Plexus
Computers,
Inc.

P/60 Computer System
Model 1060

PLEXUS

The Plexus P/60 is a powerful 16/32-bit super-microcomputer specifically designed for the popular UNIX™ operating system.

The P/60 computer system is ideal for supporting up to 40 users in applications that demand high processor performance. For software development, database management, and other CPU-intensive applications, the P/60 offers performance, reliability, and industry-standard hardware and software interfaces for OEM flexibility.

An innovative multiprocessor design coupled with an MC68000 job processor with cache memory and dedicated high-speed RAM bank form the foundation for P/60 performance. A large main memory and a choice of high-performance peripherals complete the performance emphasis. Mass storage devices and controllers are available with both standard SMD interface and the enhanced SMD for even greater performance. All peripheral controllers feature DMA interfacing to insure maximum performance with minimum job processor overhead. The design tightly links the multiprocessor architecture with a tuned implementation of the UNIX system for maximum multiuser performance.

Flexibility for the OEM is maximized by the use of industry-standard disk, tape, terminal, and printer interfaces, making it possible to attach a wide variety of peripheral devices to the P/60. A Multibus I/O bus extends this flexibility to the board level to meet sophisticated OEM requirements.

The P/60 runs the Plexus implementation of UNIX, along with industry-standard programming languages, making it compatible with a wide variety of

existing applications. In addition, the P/60 is object-code compatible with all other members of the Plexus system family.

FEATURES

Performance
☐ Multiprocessor architecture
☐ Very high performance 16/32-bit MC68000 job processor with cache memory and a dedicated high-speed RAM bank
☐ Up to 4 Mbytes of main memory
☐ Modular intelligent communications processors providing up to 40 serial ports and 5 parallel ports
☐ Intelligent mass-storage processor for disk I/O
☐ Optional high performance enhanced mass storage processor
☐ Large capacity disks
☐ Standard 9-track tape with streaming and normal mode operation

Reliability
☐ Error-checking and -correcting main memory and mass storage
☐ Extensive use of LSI and VLSI circuitry
☐ 10,000-hour MTBF disk drives
☐ Proven UNIX operating system
☐ Modular construction for easy service

Compatible Hardware
☐ Industry-standard peripheral interfaces
☐ Multibus I/O bus
☐ Industry-standard data communications

Standard Software
☐ UNIX operating system and utilities
☐ Popular languages with Berkeley and System V enhancements

Designed for the Office
☐ Quiet
☐ Compact
☐ Uses standard AC power

MULTIPROCESSOR DESIGN

The outstanding performance of the P/60 is made possible by a special multiprocessor architecture optimized for the UNIX system.

The architecture links a powerful 16/32-bit job processor with multiple intelligent I/O processors to remove I/O overhead from the job processor. During operation, the job processor performs data processing and operating system functions while either an intelligent mass storage processor or an enhanced mass storage processor handles disk I/O. Intelligent communications processors handle terminal and printer I/O as well as other data communications functions.

Each I/O processor is a powerful 16-bit microcomputer in its own right, executing a part of the operating system in its local memory. I/O processors use burst-multiplexed DMA to transfer data directly to and from main memory.

The result is multiuser performance and throughput characteristic of superminis costing 5 to 10 times as much.

MC68000 Job Processor

The P/60 job processor is based on the powerful MC68000 microprocessor. A "third generation" design, the P/60 architecture augments the microprocessor with a cache memory, on-board RAM bank, a high-speed memory map and a 32-bit memory path. These performance assists allow the MC68000 to execute at very high clock rates without wait states.

Cache Memory

Processing speed of the P/60 job processor is accelerated by a high-speed cache memory.

The on-board cache, 4 Kbytes of very high-speed 45 nsec static RAM, holds the most recently accessed code and data for a program. Subsequent processor access to these locations takes place with no processor wait states. The result is dramatically improved processor operation.

Data moves between the cache and main memory over a 32-bit dedicated memory bus.

On-Board RAM Bank

Processing speed is further boosted by a dedicated bank of very high speed RAM located on the processor board. The bank is implemented as 16 Kbytes of static RAM.

The on-board RAM bank is downloaded with frequently used UNIX routines and data at system startup. The processor operates out of this high-speed RAM bank with no wait states, significantly speeding execution of these system support routines and improving system throughput.

High-Speed Memory Map

Memory management on the P/60 is accomplished through a high-speed hardware memory map. The map translates virtual addresses to physical addresses and provides hardware memory protection.

Memory management is on a page basis, each user program having access to 4096 pages of 4 Kbytes each. Read/Write/Execute protection is provided on a page-by-page basis.

The map also provides hardware support for virtual memory operation.

Large Main Memory

The P/60 can be configured with up to 4 Mbytes of memory. Memory modules are available in 512 Kbyte or 1 Mbyte sizes, and are based on 64K RAM chips.

Memory is organized in 39-bit words, with 32 bits of data and 7 error correction bits. The P/60's large memory provides ample space for system programs and buffers, and supports multiple users running very large programs.

Intelligent Communications Processor

The ICP's powerful 16-bit processor and large memory allow segments of UNIX or customized communications and terminal handling programs to be downloaded to the ICP and executed locally.

Each ICP has 8 serial ports. They are RS232C compatible and have the modem control lines necessary to support standard asynchronous and synchronous modems. Each port is capable of asynchronous or bisync protocols at software-selectable rates up to 19.2 Kbaud. All 8 ports can operate at maximum rate simultaneously since each port has its own DMA channel.

The parallel port supports a line printer with a Centronics-type parallel interface.

Intelligent Mass Storage Processor

To get the best performance from the P/60's fast Winchester disk drives, an intelligent mass storage processor (IMSP) supervises disk I/O. The IMSP includes a 16-bit processor and 128 Kbytes of local memory, into which segments of UNIX are downloaded. The large memory allows advanced disk management techniques and buffering that significantly increases I/O performance.

In addition to performing all error checking and recovery operations, the IMSP automatically performs diagnostics using a reserved disk track. It also ensures the completion of disk transfers in progress during power failures.

The IMSP has ample memory and processing capacity to perform file system functions, system backup operations, and caching algorithms.

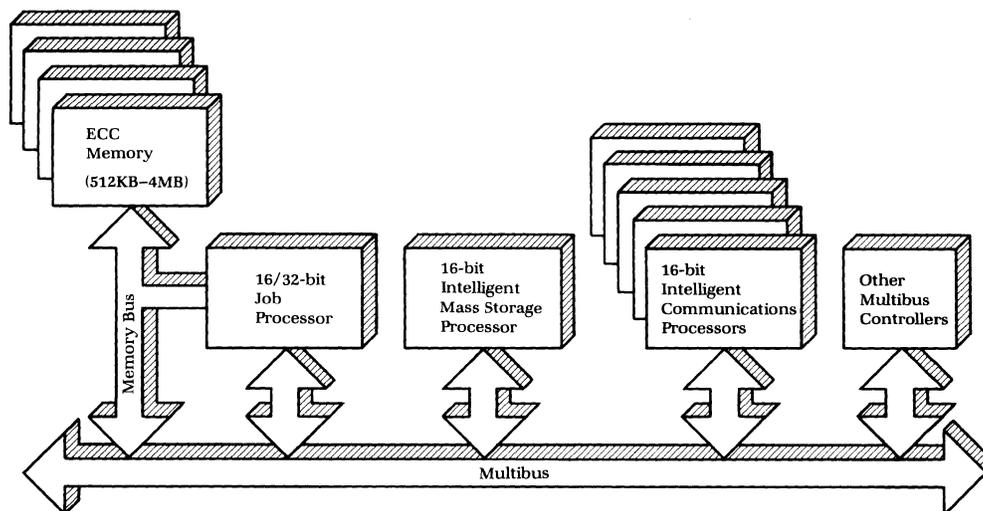## Enhanced Mass Storage Processor

The enhanced mass storage processor (EMSP) enables the P/60 to utilize high capacity disk drives employing the enhanced SMD (ESMD) interface. The EMSP utilizes an advanced microprocessor-based design to achieve high throughput and implement advanced performance features, such as, overlapped seek operations, overlapped data transfers, and 32-bit ECC error control to ensure data integrity.

PERFORMANCE PERIPHERALS

Fast, High-Capacity Disk Drives

The P/60 disk subsystem supports up to 4 high-performance disk drives. The IMSP controller supports a range of disk drives ranging in size from the standard 72 Mbyte 8-inch drive to the 285 Mbyte 14-inch drive. The EMSP supports a range of disk drive sizes, from the 145 Mbyte 8-inch drive to the 600 Mbyte 14-inch drive. Both controllers offer a DMA interface and on-board microprocessor-based intelligence. Both subsystems are rated at 10,000-hour mean time between failures (MTBF).

P/60 MULTIPROCESSOR ARCHITECTURE

Diagram components: ECC Memory (512KB–4MB); Memory Bus; 16/32-bit Job Processor; 16-bit Intelligent Mass Storage Processor; 16-bit Intelligent Communications Processors; Other Multibus Controllers; Multibus.

Dual-Mode Tape Drive

The standard P/60 tape drive is a ½-inch., 9-track, 1600 bpi unit that features horizontal mounting, automatic threading, and dual-mode operation.

In streaming mode, which is used for disk backup, the tape drive stores 46 Mbytes of data in 4.8 minutes on a 10½-in., 2400-ft. reel of tape. In normal mode, the ANSI/IBM-compatible drive provides a convenient method for exchanging data with other computer systems.

The tape is controlled by an intelligent tape controller with its own microprocessor and local memory buffer.

For program transfer with smaller Plexus systems, a streaming cartridge tape drive is available.

BUILT-IN RELIABILITY

The two most common causes of downtime in small computer systems are memory errors and disk drive errors. The P/60 automatically detects and corrects these two types of errors.

ECC Memory and Disk

The P/60 features automatic memory error detection and correction through a hardware error correction scheme. Each time main memory is accessed, dedicated hardware in each memory module performs error correction, without additional system overhead. Error detection/correction is performed via a 7-bit error code appended to each 32-bit word stored in memory.

Disk errors are handled by the built-in error correction facilities of both the IMSP and EMSP controllers. During a disk read operation, the disk controller can detect and automatically correct an erroneous burst up to 11 bits in length. Error detection and correction is performed via a 32-bit error code appended to each sector ID or data field when the field is written to the disk.

LSI Circuitry

Another common cause of downtime is small computers is component failure. To minimize component failures, the P/60 combines conservative circuit design with generous cooling so that component temperatures are kept as low as possible.

In addition, the P/60 makes extensive use of LSI and VLSI circuitry, which is inherently more reliable because it reduces the total number of parts in a circuit.

Self-Test, Easy Repair

P/60 design emphasizes easy service just as strongly as it emphasizes reliability. Every time the P/60 is turned on, each processor automatically performs an extensive self-test.

The P/60 also features a diagnostic port that allows a terminal or modem to be connected directly to the job processor. The port can be used from a remote location to isolate many hardware and software problems.

All P/60 modules are easy to access and replace. Using spare modules, mean time to repair is under 30 minutes and requires no special tools.

EASY HARDWARE INTERFACING

Industry-standard disk, tape, terminal, and printer interfaces, along with an industry-standard I/O bus, make it easy to attach a wide variety of peripheral devices to the P/60.

DESIGNED FOR THE OFFICE

The P/60 is designed to operate in an office environment. It features quiet operation and requires no special environmental control or power conditioning. The styling is modern and the subdued colors fit unobtrusively with any decor.

SPECIFICATIONS

Job Processor

Processor	16/32-bit MC68000
Performance features	4 Kbytes cache memory; 16 Kbytes high-speed static RAM; dedicated high-speed memory map
Address space	8 Mbytes
Floating-point	Conforms to proposed IEEE standard
Clock/calendar	Battery-powered
Self-test	Standard, via on-board PROM

Memory

Capacity	Up to 16 Mbytes using 512, 1024, 2048 or 4096 Kbyte modules
Configurability	4 modules (max.)
Word size	39 bits (4 bytes plus 7-bit error code)
Access	32-bit dedicated memory bus; DMA from ICP, IMSP, EMSP
Cycle time	400 nsec (including error detection and correction)
Error handling	Single-bit error detection and correction; double-bit error detection

Intelligent Communications Processor

Intelligence	16-bit processor
Memory	32 Kbytes RAM (with parity); 16 Kbytes PROM
Serial ports	8 (full duplex); RS232C interface; 19.2 Kbaud rate (max.); modem support on all ports; hardware support for async and bisync protocols
Parallel ports	1 Centronics-type interface
Configurability	5 ICP's (max.)

Intelligent Mass Storage Processor

Intelligence	16-bit processor
Memory	128 Kbytes RAM; 16 Kbytes PROM
Interfaces supported	SMD disk; streaming cartridge tape
Other functions	Error checking and recovery; diagnostics; protection against errors during power failure

Enhanced Mass Storage Processor

Intelligence	8-bit and bit slice processors
Memory	2 Kbytes RAM 16 Kbytes PROM
Interfaces support	SMD disk, ESMD disk
Other functions	Error checking and recovery

Disk Subsystem

Formatted capacity (Mbytes)	72	145	285	554
Positioning time (msec)	20	20	27	27
Rotational latency (msec)	8.3	8.3	11	11
Transfer rate (Mb/sec)	1.2	1.2	1.0	1.86
Platter size (in.)	8	8	14	14
Controller interface	SMD	SMD	SMD	SMDE
Configurability	4	4	2	2
Controller required	IMSP/ EMSP	IMSP/ EMSP	IMSP/ EMSP	EMSP
Disk MTBF (all)	10,000 hour			

Tape Subsystem

Tape drive	ANSI/IBM compatible; automatic threading
Density	1600 bpi, 9 tracks
Streaming speed	100 ips
Normal mode speed	25 ips
Rewind speed	200 ips
Reel size	7, 8½, or 10½-in.
Controller interface	Pertec standard

I/O Bus

Bus standard	Multibus I (IEEE 796)
Available slots	8 (max.)

AC Power Required	115 VAC	230 VAC
Line voltage	115 VAC±10%	230 VAC±10%
Line frequency	49–61 Hz	49–61 Hz
Current (max.)	12A	6A

PHYSICAL CHARACTERISTICS

Overall Dimensions	in.	cm.
Width	21.5	55
Depth	33.5	85
Height	55.0	140

Inside Dimensions

Width	Fits standard 19-in. RETMA rack
Depth	24 in. (61 cm)

Other Characteristics

Weight (max.)	485 lb (220 kg)
Heat dissipation (max.)	6000 Btu/hr (1512 Kgcal/hr)

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Multibus is a trademark of Intel Corporation.
Specifications subject to change.