytes of disk storage with the addition of external devices. HP’s disk storage devices offer reliable, high capacity, high performance, random access mass storage accomplished using advanced electronics. Integrated disk storage devices are connected to the server using a high performance HP fast/wide differential SCSI-2 link.

Digital Data Storage Subsystem
The Digital Data Storage (DDS) tape interchange and backup drive integrated with each server provides high capacity storage on a standard DDS DAT cassette measuring only 73 mm by 54 mm by 10.5 mm. Both DDS-2 and DDS-3 format devices are available. With data compression, up to 24 Gbytes of data can be stored on a single DDS-3 cassette. This large capacity storage on a single DDS DAT cassette eliminates the need for operator intervention during backup and offers a convenient and compact storage medium. The DDS tape drive includes automatic error detection and three levels of error correcting code to insure data reliability.

The DDS tape drive also includes a 2 Mbytes data buffer to maintain a typical host transfer rate in data compressed mode of 116 Mbytes per minute. For added backup or interchange capacities a second DDS tape drive may be integrated into a server. Additional DDS or DLT (Digital Linear Tape) drives or libraries may be added externally to the server as well.

Field Upgrades
Processor, memory and I/O upgrades are available for the HP e3000 9x9KS Servers. Through a processor board swap or through the addition of processor modules, you can easily increase your system’s performance. Also, through the easy addition of memory, I/O slots and integrated disks along with the expansion of software user licenses, you can expand your HP e3000 9x9KS Server capacity while protecting your initial server investment.

For customers trading in a non-9x9KS Server on a 9x9KS ("Box-swap upgrade"), operating system user license rebates are available.
Advanced Processor Technology

Symmetric Multiprocessing

The HP e3000 9x9KS Precision Architecture Server supports tightly coupled, symmetrical multiprocessing (SMP) of up to six processors (see Figure 1). Multiprocessing allows for economical, modular growth of processing power as system performance requirements increase. In addition, multiprocessing provides increased server availability. If one processor module fails, MPE/iX notes the failure upon reboot, deconfigures the failed processor, and continues normal boot and operation.

Hewlett-Packard has several years worth of experience tuning the MPE/iX operating system to efficiently provide a high performance SMP environment for commercial applications. Multi-processing is transparent to applications, end users and system administrators, allowing existing applications to benefit from increased SMP server performance without having to be rewritten or modified. MPE/iX has proven under many differing workloads and user applications that it can schedule and synchronize separate processes and jobs over many processors, efficiently managing the separate processors’ caches, ensuring cache consistency across the server, and concurrently managing high performance I/O to and from memory. The 9x9KS Server’s cache scheme, high performance Processor Memory Bus, multi-level bus structure and memory mapped I/O have all been tailored to insure that the 9x9KS Server and MPE/iX software environment provide exceptional SMP performance for commercial workloads.

Cache

The use of cache memory enhances HP e3000 9x9KS Server performance by minimizing CPU requests for instructions or data stored in memory. By storing frequently used instructions and data in high-speed cache memory instead of relying on system memory, the CPU can execute instructions or process data without overloading the Processor Memory Bus. This is particularly important for multiprocessor systems.

PA-RISC processors incorporated in the HP e3000 9x9KS Servers use an on-chip 2 Kbyte prefetch-miss cache as well as large instruction and data caches, all on a per processor basis. The 979KS, 939KS/030 and 929KS/030 Servers support instruction and data caches of 1024 Kbytes each. The 989KS Servers support instruction and data caches of 2048 Kbytes each. These caches operate in a write-back mode writing modified data to system memory only when the processor needs the cache location for other data or when the operating system flushes the cache location due to a direct memory access operation. This efficient cache operation in an SMP environment provides maximum system throughput. Parity checking protects the cache to insure that there is no undetected data corruption.

Instruction Pipelining

Instruction pipelining is a technique that overlaps instruction processing so that one instruction can begin to execute before the previous one has finished. Excluding penalties for cache misses and for branch instructions, the net effect is that at least one instruction completes with essentially every instruction clock cycle (see Superscalar).
In addition, the PA-8200 and PA-8000 processors support dynamic scheduling of instructions with a 56 instruction deep queue. This controlled, out of order execution of instructions is important in optimizing these processors' superscalar operation.

**Superscalar and Floating Point Operations**
The PA-RISC processors support superscalar operation that allows four operations to be executed concurrently with other operations in the same instruction cycle. The net effect of these superscalar operations is greater server performance for many integer and floating point intensive applications. Single and double precision floating point calculations are performed by a high speed, on-CPU chip floating point coprocessor (FPC).

**Memory Subsystem**
The memory subsystem uses 4 Mbit or 16 Mbit fast-page mode or 64 Mbit Extended Data Out (EDO) dynamic RAMs mounted on SIMMs and is expandable in 128-, 256- or 512-Mbyte module increments up to a maximum of 8 Gbytes.

**Virtual memory**
The PA-8000 and PA-8200 chip implements virtual addresses of 64 bits, ensuring ample expandability to meet your growing software needs. Virtual memory is divided into 65,535 spaces with each space 4 Gbytes in length. Spaces are further divided into fixed-length 4 Kbyte pages, with a page holding either code or data. A single data structure can be up to 1 Gbyte in length.

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**Figure 1. HP e3000 9x9KS Server Structure**

![Diagram of HP e3000 9x9KS Server Structure]

- Processor
- I-Cache
- D-Cache
- Memory
- Memory SIMM
- Processor Memory Bus
- Bus Converter
- HP-High Speed System Connect
- Multi-Function I/O Card
- Bus Converter
- HP Precision Bus
- Add-On I/O Card
- Add-On I/O Card
The virtual memory scheme can accommodate a virtual memory addressing space of more than 260,000 Gbytes.

Virtual-to-physical address translation is done by the Translation Lookaside Buffers (TLB). The TLBs recently accessed virtual page translations convert the 64-bit virtual address into a 32-bit physical address. When virtual addresses are missing from the TLB, some of the HP e3000 9x9KS Servers have a hardware assisted TLB miss-handler which reduces the software overhead associated with handling these misses resulting in higher server performance.

All HP e3000 9x9KS Servers provide page-level access protection with the TLB hardware supporting protection mechanisms to ensure that the currently executing process has sufficient authorization to perform the requested data, code, or I/O access.

System Organization

I/O Subsystems
The HP e3000 9x9KS Precision Architecture Servers have a high performance bus structure which provides high system throughput to handle very heavy processing and I/O demands. This bus structure is three-tiered to provide an optimum balance between processor, memory and I/O requirements (see Figure 1). An important augmentation to system hardware performance is MPE/iX's ability to reduce disk I/O significantly when compared to traditional mainframes and other systems. MPE/iX employs an efficient disk caching capability referred to as "mapped files", which enables the system to take advantage of large memory sizes to increase performance in I/O intensive applications by using main memory as a buffer for disk. This ability to minimize disk I/O is a crucial factor in providing responsive systems for critical transaction processing applications, and provides customers with a competitive advantage by improving system performance without costly peripherals or complex system administration.

High Speed Processor Memory Bus
Central Processing Units (CPUs) access main memory and I/O over a 768 Mbyte/second (peak) high-speed Processor Memory Bus (PMB). Its shared address and data paths have been designed to maximize speed and throughput of memory bound transactions. Additionally, the PMB was designed to minimize bus contention for high-performance, multiprocessing applications by having special hardware to ensure processor cache coherency. The bus speed and cache coherency hardware allow for efficient performance scaling for multiprocessing on-line transaction applications.

HP-High Speed System Connect Bus
The HP-High Speed System Connect Bus (HP-HSC) provides a high speed 100 Mbyte/second (peak), 32-bit intermediate bus for aggregating I/O transactions from the HP-Precision Buses before passing the transactions onto the Processor Memory Bus.
**HP-Precision Bus**
The HP-Precision Bus (HP-PB) supports add-on I/O cards for interfacing to peripheral devices and providing data communications/networking functions. The HP-HSC bus supports one or two HP-PB buses within the 9x9KS chassis, each supporting four add-on I/O cards making a total of eight add-on HP-PB I/O cards (maximum four for the 989KS/x00 and 989KS/x50). The HP-PB bus provides a 32-bit data path and can support a data transfer rate of 32 Mbytes/sec (peak). In a two HP-PB bus configuration, aggregate I/O throughput is 64 Mbytes/sec (peak).

**HP-PB I/O Expansion**
The 9x9KS Server supports the connection of two additional HP-PB I/O Card cages outside the 9x9KS chassis for expansion. Each HP-PB I/O Card Cage supports up to 14 add-on I/O cards for a maximum additional 28 HP-PB I/O cards. Each HP-PB I/O Card Cage is a separate 32 MBytes/sec (peak). With two HP-PB I/O Card Cages, the 9x9KS Servers support 36 add-on HP-PB I/O cards spread across four HP-PB I/O backplanes. Please see HP-PB I/O Expansion Datasheet (P/N 5968-0821E) for more details.

**Figure 2. HP e3000 9x9KS Server I/O and Peripherals**
Peripheral and Network Connections
The system comes with an integrated multi-function I/O card which includes an HP fast/wide differential SCSI-2 connection, an HP single-ended SCSI-2 connection, a 802.3/Ethernet Local Area Network (LAN) connection, an on-board support modem for remote support, a connection for UPS control, and a connection for your system console.

In addition to the integrated multi-function I/O card, additional peripheral and network functionality can be supported via add-on HP-PB interface cards (see Figure 2). Additional disks are connected via either fast/wide 20 Mbyte/second differential SCSI-2 interfaces which support up to fifteen disk drives on each interface or 5 Mbyte/second HP single-ended SCSI-2 interfaces which support up to seven drives on each interface. Additional tapes can be connected via HP SCSI-2 interfaces. Printers can be connected via either HP SCSI-2 interfaces, IEEE 802.3/Ethernet LAN or serial connections. Connections to other systems can be made via add-on Programmable Serial Interface (PSI) cards, additional IEEE 802.3/Ethernet LAN interface cards, IEEE 802.5 Token Ring LAN interface cards or FDDI interface cards.

Workstation and Serial Printer Connection
Serial connections for workstations, PCs, terminals, serial printers and other serial devices are provided via Datacommunications and Terminal Controllers (DTCs) that are distributed over an IEEE 802.3/Ethernet standard Local Area Network. This flexible connection scheme allows DTCs to be situated in the department that they serve, saving the cost and effort of running cables from the system processing unit to each workstation. The DTC72MX and the DTC16xx can support up to 72 and 16 direct or modem connected ports respectively.

PCs can also be integrated into the HP e3000 Server over LANs as emulated terminal using third party emulation products. Physical connections can be made via HP EtherTwist which is a local area networking scheme using unshielded twisted pair (or phonewire). DTC connected serial devices, LAN connected PCs and LAN based system-to-system communication can all share the same 802.3/Ethernet LAN.

Systems Management
The HP e3000 Servers have robust functionality for managing large data center environments. Hewlett-Packard and its third party partners offer a variety of systems management solutions for performance management, system accounting and configuration, security, availability, operations control and storage management. For further details on the MPE/iX operating system and its subsystems, see the MPE/iX Release 6.5 datasheet (PN 5968-8856E).
HP OpenView System and Network Management
HP OpenView IT/Operations uses a UNIX based management console and provides a fully integrated, consistent framework for managing HP e3000 systems along with other types of servers (i.e., as part of a heterogeneous system environment). Through exception-based system management, operators are notified of system events graphically and automatically. Operators can define which events to report, providing flexibility and eliminating unwanted notifications. Task-based filtering of events lets the operator focus on specific categories of messages all at once (i.e., all printer messages) and an automatic response feature brings the system one step closer to being self-managing.

High Availability
The HP e3000 Servers meet the high availability requirements of mission critical applications through a variety of hardware and software elements. Reliability, resiliency and availability are no longer mere luxuries; they are crucial to the survival and success of any business.

For basic server availability, the HP e3000 Servers features error detection and correction for the system bus and main memory, deallocation of failing memory pages, redundant I/O channels, and power protection using HP PowerTrust uninterruptible power supplies (UPSs).

Hardware redundancy also extends to on-line storage since HP SureStore E XP256 and 12H disk arrays provide different RAID level data protection. Optional Mirrored Disk/iX provides an even higher level of system availability for non-system disks through redundancy of I/O controllers, disk mechanisms, power supplies and cabling.

The MPE/iX operating system provides an excellent foundation for application environments requiring the highest levels of availability. MPE/iX's integrated transaction management functionality enables the HP e3000 servers to recover from interruptions in service quickly with no loss of data. MPE/iX's Threshold Manager monitors vital system tables which if depleted, could cause a server failure. MPE/iX also provides a high-availability infrastructure for optional products such as SharePlex/iX, AutoRestart/iX, and TurboSTORE/iX 7x24 True-Online Backup.

Planned downtime can be minimized via Patch/iX and Stage/iX, which provide a convenient method for applying MPE/iX patches. In addition, for customers who need 24x7 availability of reactive patches, HP SupportLine provides downloading of patches using the World Wide Web.
Purchasing AutoRestart/iX and/or TurboSTORE/iX 7x24 True-Online Backup with HP NetWorker for MPE/iX can minimize unplanned downtime. AutoRestart/iX accelerates recovery time after a software failure by dumping the server state to disk and restarting the server. Server availability can be further enhanced by TurboSTORE/iX 7x24 True-Online Backup, which provides high speed, unattended backup while users remain online and active within their applications. HP’s Legato NetWorker storage node for MPE/iX allows high speed DLT libraries to be directly connected to the HP e3000 server.

HP SureStore E XP256 disk arrays have two high availability solutions, Business Copy XP and Continuous Access XP. Business Copy XP creates mirror copies of data within the same disk enclosure. Continuous Access XP mirrors data to a second SureStore E XP256 disk array for decision support or disaster recovery.

SharePlex/iX is an optional product providing clustering which gives high availability, horizontal performance growth potential, load balancing, and resource sharing across multiple HP e3000 servers. The shadowing feature of SharePlex/iX allows a complete application environment to be replicated over local and wide area networks providing users with access to vital data regardless of any single point of failure or of a total data center disaster. OpenView products capture SharePlex/iX events, providing a means of monitoring and managing multiple distributed HP e3000 servers from a central operations point.

Workload and Performance Management
The optional product Workload Manager/iX allows allocation of CPU resources amongst applications. Key mission-critical applications can be assured to execute since less critical applications can be prohibited from monopolizing the server.

HP GlancePlus/iX, an optional performance monitoring and diagnostic software tool for the HP e3000 Servers, provides information on current server resource usage and process activity to quickly help isolate and resolve performance bottlenecks when they occur. GlancePlus Pak for MPE/iX, includes both GlancePlus/iX and a tool to collect comprehensive resource and performance measurement data. HP PerfView Analyzer for Windows NT or HP-UX displays this measurement data in graphical and numerical formats and can be used for troubleshooting, bottleneck detection and load balancing. HP PerfView Planner can be used to forecast the measurement data and help in capacity planning.
Security
Operating system security is an essential component of systems management. The MPE/iX operating system is designed so that user capabilities, account structures, the file system, and system security are integrated. Every file and device can optionally specify which users have access. Server security is further augmented with multi-level logon access and auditing. The optional product Security Monitor/iX can be used to provide further protection for sensitive data and system resources through stronger password protection, improved audit trails, tighter access security and the monitoring of security breaches.

Open Systems Functionality
All HP e3000 Servers provide on-line transaction processing functionality while also supporting industry and de facto standards. The HP e3000 provides interoperable networking and application portability through standard application programming interfaces. For further details on the MPE/iX operating system and its subsystems, see the MPE/iX Release 6.5 datasheet (5968-8856E).

MPE/iX’s support of the IEEE POSIX 1003.1 and 1003.2 standards allow for easy porting of applications developed using these standard open interfaces. The POSIX interfaces are tightly integrated into the MPE/iX environment such that traditional MPE/iX applications and new POSIX applications can easily share resources. This tight integration allows POSIX applications to leverage MPE/iX security; high availability; transaction processing, workload and performance management; and systems and network management functionality.

Information Management
The HP e3000 Servers support several database management products for information storage. HP ALLBASE/SQL is HP’s high-end relational DBMS for HP e3000 Servers and is tightly integrated with MPE/iX. It provides key benefits for customers requiring a mainframe class DBMS: high availability, support for large databases (>50 Gbytes) and large numbers of concurrent users (>500), and support of key standards and client-server features.

HP IMAGE/SQL is HP’s TurboIMAGE include an SQL interface and key client-server features (i.e., ODBC and JDBC support). Hewlett-Packard and Oracle work closely together to ensure that Oracle databases are also supported on the HP e3000 Servers.

Software developers are provided with a rich selection of HP e3000 programming languages and CASE tools that support these databases. Reporting and presentation tools are available to allow access to the stored data without programming.
Internet and Java Accessibility
MPE/iX includes industry-standard Internet Services that make it easy to integrate the HP e3000 into a heterogeneous environment. Internet Services include FTP for file transfer, Telnet for virtual terminal access, DNS BIND for host name resolution and LDAP client support for accessing X.500 network directories. HP e3000 Servers support the http protocol and can act as a web server with the Apache WebServer software that is bundled as a supported part of MPE/iX Release 6.5.

For support of industry standard Java applications, MPE/iX Release 6.5 bundles Java Version 1.2 which includes the Java Virtual Machine, Java Just-In-Time Compiler and the Software Developers Kit (SDK). With MPE/iX, the HP Java Database Connectivity (JDBC) driver is bundled and allows Java application developers to easily access data stored in IMAGE/SQL and ALLBASE/SQL databases.

Industry Standard Networking
HP networking solutions are based on de facto and industry standards. These standards include:

• IEEE 802.3 LAN
• 100Base-T LANs (Fast Ethernet)
• Transmission Control Protocol/Internet Protocol (TCP/IP)
• Sequenced Packet Exchange/Internet Packet Exchange (SPX/IPX)
• Light Weight Directory Access Protocol (LDAP)
• Systems Network Architecture (SNA)
• Open Software Foundation’s Distributed Computing Environment (OSF/DCE)

System-to-System Communication
For system-to-system communications, there is a complete offering of local and wide-area networking services for HP e3000 Servers from HP and third parties. Internet (ARPA) Services (including BSD sockets) which allow for transparent file access, file transfer, sharing of resources in a open TCP/IP environment and Telnet services (both inbound and outbound), are bundled with all HP e3000 Servers. For HP e3000 to HP e3000 communication, the HP Network Services product provides virtual terminal and file transfer capabilities as well as other networking services.
Desktop Integration
The HP e3000's support of Samba/iX enables desktop users using the NT operating system to access enterprise-wide information and computing resources on HP e3000 Servers. This provides users with the best of both worlds: access to desktop applications plus access to the power and resources of the HP e3000 Server. The ODBC and JDBC interfaces bundled with HP ALLBASE/SQL and HP IMAGE/SQL enable desktop PC computers connected to the HP e3000 Server to directly access data in the server's databases without recoding the desktop PC's applications.

HP e3000 System-to-System and Desktop Networking products are supported over industry standard links; IEEE 802.3; 100Base-T LANs (Fast Ethernet); IEEE 802.5 Token Ring; and FDDI (system-to-system only) for local-area communication and X.25 for wide-area connection. NS Point-to-Point is also supported for a direct connection between HP e3000 systems.

For HP e3000 Servers, the MPE/iX Spooler supports spooled printing to TCP/IP network attached Printer Control Language (PCL) printers. Network attached printers can be shared with other HP e3000 and non-HP e3000 servers with interleaving of output to the network printers.

IBM Coexistence
For seamless integration into an IBM computing environment, the HP e3000 Servers offer a complete array of SNA and BSC connectivity products, including: interactive communication products SNA IMF for 3270 emulation and SNA DHCF for IBM 3270 access to the HP e3000 Server; batch communication products SNA/NRJE and BSC RJE; and LU 6.2/PU 2.1 API for program-to-program communications. SNA/SDLC Link, SNA/Token Ring, BSC Link and SNA/X.25 provide the link for HP-to-IBM communication in SNA and BSC environments.

System Software and Supported Peripherals
For a complete list of supported system software and peripherals, refer to the "HP e3000 900 Series Computer Systems Configuration Guide" or contact your HP sales representative.

Support Services
A wide range of hardware and software support services is available worldwide for all HP e3000 products. Contact your HP sales representative for details on all available support services.

Ordering Information
The HP e3000 Servers are available pre-loaded with the MPE/iX Fundamental Operating Software, any HP provided database (IMAGE/SQL and/or ALLBASE/SQL) and subsystem software ordered from HP.

For a complete list of supported system software, refer to the “HP e3000 900 Series Computer Systems Ordering Guide” or contact your HP sales representative.

Server installation is included standard with the HP e3000 Servers.
Table 1. HP e3000 989KS, 979KS, 939KS/030, and 929KS/030 Servers Environmental Specifications

Environmental specifications:

Regulatory Compliance: UL Listed, CSA Certified, TUV approved, compliant with EN 60950 and EN41003. Contact your local HP Sales representative for European Datacom license numbers.


AC Power Input Voltage/ Frequency (autoring input):

<table>
<thead>
<tr>
<th>Range</th>
<th>Rated Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>100V</td>
<td>19.5</td>
</tr>
<tr>
<td>120-127V</td>
<td>16.0</td>
</tr>
<tr>
<td>200-240V</td>
<td>10.0</td>
</tr>
<tr>
<td>50-60Hz</td>
<td></td>
</tr>
</tbody>
</table>

Maximum Power Dissipation: 1700 Watts
Maximum Heat Dissipation: 5800 BTUs/hr

Physical Dimensions:

<table>
<thead>
<tr>
<th></th>
<th>Deskside</th>
<th>Racked</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>641 mm (25.2 in.)</td>
<td>752 mm (29.6 in.)</td>
</tr>
<tr>
<td>Width</td>
<td>440 mm (17.3 in.)</td>
<td>483 mm (19.0 in.)</td>
</tr>
<tr>
<td>Depth</td>
<td>610 mm (27.7 in.)</td>
<td>704 mm (27.7 in.)</td>
</tr>
<tr>
<td>EIA Units</td>
<td>N/A</td>
<td>17</td>
</tr>
<tr>
<td>Weight</td>
<td>60–75 Kg (132–165 lbs.)</td>
<td>69–84 Kg (152–185 lbs.)</td>
</tr>
</tbody>
</table>

Temperature:

<table>
<thead>
<tr>
<th>Operating</th>
<th>Non-operating (with tape media):</th>
</tr>
</thead>
<tbody>
<tr>
<td>+5º to +40º C (41º to 104º F);</td>
<td>-40º to +45º C (-40º to 113º F)</td>
</tr>
<tr>
<td>+5º to +35º C (40º to 95º F) for 989KS/x50</td>
<td></td>
</tr>
<tr>
<td>Max. rate of change: 20º C/hour with hard media, 10º C/hour with tape media</td>
<td></td>
</tr>
</tbody>
</table>

Non-operating:

-40º to +70º C (-40º to 158º F) for 989KS/x50

Relative Humidity:

<table>
<thead>
<tr>
<th>Operating</th>
<th>Non-operating</th>
</tr>
</thead>
<tbody>
<tr>
<td>15% to 80%, non-condensing, maximum wet bulb = 26º C</td>
<td>5% to 90%, non-condensing,</td>
</tr>
</tbody>
</table>

Altitude:

<table>
<thead>
<tr>
<th>Operating</th>
<th>Non-operating</th>
</tr>
</thead>
<tbody>
<tr>
<td>To 3.0 km (10,000 feet) above sea level</td>
<td>To 4.5 km (15,000 feet) above sea level</td>
</tr>
</tbody>
</table>

UPS Holdup Time: Minimum of 15 minutes (with HP PowerTrust UPS)

Acoustics:

Data measured at 24º (75.2ºF). Acoustic performance and fan speeds vary with temperature between 18ºC (64.4ºF) and 40ºC (104ºF).

<table>
<thead>
<tr>
<th>Deskside Operator Position:</th>
<th>Racked System:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tape Backup Mode:</td>
<td>Tape Backup Mode:</td>
</tr>
<tr>
<td>Normal Operating Mode:</td>
<td>Normal Operating Mode:</td>
</tr>
<tr>
<td>Normal Operating Mode:</td>
<td>Normal Operating Mode:</td>
</tr>
<tr>
<td>Normal Backup Mode:</td>
<td>Normal Backup Mode:</td>
</tr>
</tbody>
</table>

Deskside: = <5.8 Bels-LWA
Normal Operating Mode: = <5.7 Bels-LWA
Normal Operating Mode: = <45 dB-LpA, no prominent tones
Normal Operating Mode: = <6.5 Bels-LWA
Normal Operating Mode: = <6.5 Bels-LWA
Normal Operating Mode: = <6.5 Bels-LWA
Normal Operating Mode: = <6.5 Bels-LWA
Normal Operating Mode: = <6.5 Bels-LWA

Racked: = <52 dB-LpA, no prominent tones
Normal Operating Mode: = <52 dB-LpA, no prominent tones
Normal Operating Mode: = <52 dB-LpA, no prominent tones
Normal Operating Mode: = <52 dB-LpA, no prominent tones
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