



Model 3250

INTRODUCTION

The Model 3250 is the latest supermini in the Perkin-Elmer Series 3200 family and continues a reputation for superior performance through the use of state-of-the-art 32-bit hardware and software technology.

With over a decade of experience producing the most advanced minicomputer systems available, Perkin-Elmer has become synonymous with high reliability, maintainability, flexibility, and ease of use in systems, while extending previous limits for processing power, system capacity, integrity, and accuracy.

PRODUCT DESCRIPTION

The Model 3250, shown in Figure 1, features an ultra high-performance modular central processing unit which implements the established Perkin-Elmer Series 3200 instruction set. The combination of the 3250 with the field-proven 32-bit operating system and a comprehensive suite of software establishes the standards for supermini performance and flexibility in the 32-bit arena.

The features of the Model 3250 include:

- 32-bit parallel architecture — 64-bit arithmetic unit, 64-bit memory bus and 32-bit data paths which enhance the power of the system by allowing parallel processing of data.
- Large memory capacity — 16MB of directly addressable memory using 64K MOS RAM chips with interleaved memory for efficient large program handling and real-time processing.
- Cache memory — 4-way set associative 8KB cache for optimum memory system performance.

- High memory bus bandwidth — 64MB/second peak through a full 64-bit bus to allow high I/O throughput with minimum degradation of processing power.
- High I/O throughput — 40MB/second — 4 independent DMA channels each capable of accommodating up to 8 concurrent DMA transfers.
- Four external interrupt subsystems with a total of 1023 levels, hardware vectoring, and dedicated register stacks to minimize context switching time.
- High performance floating point with R-Star rounding for increased accuracy.
- 8 sets of 16 full 32-bit general registers to minimize context switching and system overhead.
- System oriented packaging—full 16MB system available in a single 56-inch cabinet.
- Real-time oriented architecture and software for today's complex system requirements.
- Full software support with mature, field-proven 32-bit software.

The 3250 sets new standards in price, performance, and packaging for today's high performance systems. The 3250 processor's ability to process large computational programs with high concurrent I/O make it uniquely suited to many high performance requirements.

The 3250 adds a new dimension to the Series 3200 family by providing even more cost effective computational power and by its innovations in packaging. The 3250 is available in both packaged systems and as a Central Processing Unit and includes features usually only available as options.

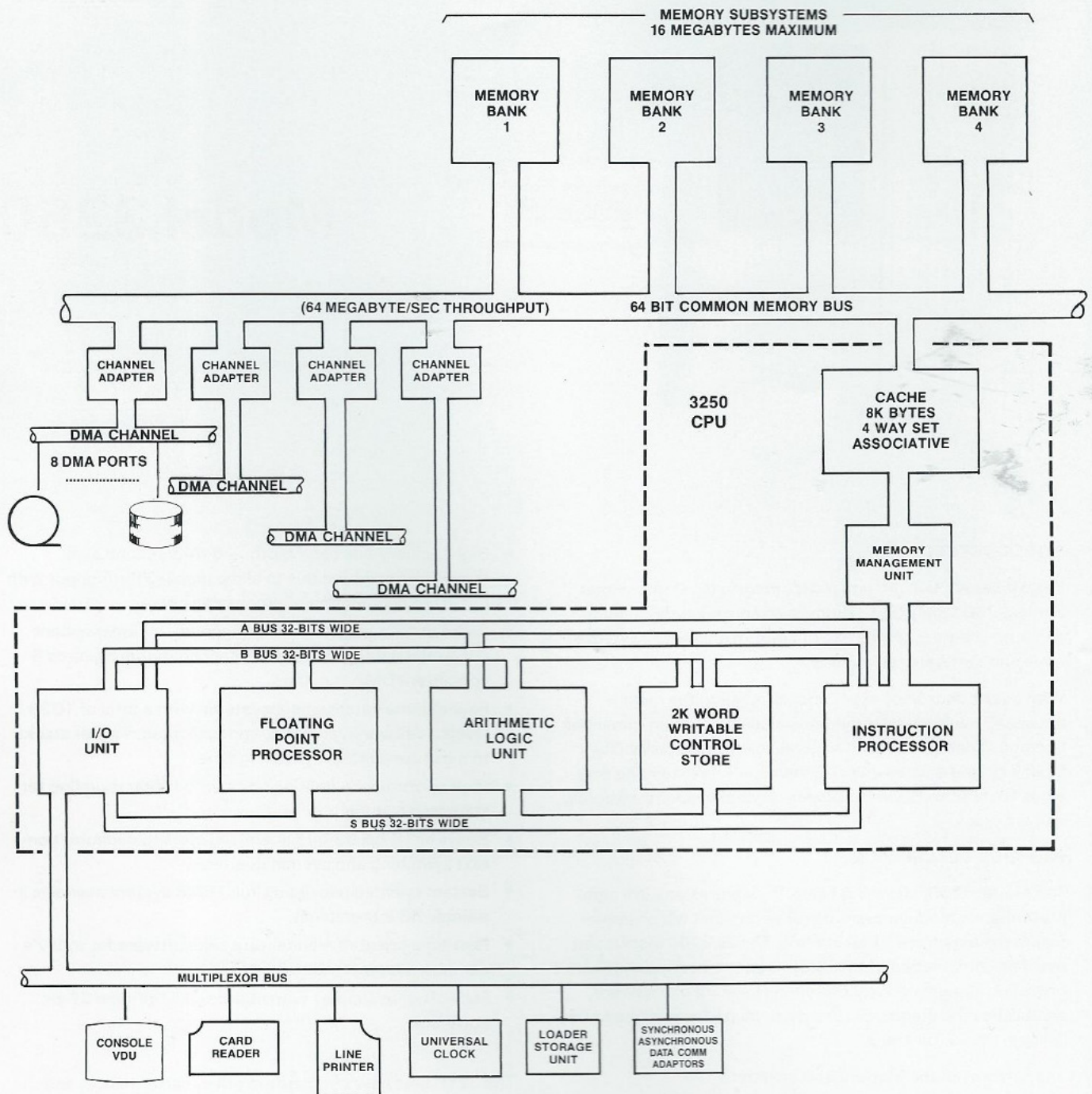


Figure 1. 3250 Block Diagram

Standard features of the 3250 include:

- System cabinet, memory, and I/O chassis
- High availability, wide range power system
- Power fail detection with automatic restart
- System control panel
- Loader Storage Unit
- System Console
- Universal Clock
- Provision for remote diagnostics
- Built-in processor/memory test
- Cache memory — 8KB; 4-way set associative
- Error correcting memory with hardware memory segmentation, protection and relocation.
- Battery Backup, Error Logger, and Memory Scrubber.

Optional features for the 3250 processor include:

- Floating Point Processor (FPP) — The high-performance Floating Point Processor option provides 48 single and double-precision floating point instructions. It also contains eight 32-bit single-precision registers and eight 64-bit double precision registers. Twelve instructions are available to transfer data between the single and double-precision registers for mixed-mode calculations. High floating point accuracy is achieved via R-Star rounding. This rounding technique, implemented in the Series 3200 provides more accurate results over extended calculations, as opposed to conventional rounding.
- Data Handling Option — The Data Handling option is primarily used for data communications applications, and provides fast, more efficient operation. Two instructions, Process Byte and Process Byte Register, are used to calculate a cumulative checksum based on an old checksum and a new data byte. The check can be used for BISYNC or SDLC.
- Writable Control Store (WCS) — Writable Control Store offers 2048, 32-bit words of user-alterable control storage for custom-tailoring the Model 3250 to a specific application. Special scientific or mathematical algorithms, communications protocols, or time-critical subroutines can be easily implemented in WCS. The microprogrammed routines typically execute two to three times faster than the equivalent assembly level routines. WCS is supported by appropriate microcode development software.

MEMORY SYSTEM

The Model 3250 memory system uses 64K MOS RAM chips, implemented in 1 and 2 megabyte modules. Using these modules, memory can be configured from the smallest size of 1MB to a maximum of 16MB.

The memory system is organized into a single bank, or two or four-banks, with memory divided equally across multiple banks. A single bank system is non-interleaved; two-bank system can be non-interleaved or two-way interleaved; a four-bank system can be non-interleaved, two or four-way interleaved.

The memory system is designed to operate whenever possible in the quadword (16-byte) mode. This improves overall throughput by reducing bus overhead.

All memory is connected to the Common Memory Bus (CMB), which consists of two unidirectional, asynchronous, 32-bit buses. One bus transfers addresses and writes data while the other is used for reading data only. All read/write operations can be performed on up to four fullwords at a time, using the quadword mode described above.

Error correction and error logging are standard on the Model 3250. Error correction is performed on a full 32-bit word using a 7-bit modified Hamming code. These seven additional bits for each word in memory perform error detection and correction on all single bit errors. Detection is performed on all double bit (two) errors and partial detection on multiple bit (more than two) errors.

The Memory Error Logger identifies and logs memory errors, with fault isolation to the chip level. The operating system periodically polls the Memory Error Logger for error trends. Customer service engineers can then quickly identify and replace faulty memory chips.

Memory Scrubber

A Memory Scrubber will periodically purge the memory system of soft (single bit) errors by performing read cycles throughout the memory system. The ECC feature is capable of correcting these single bit errors before they become multiple bit errors thereby providing a significant improvement in system reliability. Because of the wide bandwidth (64MB/sec) of the Common Memory Bus, the Memory Scrubber does not degrade the system performance or throughput.

POWER SYSTEM

The 3250 uses a modular, bulk power system. Its modular design and high technology features contribute to its reliability and maintainability. The significant features are:

- High-reliability circuit design
- Control of system power-up and power-down sequences and computer system initialization
- High-noise immunity design
- Uni-point cabinet and chassis grounding system
- LED maintenance annunciator for fault isolation
- High-efficiency design for lower power consumption
- Brown-out protection
- Thermal protection
- Overcurrent/overvoltage protection
- Optically coupled interface circuitry and control logic for coordination of multiple cabinet power subsystem networks.

The power subsystem, located at the top of the cabinet, is designed with wide input tolerances to assure reliable operation in both domestic and international installations. The power system, without modification, will accept a voltage range of 180-264 VRMS and a frequency range of 47-63 HZ. The power system is U.L. and C.S.A. certified and is VDE compliant.

SYSTEM CONTROL

Operator control is provided by the System Control Panel and the system terminal, a microcode-supported device interfaced to the system by a standard 2-Line Communications Multiplexor. The System Control Panel controls power to the system and Initial Program Loading. It also provides controls for system initialization, processor halt, run, and single step. Light Emitting Diodes (LEDs) on the System Control Panel indicate current system state.

The Model 3250 includes a Model 550B Video Display Unit as its system terminal. Keyboard commands through the system terminal allows the operator to examine and modify processor registers, main memory locations and start program execution. The system terminal may be used as the system console under OS/32.

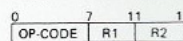
Instructions

The 3250 instruction set includes a comprehensive array of instructions for high-performance processing. The instruction set performs the following broad classes of operations:

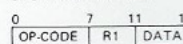
- Load/store halfwords, fullwords and multiple words
- Fixed-point arithmetic
- Logical operations (AND, OR, exclusive OR, compare and test)
- Logical and arithmetic shifts and rotates
- Bit string and bit manipulation
- Floating-point arithmetic on single (32-bit) and double (64-bit) precision operands.
- Status and control functions
- List operations
- Data handling operations
- Input/Output
- Byte manipulations
- Writable Control Store operations
- Mixed floating point transfers
- Privileged system functions
- Storage-to-storage instructions
- Decimal conversion instructions

The 3250 instruction set uses the eight different instruction formats illustrated in Figure 2.

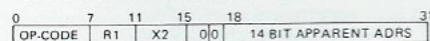
REGISTER TO REGISTER (RR)



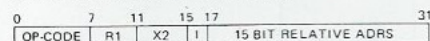
SHORT FORMAT (SF)



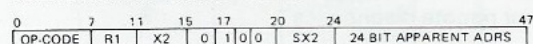
REGISTER TO INDEXED MEMORY 1 (RX1)



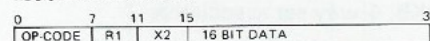
REGISTER TO INDEXED MEMORY 2 (RX2)



REGISTER TO INDEXED MEMORY 3 (RX3)



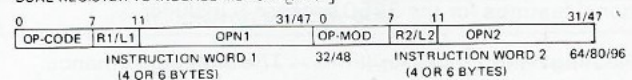
REGISTER IMMEDIATE (RI)



REGISTER IMMEDIATE (RI2)



DUAL REGISTER TO INDEXED MEMORY (RX)²



- OP-CODE HEXIDECIMAL REPRESENTATION OF FUNCTION TO BE PERFORMED.
 R1 SPECIFIES ONE OF 16 G.P. REGISTERS AS FIRST OPERAND.
 R2 SPECIFIES ONE OF 16 G.P. REGISTERS AS SECOND OPERAND.
 X2 SPECIFIES ONE OF 15 G.P. REGISTERS AS AN INDEX VALUE.
 SX2 SPECIFIES ONE OF 15 G.P. REGISTERS AS A SECOND INDEX VALUE.
 OP SPECIFIES THE CLASS OF INSTRUCTION (RX)².
 OP-MOD SPECIFIES THE PARTICULAR INSTRUCTION (RX)².
 OPN1 SPECIFIES THE FIRST OPERATION TO BE PERFORMED.
 OPN2 SPECIFIES THE SECOND OPERATION TO BE PERFORMED.
 R1/L1 SPECIFIES LENGTH IN BYTES OF OPN1 OR REGISTER THAT CONTAINS THE LENGTH (RX)².
 R2/L2 SAME AS R1/L1 BUT FOR OPN2 (RX)².

Figure 2. Instruction Formats

Central Processing Unit

- Halfword formats are used for register-to-register and register with four-bit constant operations.
- Fullword format instructions can perform operations on a register with memory or 16-bit constant. These instructions can directly address the first 16K bytes of memory and 16K bytes relative to the location counter. All of memory can be addressed via single-register indexing.
- The 48-bit format instructions can perform operations on a register with memory or a 32-bit constant. These instructions can address all of memory directly or via single-register or double-register indexing.
- The 64/96-bit format of the (RX)² instructions is essentially a pair of RX format functions embedded in a single instruction. An (RX)² instruction is composed of two instruction words, where each of the instruction words may be any one of the RX formats. For example, the first instruction word might be RX1, while the second is RX3, yielding a 10-byte instruction. The type of RX format used for each instruction word is independent of the type used for the other instruction word.

For further definition of instruction formats, see the Model 3250 Users Manual.

The 3250 instructions operate on data in the formats illustrated in Figure 3. Fixed point arithmetic and logical instructions operate on words or halfwords, floating point hardware uses one-word or two-word operands.

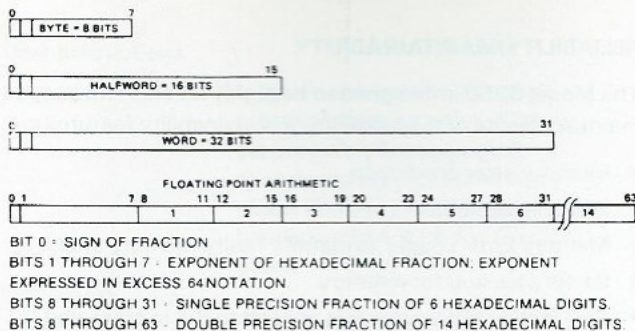
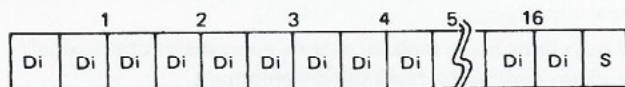


Figure 3. Data Formats for Fixed and Floating Point Arithmetic

There are two additional formats for packed and unpacked decimal.

A number represented in packed decimal format is a fixed point, signed integer and consists of an integral number (1 through 16) of consecutive bytes of the form:



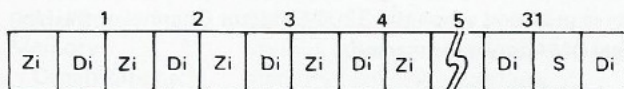
Di = HEXADECIMAL DIGIT 0-9 (ALL OTHERS ILLEGAL)

S = SIGN

i = 1, 2, 3, ... 31 RESPECTIVELY

PACKED DECIMAL FORMAT

The other decimal format is unpacked or zoned format. A number represented in unpacked decimal format is a fixed-point, signed integer and consists of an integral number (1 through 31) of consecutive bytes of the form:



Zi = ZONE DIGIT

Di = HEX DIGIT 0-9 (OTHER VALUES ILLEGAL)

S = SIGN

Where i = 1, 2, 3, ... 31

UNPACKED DECIMAL FORMAT

SOFTWARE

Perkin-Elmer provides a full range of excellent, field-proven 32-bit software for the Series 3200.

The Model 3250 runs under control of OS/32, a versatile general-purpose, multitasking operating system which supports a multi-programming environment for up to 255 tasks. The scope and power of the operating system can be extended through MTM and utilities.

The Multi-Terminal Monitor (MTM) provides interactive program development facilities for up to 64 concurrent terminal users.

The Telecommunications Access Method (ITAM/32) is supplied with OS/32 and provides data communications facilities for:

- BISYNC, ASYNC, SDLC and other protocols.
- HASP/32 for emulating IBM HASP workstation.
- 2780/3780 RJE workstation emulation.
- Specialized communications applications.

LANGUAGES

Program development languages include the Common Assembly Language (CAL) and CAL MACRO, FORTRAN VII, RPG II, BASIC II, COBOL, CORAL 66 and Pascal.

FORTRAN VII

FORTRAN VII is a comprehensive FORTRAN language system, featuring both a universally and globally optimizing compiler that provide unequaled execution speeds for FORTRAN programs on Perkin-Elmer 32-bit computer systems. It meets the American National Standard FORTRAN and includes (X-3.9-1978) full language definition. In addition, a number of carefully selected language extensions provide increased programmer convenience so that full advantage is taken of the Perkin-Elmer 32-bit architecture.

FORTRAN VII is augmented by a comprehensive run-time library. The ISA FORTRAN extensions for industrial processing and control are an integral part of the library. FORTRAN VII includes an extremely efficient development facility that can be shared by any number of concurrent MTM users.

PASCAL

Perkin-Elmer's Pascal is a multi-purpose, structured high-level programming language, conforming to the draft ANSI standard. The compiler produces highly efficient optimized code that can be shared by any number of users. Perkin-Elmer provided extensions allow the user full access to OS/32 services, the FORTRAN Run-Time Library, and user-written routines.

COBOL

Perkin-Elmer's implementation of COBOL conforms to the American National Standard X3.23-1974 and supports many high level ANSI-1974 features. Additional syntaxes are provided to facilitate the coding of programs for on-line concurrent use in a RELIANCE transaction processing environment.

CAL and CAL MACRO

The assembly language, CAL, generates object code for Perkin-Elmer 16 and 32-bit computers. It has a powerful macro pre-processor, CAL MACRO, which enables development of macro instruction sequences.

BASIC II

Perkin-Elmer's BASIC II is a powerful, interactive programming language which uses Dartmouth's BASIC conventions. BASIC II also offers significant enhancements for both experienced and novice programmers.

RPG II

RPG II is designed to allow an efficient yet simple approach to solving a wide variety of business problems. Using standard

RPG II specification sheets, users describe files, data tables, arrays, and information relating to the processing of input data and generation of output data and reports. RPG II has been designed to be used with the RELIANCE transaction processing system.

RELIANCE

RELIANCE is an integrated transaction processing software system for the Perkin-Elmer Series 3200. RELIANCE consists of data management (DMS/32) and transaction processing software, COBOL and FORTRAN are the application programming languages for use with RELIANCE and are available as separate components. RELIANCE provides easy and efficient program development, high system performance, ultra-high reliability, security and recoverability.

Up to 128 terminals can be on-line to a RELIANCE system, any of which may be remote. Dial-in facilities are provided.

RQL/32

An adjunct to RELIANCE, RQL/32 permits non-programmers to interactively query the data base.

UNIX*

Edition VII Workbench is a standard version of the UNIX* Time Sharing System, Seventh Edition, available with the Source Code Control System (SCCS) facilities of PWB/UNIX.

Edition VII Workbench is a multi-programming time-shared system suited to installations as large as 128 users.

CONFIGURATIONS AND PACKAGING

The 3250 is available in packaged system configurations and as a processor. There are basic processor configurations offered under the Model 3250: the 3251, 3252 and the 3254.

All basic systems include the features mentioned earlier as standard processor parts. The difference in these processors is in the number of memory banks and the quantity of DMA buses and memory included.

The 3252 has two memory banks each containing a base of 1MB for a total of 2MB's and two DMA buses. The 3254 contains four banks each with a base of 1MB for a total of 4MB's and four DMA buses.

All of these processors are configured in one cabinet and can be expanded up to 16MB's of memory with four banks within this cabinet. Also included is an eight slot I/O chassis. The cabinet contains enough space and power to upgrade any of these processors to a 16MB, four-bank system.

The Models 3251 and 3252 processors are available in packaged systems. These systems include the processor, a magnetic tape drive, fixed or removable media discs, and up to 4 MB's of directly addressable MOS memory.

RELIABILITY/MAINTAINABILITY

The Model 3250 is designed to be highly reliable and easy to maintain. Some of the reliability/maintainability features are:

- Memory error correction
- Memory scrubber
- Memory Error Logger to identify faulty memory chips
- Battery backup for memory
- Self Test — When power is applied to the system, the basic memory and processor functions are checked. Additional memory and processor checks are performed when the operating system is loaded.
- Multi-media diagnostic package — Includes diagnostic programs for processor, memory and all peripherals with the purchase of the operating system.
- Modular power subsystem with extensive maintenance features.
- All systems must pass an extensive series of operational and environmental tests before shipment.

COMPATIBILITY

The 3250 is user-level software compatible with the Perkin-Elmer Series 3200 family, providing a natural upward growth path. All high level languages are totally compatible across Perkin-Elmer's entire 32-bit product line.

The multiplexor bus on the 3250 is compatible to that on the 7/32, 8/32, 3210, 3220, 3230 and 3240. The 3250 DMA bus is not compatible with the EDMA bus of the 8/32 and 3220; however, completely compatible DMA transfer capability is provided when the 3200 Selector Channel or the Universal DMA Interface is used.

The WCS format is compatible with that of the 3240; however, it is different from the 3220 format. Microprograms developed for the 3220 will need modification before being used on the 3250.

Specifications

Technology

Processor	Schottky TTL, MSI, LSI
Control Store	50ns, bipolar ROM
WCS	50ns bipolar RAM
Main Memory	150ns, 64K Dynamic RAM
Cache Memory	50ns, bipolar RAM

Processor

Instruction Length	16, 32, 48, 64, 80, 96 bits
Data Length	1, 8, 16, 32, 64 bits, strings from 0 (null) to $(2^{24})-1$ in length.
Hardware Registers	8 sets of sixteen 32-bit general registers. Eight 32-bit floating point registers. Eight 64-bit double precision floating point registers.
Addressing	Direct to 16M bytes relative to 16K bytes, single and double indexing to 16M bytes.
Arithmetic	Two's complement (fixed point $\pm 2,147,483,648$); Sign/magnitude (floating point — 5.4×10^{-79} to 7.2×10^{75}).

* UNIX is a trademark of Bell Telephone Laboratories, Inc.

User Instructions

Repertoire	Instructions include: 17 single precision floating point, 17 double precision floating point, 12 mixed mode (single/double precision floating point), 2 data handling and 4 Writable Control Store.
Instruction Lookahead	16 byte instruction prefetch buffer.
Cache Memory	8KB in a four-way set associative organization
Input/Output Characteristics	Maximum number of I/O devices — 1023 Number of Auto Driver Channels — 1023 Number of DMA ports — 32 (4 DMA buses, 8 per bus)
I/O Transfer Rates	Auto Driver Channel; greater than 64 transfers/sec. (8 or 16-bit transfers) DMA transfer 10MB/sec. per DMA bus in burst mode (4 max.), total of 40MB/sec.
External Interrupts	Four interrupt subsystems with automatic device identification and vectoring on 1023 levels.
Main Memory Type	150 nsec MOS (with ECC)
Data Length/Access	8, 16, 32, 64, or 128 bits
Basic Memory	
Access Time:	500 nsec.
Data Paths	32 bits
Memory Organization:	Various options with differing memory bank configurations, including: <ul style="list-style-type: none">• Non-interleaved (1, 2 or 4 banks)• Two-way interleaved (2 or 4 banks)• Four-way interleaved (4 banks only) All interleaving is on quad-word boundaries.
Memory Size	1MB to 16MB
Environmental	
Temperature	0-50°C
Humidity	0-90% (noncondensing)
Vibration	0-55Hz at 1.25G's
Storage Temperature	-55°C to 85°C
Power Requirements	180-264 VRMS (brown-out protection), 230V single-phase (preferred) 47-63 Hz, 24 amps (max.) per cabinet

PRODUCT NUMBERS

Processors

M32-702	3252 Processor with 2MB
M32-703	3252 Processor with 4MB
M32-704	3254 Processor with 4MB
M32-705	3254 Processor with 8MB

Memory Expansions

M32-711	1MB Memory Expansion
M32-712	2MB Memory Expansion
M32-710	Memory Bank Expansion

3250 Packaged Systems

M32-833	3251 Pkg Sys w/1MB MOS Mem MSM80 Disc Subsystem & 9 Trk 75 IPS 800/1600 Mag Tape Subsystem 60Hz
M32-835	Same as M32-833 except 50Hz
M32-800	3252 Pkg Sys w/2MB MOS Mem MSM80 Disc Subsystem & 9 Trk 75 IPS 800/1600 Mag Tape Subsystem 60Hz
M32-801	Same as M32-800 except 50Hz
M32-802	3252 Pkg Sys w/2MB MOS Mem MSM80 Disc Subsystem & HPTD 125 Mag Tape Subsystem 60Hz
M32-803	Same as M32-802 except 50Hz
M32-804	3252 Pkg Sys w/2MB MOS Mem MSM300 Disc Subsystem, & 9 Trk 75 IPS 800/1600 Mag Tape Subsystem 60Hz
M32-805	Same as M32-804 except 50Hz
M32-806	3252 Pkg Sys w/2MB MOS Mem MSM300 Disc Subsystem & HPTD 125 Mag Tape Subsystem 60Hz
M32-807	Same as M32-806 except 50Hz
M32-808	3252 Pkg Sys w/2MB MOS Mem MSM80F Disc Subsystem & 9 Trk 75 IPS 800/1600 Mag Tape Subsystem 60Hz
M32-809	Same as M32-808 except 50Hz
M32-810	3252 Pkg Sys w/2MB MOS Mem MSM80F Disc Subsystem & HPTD 125 Mag Tape Subsystem 60Hz
M32-811	Same as M32-810 except 50Hz
M32-812	3252 Pkg Sys w/4MB MOS Mem MSM80 Disc Subsystem & 9 Trk 75 IPS 800/1600 Mag Tape Subsystem 60Hz
M32-813	Same as M32-812 except 50Hz
M32-814	3252 Pkg Sys w/4MB MOS Mem MSM80 Disc Subsystem & HPTD 125 Mag Tape Subsystem 60Hz
M32-815	Same as M32-814 except 50Hz
M32-816	3252 Pkg Sys w/4MB MOS Mem MSM300 Disc Subsystem & 9 Trk 75 IPS 800/1600 Mag Tape Subsystem 60Hz
M32-817	Same as M32-816 except 50Hz
M32-818	3252 Pkg Sys w/4MB MOS Mem MSM300 Disc Subsystem & HPTD 125 Mag Tape Subsystem 60Hz
M32-819	Same as M32-818 except 50Hz
M32-820	3252 Pkg Sys w/4MB MOS Mem MSM80F Disc Subsystem & 9 Trk 75 IPS 800/1600 Mag Tape Subsystem 60Hz
M32-821	Same as M32-820 except 50Hz
M32-822	3252 Pkg Sys w/4MB MOS Mem MSM80F Disc Subsystem & HPTD 125 Mag Tape Subsystem 60Hz
M32-823	Same as M32-822 except 50Hz

Processor Options

- M32-716** WCS (Support program on 10MB Disc)
- M32-717** WCS (Support program on 16MB Disc)
- M32-718** WCS (Support program on 800CPI Mag Tape)
- M32-719** WCS (Support program on 1600CPI Mag Tape)
- M32-720** DMA Bus Option
- M32-722** High Speed Data Handling Option

Power, Chassis, Cabinets

- M49-140** Expansion Cabinet (60HZ)
- M49-141** Expansion Cabinet (50HZ)
- M49-143** I/O Expansion Chassis
- M49-145** Power Control Module and P5 Module
- M49-146** P5 Expansion Power Module

Related Documentation

- 50-001** 3250 Users Manual
- 47-029** Maintenance Manual
- 50-004** 3250 Micro-Programming Manual
- 47-010** 3250 Power System Manual
- 50-030** 3250 Memory System Manual

PERKIN-ELMER

Data Systems Group

2 Crescent Place
Oceanport, N.J. 07757
(201) 870-4712
(800) 631-2154

The information contained herein is intended to be a general description and is subject to change with product enhancement.

Manufacturing facilities and Sales/Service offices located throughout the world; major subsidiaries located in AUSTRALIA: Adelaide, Albury, Brisbane, Canberra, Melbourne, Perth, Sydney, and NEW ZEALAND: Wellington; CANADA: Calgary, Montreal, Ottawa, Toronto, Vancouver; ENGLAND: Manchester, Slough; FRANCE: Arcueil, Bordeaux, Grenoble, Lille, Lyon, Perigueux, Toulouse; WEST GERMANY: Dusseldorf, Frankfurt, Munich; AUSTRIA: Vienna; NETHERLANDS: Gouda; SINGAPORE; HONG KONG; JAPAN: Tokyo. Other countries are serviced by a network of distributors.

Printed in U.S.A. March, 1982