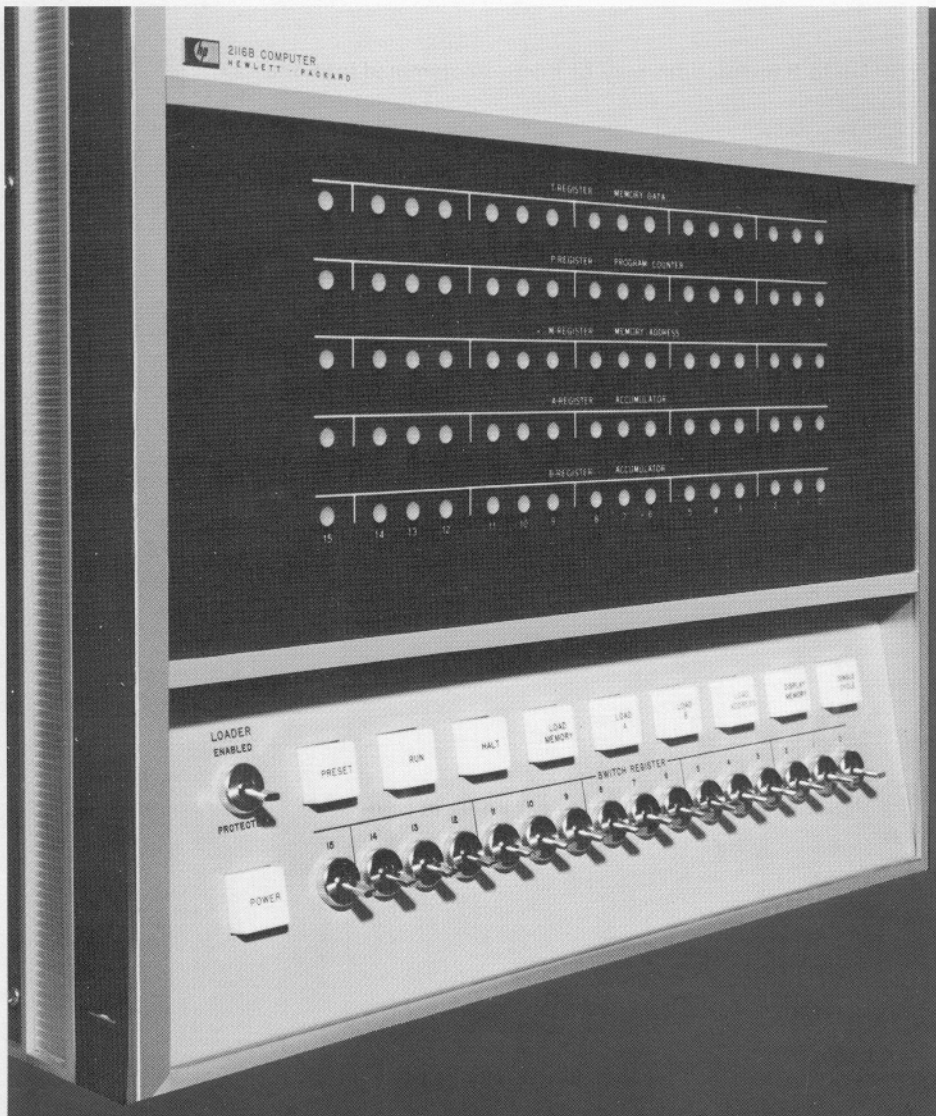
HEWLETT hp PACKARD

digital computers

2116B



...a powerful general-purpose computer for scientific, real-time, and instrumentation applications

FEATURES

GENERAL

- Parallel logic
- Modular hardware expansion
- Modular, efficient software

PROCESSOR

- Powerful instruction set – 70 basic instructions
- Up to 8 instructions may be microprogrammed into one word
- Two accumulators, both addressable to simplify programming
- Unlimited levels of indirect addressing allowed
- Registers are displayed, readily modified through console
- Rack-mountable
- Power Fail option preserves status, restarts automatically
- Extended arithmetic capability available as plug-in option

MEMORY

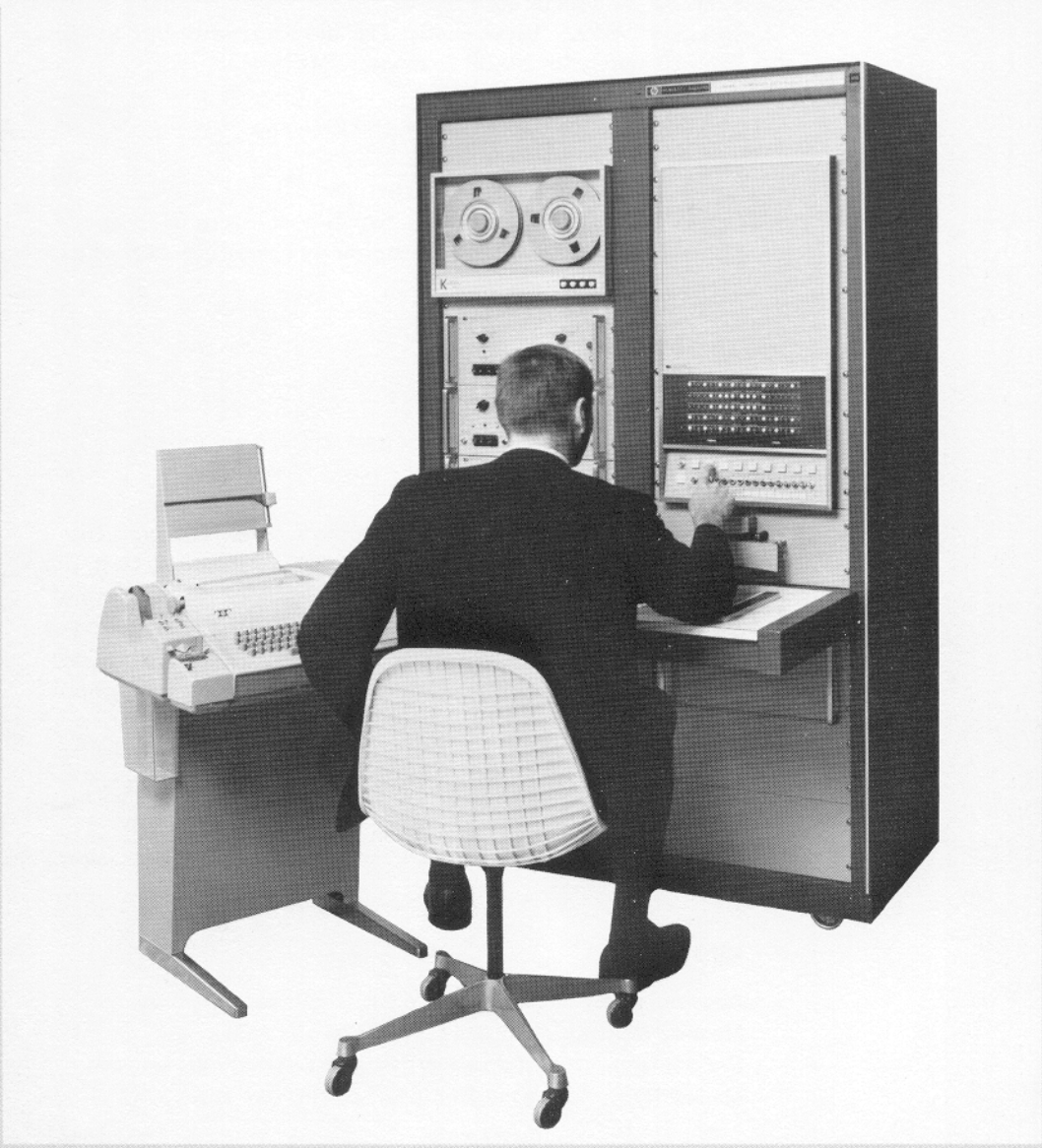
- Magnetic core storage
- 16-bit word size – 17th bit accessible by plug-in Parity option
- Capacity of 8192 or (optional) 16,384 words, externally expandable to 24,576 or 32,768 words
- Memory cycle time 1.6 microseconds
- Protected 64-word block for stored loader
- Large 1024-word page size
- Directly address two pages, indirectly address any page

INPUT/OUTPUT

- 16 internal I/O channels, externally expandable to 48
- All channels buffered and bi-directional
- Multilevel priority interrupt for device servicing
- Peripherals interfaced simply with plug-in cards
- 2 optional high-speed Direct Memory Access channels
- Interface cards for Hewlett-Packard digital instruments
- General Purpose interface cards for user's devices
- Peripherals include Magnetic Tape, Disc, Card Reader, Line Printer

SOFTWARE

- FORTRAN, ALGOL and BASIC compilers
- Basic Control System (BCS) for I/O flexibility
- Modular I/O drivers – for device-independent programming
- Linking/Relocating Loader – links programs at load time
- Two-pass Extended Assembler – selectable absolute or relocatable code
- Modular Debug package – for on-line program debugging
- FORTRAN library accessible at compiler or assembly level
- Utility programs – Symbolic Editor, Prepare BCS, Diagnostics



The HP 2116B is a stored-program, digital computer for general-purpose scientific computation. A high-speed core memory, expandable to 32K in 8K modules, combined with a convenient 16-bit word length, render the 2116B a suitable machine for the serious computer user. Its input/output structure has been designed to allow simple integration into systems. Features such as standard plug-in interfaces for peripheral devices and multilevel priority interrupt for each channel, enable the user to easily assemble a system around the HP 2116B to suit his particular application.

An outstanding software capability is available to the 2116B user. It includes compilers for three high-level languages – FORTRAN, ALGOL, and Conversational BASIC (a language so close to English it can be learned in three to four hours). HP 2116B software also includes sophisticated executive programs to operate data acquisition systems in real time, to permit simultaneous (time-shared) access to the 2116B by up to 16 users, and to allow operation of the 2116B in a multiprogramming environment, concurrently running real-time foreground programs and background programs.

SPECIFICATIONS

MEMORY

Type: Magnetic core
Size: 8192 16-bit words (16,384 words with Option 05)
Total memory with 2150B Extender: 24K or 32K
Page Size: 1024 words
Direct Addressing: Current page and Base page
Indirect Addressing: All pages
Speed: 1.6 microsecond cycle time
Loader Protection: "Protected" switch disables last 64 locations
Memory Parity Check: 1 card, constantly checks accuracy of transferred words

ARITHMETIC

Parallel, two's complement binary

COMPUTE SPEED

	Microseconds	With Extended Arithmetic Unit	
Add	3.2	3.2	(1 instruction)
Subtract	4.8	4.8	(2 instructions)
Multiply	150*	19.2	(1 instruction)
Divide	200*	20.8	(1 instruction)
Floating Point Add	700*	700*	
Floating Point Subtract	700*	700*	
Floating Point Multiply	900*	344*	
Floating Point Divide	1100*	448*	

*Subroutine — time approximate

REGISTERS

Accumulators: Two (A and B), 16 bits each
Memory Control: Three (T, P, M), 16 bits each
Supplementary: Two (Overflow and Extend), one bit each
Manual Data: One 16-bit Switch Register

INSTRUCTIONS

Memory Reference	(2-cycle):	14
Register Reference	(1-cycle, microprogrammable):	43
Input/Output:		13
Total:		70

INPUT/OUTPUT

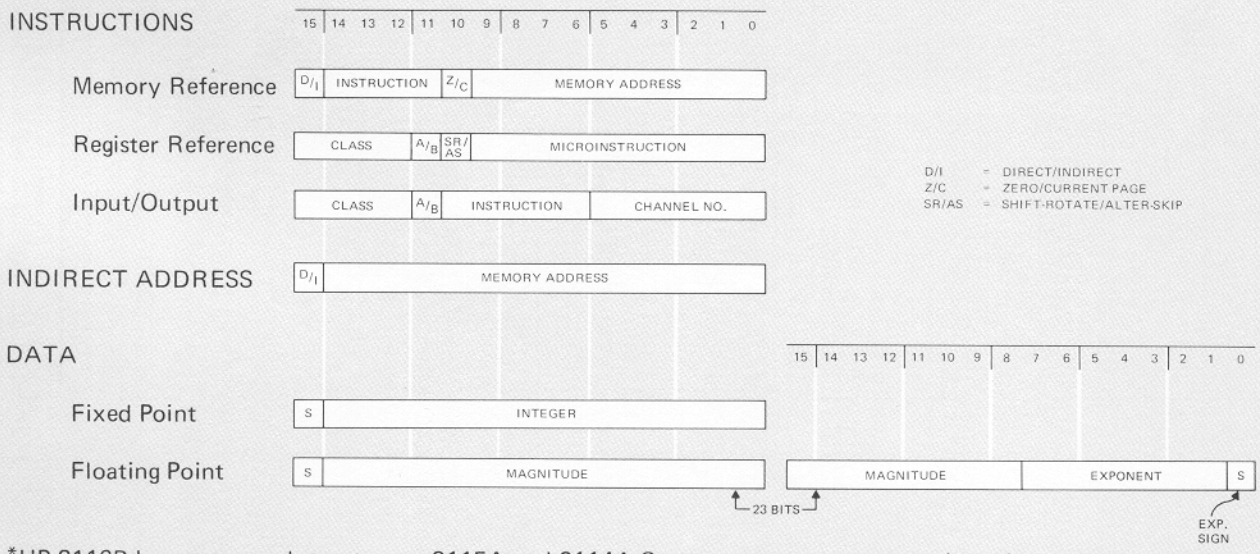
Number of channels in basic 2116B: 16
Total channels with HP 2150B Extender: 48
Channel capacity: 16 bits, parallel transfer
Service method: priority interrupt hardware, standard
Priority assignment: by slot position of interface card

high speed and easy-to-use input/output.

DATA FORM

Punched Tape: 1-inch, 8-level ASCII code. Parity not used.
Magnetic Tape: 7-channel NRZI, IBM-compatible. 1/2 inch.

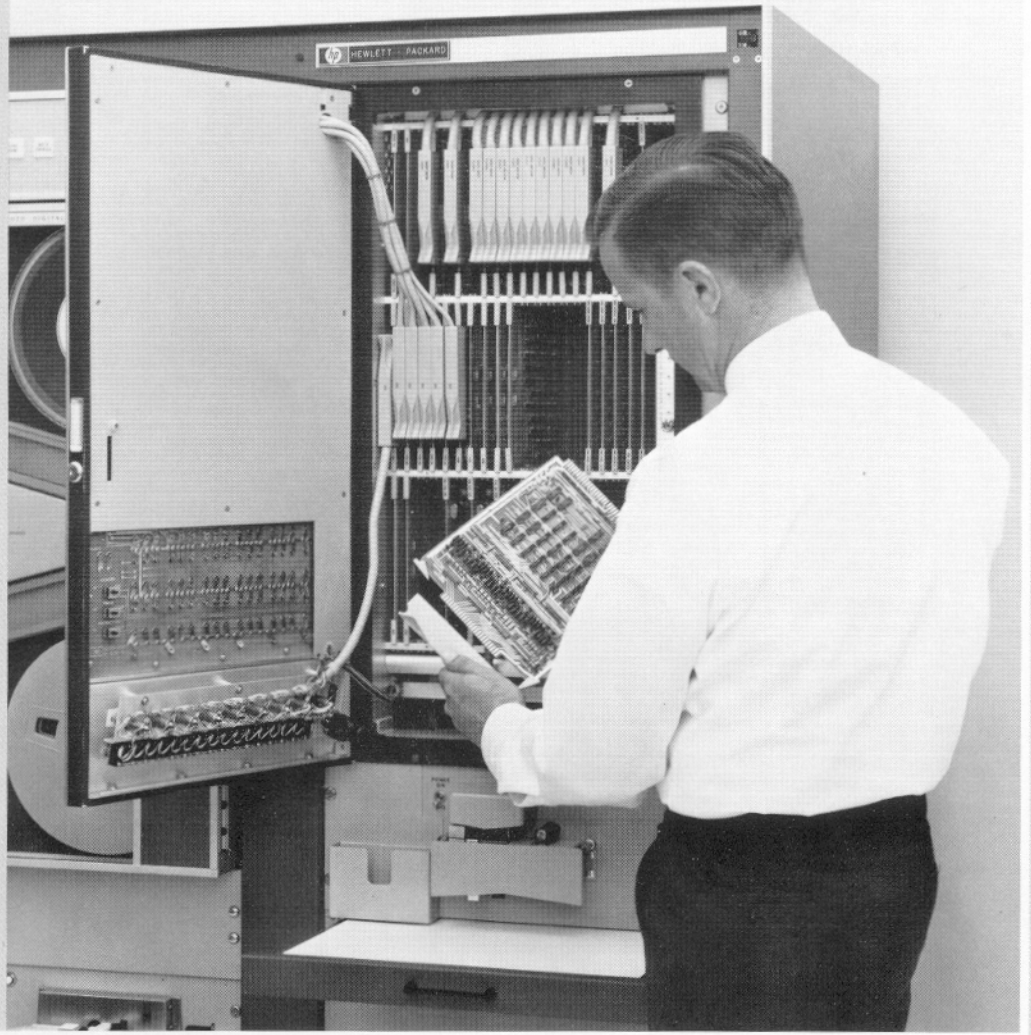
WORD FORMATS*



D/I = DIRECT/INDIRECT
Z/C = ZERO/CURRENT PAGE
SR/AS = SHIFT-ROTATE/ALTER-SKIP

*HP 2116B has same word structure as 2115A and 2114A Computers, so programs are interchangeable

multilevel priority interrupt. Priorities can be



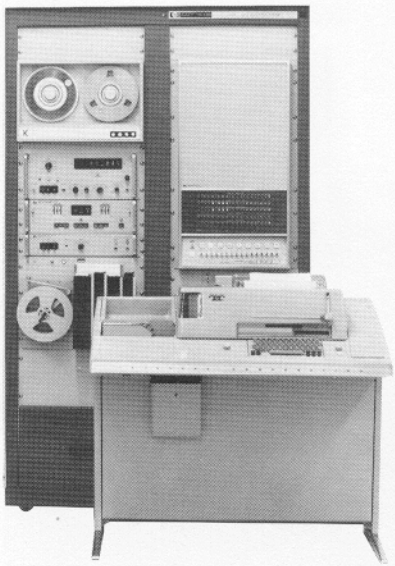
I/O interface cards can be installed or moved (to reassign service priority) simply by swinging open the HP 2116B front panel.

The HP 2116B is designed for application
(We also make smaller computers

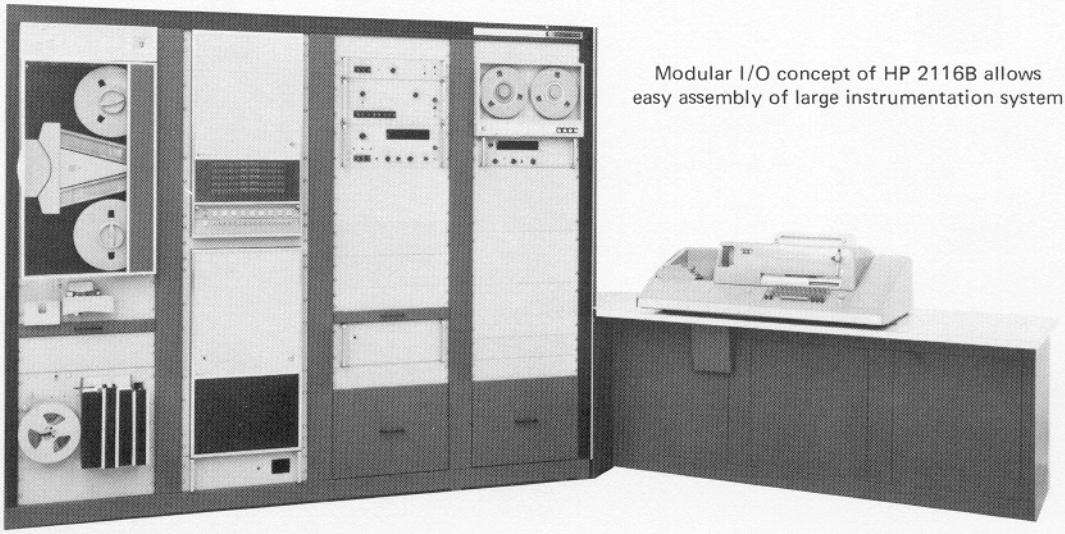
Memory capacity, speed and input/output flexibility of the HP 2116B enable this computer to be used in a wide diversity of computation and control applications. An attempt to categorize applications would only restrict its real utility. The 2116B applications described here may at least convey some idea of the range of tasks to which this versatile, powerful machine can be put.

DATA ACQUISITION AND INSTRUMENTATION

Data acquisition/instrumentation covers the gamut of on-line data gathering/reduction applications, including (to name but a few): laboratory data analysis, engine testing, missile tracking, navigation, and process monitoring. The putting-together of instrumentation systems to solve specific measurement problems is made easier because the 2116B computer can be used, through standard interfaces, with Hewlett-Packard measuring instruments which cover all branches of electronics, and reach also into chemical, nuclear and medical analysis. Additionally, standard "general-purpose" interfaces are availably for peripheral devices the customer may have purchased elsewhere, or invented himself.



The system shown at right is a standard data acquisition system (HP 2018A) available from Hewlett-Packard for automatic measurement and reduction of voltages, resistances and frequencies sampled directly, or transduced from physical parameters. One of the features of the Data Acquisition Executive software furnished with this system is that the operator can change signals to be measured, frequency of sampling, computation constants, etc., directly through a keyboard without recompiling the test program. The basic structure of this system can readily be expanded to satisfy different or more demanding situations; the modular hardware/software concept behind the HP 2116B makes this both easy and inexpensive. The system shown below, for instance, is a large system utilizing the HP 2150B Extender (mounted below the computer) for added input/output capacity.



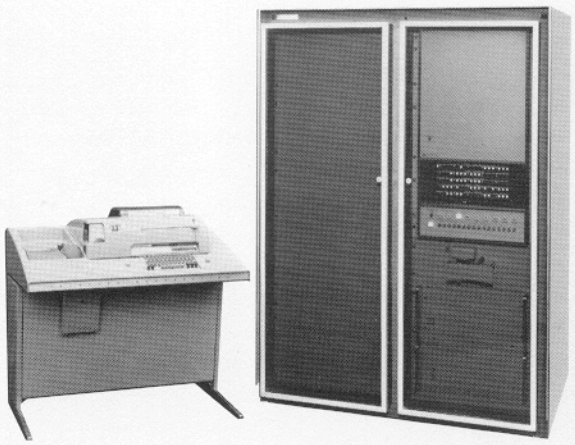
Modular I/O concept of HP 2116B allows easy assembly of large instrumentation system

requiring a powerful, versatile computer.
2115A and 2114A — for smaller jobs.)

TIME SHARING

The HP 2116B Computer, combined with disc memory and control teleprinter, is available as a 16-terminal time-sharing system (HP 2000A) operating in Conversational BASIC. Terminals can be cabled directly to the system (saving telephone charges) or connected via Dataphones. With telephone access any number of terminals can be used, with up to 16 serviced simultaneously. The system may also be operated off line with other peripherals in FORTRAN, ALGOL or Assembly language.

The 2000A time-shared system forms a much lower cost alternate for commercial time-sharing services, the equipment costs of which are so high as to discourage private ownership. HP 2000A systems are also used for general-purpose engineering computation and for teaching the use of computers in colleges and high-schools.



PRODUCTION TESTING

With the rapid increase in quantity and complexity of all kinds of electronic devices manufactured today, the demands of production check-out are outrunning the capabilities of manual testing. The solution lies in computer-controlled test systems. Hewlett-Packard offers such a system (HP 2060) built around the HP 2116B computer, for rapid testing of circuit boards and other logic modules. Production personnel can quickly sort boards for logic faults, working from load-and-go test tapes. Production technicians can also use the system to locate faults on rejected boards. Besides the obvious economy of such a system, it prevents the formation of testing bottlenecks which can strangle production.

MULTIPROGRAMMING

The full power of the HP 2116B Computer is realizable with the Real-Time Executive software system. In this application the HP 2116B is used in conjunction with disc memory and other peripherals to provide real-time execution of core and disc resident programs concurrently with background programs stored on disc or paper tape. Programs may be in (real-time) FORTRAN or Assembly language. Multipriority scheduling of all programs and disc swapping of real-time programs make this an extremely flexible system. Re-entrant library routines and I/O drivers add to the efficiency of the system.

The HP 2116B is self-contained, with front-panel access to all major circuits.

PHYSICAL SPECIFICATIONS

VENTILATION

Intake on sides and back at bottom, exhaust at top. Air flow 600 cfm. Heat dissipation 5500 BTU/hr.

INSTALLATION

For use on bench, or mounted in standard 19-inch rack, using adapters furnished (panel height 31-1/2 inches). Requires no special wiring, subflooring, or other special installation preparations.

WEIGHT

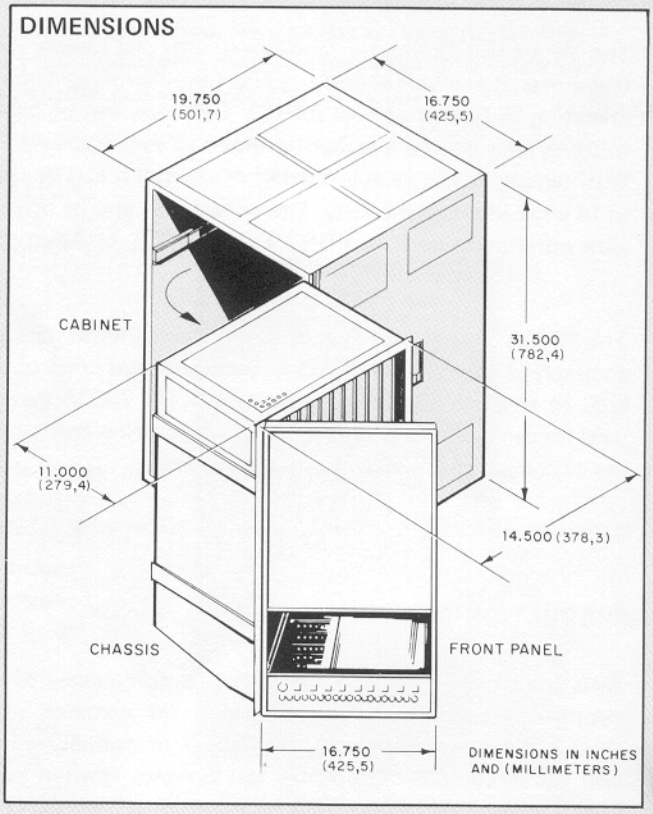
Net 230 lb (104 kg)
Shipping 330 lb (150 kg)

POWER REQUIRED

Source: 115/230V ±10%, 50 to 60 Hz
Consumption: 1000W min to 1600W max, depending on number of I/O interfaces installed.

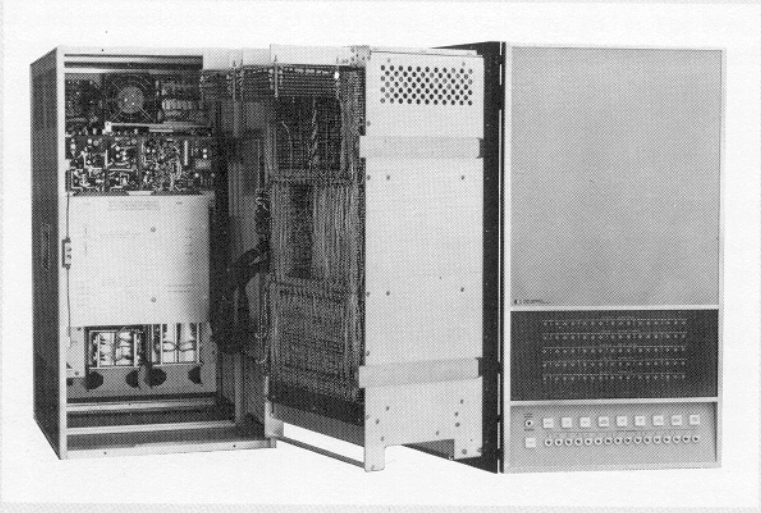
ENVIRONMENTAL CONDITIONS

From 0° to +55°C (+32° to +131°F)
Relative humidity to 95% at 40°C



CABINETS

Single, dual and triple bay cabinets are available for rack-mounting the HP 2116B Computer, and peripherals. Cabinets include: power strip, switch and indicator lamp, power cord, caster base, fan and filter, instrument mounting rails, and blank panels for unoccupied panel space. Optional drawers and fixed and slide-out shelves may also be included. Ask for the 2940A Series data sheet, for cabinet ordering information.



SERVICE ACCESS

Front panel hinged at left side, permitting front access to input/output connectors, test switches, plug-in circuit boards, and panel wiring. Main chassis slides forward out of cabinet and swings to right. Permits front access to backplane wiring, power supply, fuses, and 115/230V jumpers.