The 11/23s
Microcomputers with mid-range mini performance
The 11/23

More choices than ever before
As a leader in the microcomputer industry, we know from experience that good designers want choices. The more the better. That’s why Digital has introduced a whole new series of microcomputer products. A series that gives you far more choice than you’ve ever had before from any microcomputer manufacturer:
- A choice of processors
- A choice of proven operating systems and high-level languages representing hundreds of man years of development
- A choice of functionality
- A choice of board or box configurations
- A broader choice of options
- And, of course, a choice of price

More performance than ever before
Chances are, you’ve already met our LSI-11 family of microcomputers. Our standard-setting LSI-11/2 and complementary 11/03 appeared in 1977. Now we want you to meet the next generation: our 16-bit, board-level LSI-11/23 and its boxed configuration, the PDP-11/23. Nine board-level models. Two box versions. All compatible with our earlier LSI-11s and PDP-11/03s.

Like our earlier microcomputers, the new “11/23s” employ space-saving double-height boards. But there the resemblance ends. The 11/23s offer features and performance found in our best selling mid-range minicomputer.

Imagine. Microcomputers with the power of a mid-range mini.

And imagine the benefits to you. Now you can provide application capabilities no other microcomputer offers. Capabilities that include sophisticated memory management with relocation, segmentation and protection; up to 256K bytes of addressing; 46 floating point and math instructions; our industry-standard LSI-11 Bus; a host of options; and software that gives you a choice of proven single-user or multi-user operating systems for application development and application environments.

Your choices
No single microcomputer can satisfy all design requirements. So Digital gives you a range of choices no other manufacturer can match. A range that includes:
- Field-proven LSI-11/2s and PDP-11/03s for price-sensitive applications
- LSI-11/23s and PDP-11/23s for applications where performance is paramount
- LSI-11/23s and PDP-11/23s, plus software, for applications requiring a performance-critical “hardware/software” solution.
For the price-sensitive
Where applications call for economy-minded microcomputer performance, we offer our time-tested LSI-11/2 and PDP-11/03, plus a new "multifunction," double-height module available in two configurations. Both configurations contain all of the elements (except CPU) required to implement a small system: 8K or 32K bytes of RAM, sockets for a boot or 8K bytes of PROM, two serial I/O ports, and a 60Hz crystal clock.

For paramount performance
For applications that require a high-performance processor, large memory, plus adaptability to your hardware and software, we offer four board-level models of the 11/23. They range from a 2-board system with 64K bytes of RAM (without memory management) to 3-, 4-, and 5-board systems (each with memory management), with 128K, 192K, and 256K bytes of RAM, respectively.

For performance-critical hardware/software solutions
Where high performance and software are required, we offer a choice of three board-level 11/23s, along with a software license to copy either our single-user RT-11 or multiuser, multitask, memory-only RSX-11S operating systems. Each model includes the processor module and memory management unit, multifunction module, 96K, 160K, or 224K bytes of RAM.

And for customers who prefer high performance in boxed versions of the 11/23, Digital offers two packages which include the LSI-11/23 microprocessor module, either 128K or 256K bytes of MOS memory, bootstrap/diagnostics/terminator and ROM module, 4-line EIA serial interface module, and an attractively designed box containing 9 module slots, power supply and input panel. Single-user RT-11 and multiuser, multitask RSX-11M and RSX-11S are optionally available with these packages.

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A peerless processor

Like its LSI-11/2 and PDP-11/03 companions, the new 11/23 utilizes space-saving double-height boards only 5.2 by 8.9 inches (13.2 by 22.8 cm). The 16-bit processor module contains the processor package, a superset of our original LSI-11 Bus interface, a socket for our memory management unit, and accessory sockets for options such as our floating point instruction set. Combining the performance of a mid-range mini with the form of a microprocessor, the 11/23 offers you the following features:

Instruction set
- Over 400 instructions
- PDP-11 Extended Instruction Set (standard)
- Up to 256K bytes of addressing, with memory management (including relocation, segmentation and protection)
- Floating point microcode option with 46 instructions (32-bit single and 64-bit double precision, 7 and 17 digit decimal accuracy)
- 12 address modes
- Compatibility with other PDP-11 family computers

Processor and Bus Architecture
- Program execution 2.5 times faster than LSI-11/2 and PDP-11/03
- Asynchronous bus operation
- Direct memory access
- Provision in processor and bus for user implementation of 4-level vectored interrupts and parity
- Standard microcode for power fail/auto restart, 4 power-up modes, and Octal Debugging Technique
- 8 general registers

Processor component functions

Data and control chips
Heart of the 11/23 processor consists of two chips on a dual-carrier package, the Data Chip and the Control Chip. The Data Chip includes the PDP-11 registers, temporary storage registers, Processor Status Word, the Arithmetic and Logic Unit, and conditional branching logic.
It performs all arithmetic and logic functions, handles all data and address transfers with the LSI-11 Bus (except relocation), and operates most of the signals used for interchip communication and external system control. The Control Chip contains microprogram sequence logic and 552 words of microprogram storage, plus Programmable Logic Arrays.

**Microinstruction and data address line buses**

A 16-bit Microinstruction Bus internal to the processor board provides communication and control between the Data and Control Chips (and, when present, the Memory Management Unit and the Floating Point Unit). The 16-bit, time-multiplexed Data Address Line Bus transfers data between the chips and to and from the processor and LSI-11 Bus. This internal bus also connects to interface logic, which allows the processor to communicate with a standard LSI-11 Bus.

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**Memory Management Unit**

- User and system software modes
- Extended physical addressing up to 256K bytes
- Memory relocation, segmentation, and protection

For 11/23 models with more than 64K bytes of memory, the Memory Management Unit (MMU) is supplied. It performs two basic functions: It handles memory management—including relocation, segmentation, and protection—and it contains the floating point accumulators and status registers for the floating point option.

In its memory management role, the MMU enables the 16-bit machine to provide 18-bit capability for a four-fold extension of addressable memory. Programs operating in systems with memory management continue to work in a compatible fashion with non-MMU systems having 64K bytes of virtual address space available. The virtual address space is segmented into 8 ranges of 8K byte addresses, each of which is separately relocatable up to 256K bytes of physical memory. This segmented approach facilitates shared sections of program and data, thus conserving memory space and simplifying the programming of large memory applications.

The MMU is designed for a multiprogramming environment, enabling the processor to operate in either a kernel or user mode. In the kernel mode, programs have complete control and can execute all instructions. In the user mode, programs are prevented from executing instructions that could modify a kernel program, halt the computer, or use memory space assigned to the kernel or to other users.

Because several programs can reside in physical memory simultaneously, access to these programs and the memory space they occupy must be strictly defined and controlled. Consequently, the MMU provides the following types of protection: control of space allocated to a given program, safeguard against modification of common subroutines and algorithms, prevention of control or modification of operating system software, and prevention of access to or modification of memory occupied by other user programs. Each of these forms of access protection can be assigned on a per segment basis.

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**Floating point processor**

- 46 floating point and data conversion instructions
- Execution speed 5 to 10 times faster than equivalent software routines
- Single-precision (7 decimal digit), double-precision (17 decimal digit) floating point numbers
• Single-precision 16-bit or double-precision 32-bit integers
• Allows programs to be generated using FORTRAN IV-PLUS (with the minicomputer industry’s leading FORTRAN compiler)

Our floating point capability is an option for the 11/23. It is completely compatible with our PDP-11/34 floating point processor (FP-11A), offers both single and double precision, and includes features such as floating to integer and integer to floating conversion. The microcode to implement this option resides in two chips on one 40-pin package. The MMU is required to support the floating point option since it contains all of the floating point accumulators and status registers.

**Instruction set**

The 11/23 instruction set is an implementation of the PDP-11 set. This enables users to take advantage of Digital’s ten years of experience with the PDP-11 family, including all associated application notes, software, documentation and training programs. The instruction complement uses the flexibility of general-purpose registers to provide more than 400 powerful instructions.

The instruction set includes both single and double operand instructions. Each instruction can equally access operands located in processor registers, in memory locations, or in I/O interface registers. Frequently, a single powerful PDP-11 family instruction can perform a function that requires several instructions to implement on other less powerful microcomputers.

The 11/23 instructions allow byte and word operand addressing. This saves memory space and simplifies the implementation of control and communication applications. Bit and multiple word operands (including floating point) are also supported by the PDP-11 family instruction set. And the set contains a full complement of conditional branches for signed and unsigned operands, eliminating excessive use of jump instructions.

**Extended instruction set (EIS)**

Standard with the 11/23 instruction set is an extended instruction set which gives the capability of performing hardware integer multiply and divide, and which allows direct implementation of multiple shifting.

**Operand addressing**

Much of the power of the 11/23 is derived from its wide range of addressing capabilities. The PDP-11 address modes include register addressing, auto-increment or auto-decrement stack or table addressing, and index addressing. All four primary addressing modes can be either direct or deferred. Four additional address modes using the program counter give immediate, absolute, relative, and relative deferred capability. In all, there are 12 address modes for accessing either word or byte operands. But even more important is the fact that these address modes are completely and consistently applied to the instruction set. Nearly all of the instructions can use any of the address modes.

**LSI-11 Bus**

Virtually an industry standard because of its simplicity and ease of interfacing, the LSI-11 Bus is compatible with the 11/23 as well as most earlier LSI-11 and PDP-11/03 options. It handles all communication between modules and connects the memory and I/O interface elements to the central processor. Because the communication is asynchronous, the addressed modules are not performance-limited by the operating speed of other devices on the Bus. Instead, each operates at its own speed, enabling better overall system performance and migration.

During operation, address and data information are time-multiplexed with data on the Bus. The processor first places the address of the desired memory location or I/O interface register on the Bus, followed by control signals which indicate that the address is valid. Since the Bus is bidirectional, additional control signals are used to indicate the direction of data flow. The addressed module interprets these signals and responds by either accepting data from the processor, or transmitting data to it.

The Bus provides a fully vectored, prioritized interrupt scheme, with nearly an unlimited number of independent interrupts in a system. Every interrupt stimulus can have its own vector and interrupt service routine, eliminating the need to poll I/O devices to find the source of the interrupt. Priority is determined by a device's position on the Bus. That is, the closer a device is electrically to the processor, the higher its priority. The processor can enable or
disable all interrupts in the system, or it can enable or disable interrupts for a particular device through individual control and status registers.

If faster data transfer is required, the I/O interface module may use standard Direct Memory Access (DMA) techniques. Here, the I/O device interface actually controls the Bus address and control signals in exactly the same way as the processor. DMA offers two primary advantages: speed of transfer and low processor overhead.

Interfacing to the LSI-11 Bus for both program transfer and DMA is simplified through the use of interface chip kits. These kits contain custom integrated circuits designed by Digital specifically for the LSI-11 Bus. In addition to simplifying the interfacing, the kits make it possible to implement interfaces in minimal board area, leaving more space for application-specific logic.

Octal debugging technique

Program debugging is normally accomplished at the computer console. But while convenient, such a console is frequently impractical in many applications. For that reason, Digital has developed an Octal Debugging Tech-

ique (ODT) which can be implemented from either a local or remote terminal. ODT exists in the 11/23 as a portion of the processor microcode which allows the processor to respond to commands and information entered via the terminal. The communication itself is a stream of ASCII characters interpreted by the processor as console commands. In addition to running and debugging programs, ODT can also be used for remote control and/or loading of 11/23 systems.

Power fail/auto restart

Power failure is one of several conditions which can cause the CPU to trap to a set of fixed locations. Whenever power sequencing signals indicate an impending ac power loss, a micro-coded power-fail sequence is initiated. The microprocessor then traps to a defined location to execute a user's power-down routine and an orderly system shut-down. Jumper-selectable restart is possible through a power-up vector, standard or user-defined bootstrap location, ODT, or user microcode.
Super software

Digital software for the 11/23 is complete, proven, available, and warranted for 90 days. It facilitates development, and it also provides an environment for application software in target applications. The range of software now offered for the 11/23 was previously available only for larger minicomputers.

Here are your choices:

**RSX-11M operating system**

- Multiuser
- Multitasking
- Checkpointing
- File protection
- Mass storage-based
- File storage and retrieval
- Device independence

The 11/23 with hard-disk storage supports one of the most powerful software tools available—our RSX-11M operating system, backed by 300 man years of programming. Its memory management features complement those of the 11/23 hardware, providing a development or application tool no other microcomputer manufacturer can match. It supports a variety of high-level languages, including FORTRAN IV, FORTRAN IV-PLUS, BASIC and BASIC-PLUS-2, and it enables a number of programmers to share the 11/23 simultaneously with complete protection while developing and debugging their programs.

**RSX-11S operating system**

- Memory-based
- Multitasking
- Subset of RSX-11M

As the smallest member of the RSX-11 family of real-time, multitasking operating systems, RSX-11S provides a dedicated, execute-only environment for monitoring and controlling many real-time processes concurrently. It is implemented as a memory-based, compatible subset of RSX-11M and, thus, is not dependent on any mass storage device for execution. RSX-11S system generation and program development take place on a host RSX-11M system.

**RT-11 operating system**

**Features**
- Real-time support
- Foreground/background execution program
- Supports 256K bytes of main memory
- Supports two concurrent tasks
- Mass storage-based
- Easy-to-use command language
- Powerful editor
- Debugging facilities

RT-11 is Digital's single-user, foreground/background operating system. Like RSX-11M, it supports a variety of high-level languages, offers a very “approachable” command language, and supports a wide range of peripherals, including our RL01 cartridge disk, RX02 floppy disk, and TU58 (DECTAPE II) magtape mass storage devices. Fully interrupt-driven, overlapped input/output provide fast program execution. Simultaneous execution of foreground/background tasks optimizes system capabilities. And a nested “command file” execution allows frequently used groups of system commands to be stored and recalled for execution with one simple command.

**Languages**

Among the many languages offered by Digital for use with the 11/23 are a MACRO assembler, FORTRAN IV, FORTRAN IV-PLUS, BASIC, BASIC-PLUS-2, APL, and FOCAL.

**Communications software**

For applications requiring a communications capability, we offer a broad range of software products which includes DECnet Phase II for networking, 2780 emulation, and multiplexing capability.

**Software development hardware**

Any PDP-11 system that includes memory management can be used to develop software for the 11/23. The PDP-11/03 packaged systems use the same LSI-11 Bus as the 11/23, thus facilitating hardware development as well as RT-11 software development within 56K byte limits. For RSX-11M software development, as well as RT-11 development up to 248K bytes, the PDP-11/34 packaged systems should be considered.
11/23 options

A great many options are available for use with the 11/23. They are also compatible with earlier LSI-11 and PDP-11/03 microcomputers.

Mounting box (BA11N)*

The mounting box provided with the 11/23 is designed to serve as either a mounting or expander box for LSI-11 Bus systems. The box includes a backplane assembly, power supply and ac input panel. The backplane assembly consists of a backplane card frame and two cooling fans. The frame will accept nine double-height or quad-height modules. To facilitate access to the module slots, the entire assembly can be easily removed from the mounting box through an access door equipped with strain reliefs for the LSI-11 Bus and communications cables.

Memory module (MSV11-DD)*

The 11/23 system memory consists of dynamic MOS/RAM modules (64K bytes each) that can be installed in any LSI-11 Bus. On-board memory refresh is provided, eliminating the need for refresh signals on the Bus and enhancing performance. System memory address space to which the module will respond is user-configured via jumpers contained on each module. An address can start at any 8K byte bank boundary ranging through the 0 to 256K byte address space. Typical access time is 210ns.

4-channel asynchronous serial interface (DLV11-J)*

The 4-channel asynchronous serial interface is used to interface peripheral equipment to the LSI-11 Bus. It transmits and receives data from the peripheral device over RS423 and RS422 (compatible with RS-232C) “data leads only” lines. The module can be used with 20mA current loop devices when a DLV11-KA option is installed. With this interface, the processor can communicate with a local terminal (such as a console teleprinter), a remote terminal (via data sets and private lines), or another local or remote processor. All four channels can be configured for independent, crystal-controlled baud rates over a range of 150 to 38.4K bits per second. Character formats include 7 or 8 data bits, 1 or 2 stop bits, parity or no parity, and even or odd parity.

Diagnostics/bootstrap/terminator module (BDV11)*

The module is a quad-height board that includes 4K bytes of ROM which contain the diagnostics for the processor, memory, and serial line unit. The desired diagnostics are selected by setting switches on the module. A “loop on test” switch also allows repeated execution of a particular diagnostic to aid in fault isolation. The module’s bootstrap programs can be used to boot LSI-11 compatible peripherals.

This module also can be used to load up to 32K bytes of user program automatically on power-up. The user program is stored in ROM

*Standard components for the PDP-11/23 boxed systems.
or EPROM chips on the board. Space is allocated for up to 4K bytes of 2708 EPROM chips and up to 32K bytes of 8316E ROM chips or 2716 EPROM chips. Loading of the program from these ROMs is selected by means of a switch on the module. The module also terminates bus signals.

**Multifunction module (MXV11)**

The multifunction module is a double-height board designed for use with LSI-11 family microprocessors. In conjunction with the processor module it provides all of the elements necessary to implement a small system, thus reducing the size, power consumption, cost and complexity of such systems. Available with either 8K or 32K bytes of RAM, the module also includes a 60Hz crystal clock, two independently configurable asynchronous serial line units with baud rates from 150 to 38.4 bits per second (RS-423 standard, backward compatible with RS-232C), and sockets for two 5V 24-pin UVPROM or fusible-link PROM chips. For small data processing applications, an optional boot (MXV11-A2) is available which plugs into the PROM sockets, and which can be used with either our TU58 magtape or a compatible disk mass storage subsystem. User-installed, these chips also provide limited diagnostics.

**LSI-11 bootstrap/diagnostic chip set (MXV11-A2)**

The bootstrap chip set option is available for use with the multifunction module described above. It provides automatic diagnostic and program loading capability, and accommodates serial interface versions of the TU58 magtape storage device as well as the RX01 and RX02 floppy disk and RL01 top-loading cartridge disk storage subsystem.

**EPROM/PROM/ROM module (MRV11-C)**

The MRV11-C is a double-height, high-density ROM module for the LSI-11 Bus. It is fully compatible with Digital’s LSI-11 and 11/23 families of microcomputers. The module contains sixteen 24-pin sockets which accept masked ROMs, fusible-link PROMs and ultra-violet erasible PROMs. In addition, it accepts several densities of ROM chips, up to and including 4K x 8 chips. Using these high-density chips gives the module a total capacity of 64K bytes.

The module can be accessed directly or through window mapping. Direct access provides total random access to all ROM locations on the module. Window mapping provides two 2K byte windows in memory address space to access 2K byte segments of the ROM array. The segments viewed through each window can be varied under program control. In addition to solving a number of PROM application problems, window mapping of ROM modules can be conveniently used to load programs and data into read/write RAM.

**Mass Storage devices**

**DECTAPE II (TU 58)**

DECTAPE II is a low-cost storage device offering random access on block-formatted, pocket-sized cartridge media. Available with one or two tape drives and microprocessor-based controller, it reads and writes in fixed 512-byte blocks at 800 bpi. Read/Write speed is 30 ips, block search speed is 60 ips. Capacity is 256K bytes per drive, two drives per controller maximum.

**Double-density floppy disk subsystem (RX02)**

The RX02 is a low-cost floppy disk subsystem with two drives which provide a total on-line storage capacity of 512K bytes in industry-standard format. Average seek time is 180ms, the peak data transfer rate is 31K bytes per second. Built-in features provide high reliability.

**Cartridge disk subsystem (RL01)**

The RL01 is a 5.2M byte, top-loading cartridge disk subsystem that can be expanded to 20.8M bytes. Simplicity of electrical and mechanical design combine to provide very high reliability. Average seek time is 55 ms, peak data transfer rate is 512.5K bytes per second. Four drives per controller maximum.
Accessories

Backplane/card guide assemblies (H9270, H9281)

These assemblies contain the LSI-11 Bus in a convenient package. All Bus data, control and power connections are prewired on the printed circuit backplane to each module location. The H9270 backplanes can be used for either single or quad-height modules, accommodating 8 of the former or 4 of the latter. The H9270 backplane can be connected to provide more module space. The H9281 backplane accepts only double-height modules and is available in configurations for 4, 8, and 12 module slots.

Mounting chassis/power supply (BA11-VA)

A mounting chassis is available which provides a low-cost mounting enclosure which can be used as a tabletop unit or attached to any flat surface. The chassis includes a 4-slot H9281 backplane and a power supply adjustable via switches for operation anywhere in the world.

Universal PROM programmer (PB11)

The universal PROM programmer is a complete hardware/software solution to PROM programming requirements. It consists of a tabletop PROM programming unit able to accept a number of adapter modules, making it possible to program a variety of PROM chips. It connects via serial line to a development system, thus avoiding the need to create a program on one system and then physically transfer it to another. Also, the software enables PROM blasting without the need for programmer interaction.

These additional options are also available:

PROM/RAM modules
8K byte fusible-link PROM (MRV11-AA)
8K byte erasable UV PROM/512 byte RAM (MRV11-BA)

Communications interfaces
Single-line serial interface with modem control (DLV11-E)
Single-line serial interface (DLV11-F)
4-line serial interface multiplexer (DZV11)
Synchronous line interface (DUV11)

I/O interfaces
Parallel line interface (DRV11)
DMA interface (DRV11-B)
IEEE instrument bus interface (IBV11-A)

A/D, D/A converters
A/D converter (ADV11-A)
D/A converter, four-channel (AAV11-A)

Other modules
Programmable real-time clock (KWV11-A)
Interface design CHIPKIT (DCK11-AA)
Specifications

11/23 processor
Dimensions
13.2 cm x 22.8 cm
(5.2 in x 8.9 in)

Power Requirements

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<td>5V ± 5%</td>
<td>2.0 A</td>
<td>3.2 A</td>
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<tr>
<td>12V ± 5%</td>
<td>0.2 A</td>
<td>0.6 A</td>
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Bus Loads
ac 2 unit loads
dc 1 unit load

Environmental

Storage
-40°C to 125°C
10% to 90% relative humidity, noncondensing

Operating
5°C to 60°C, maximum outlet temperature rise of 5°C above 50°C
Derate maximum temperature by 1°C for each 1000 ft. above 8000 ft.
10% to 90% relative humidity, noncondensing

Timing (based on 300ns CPU microcycle time)
Interrupt latency (based on MSV11-DD)
Worst case 55.7 μs (when using EIS instructions)
10.8 μs (when not using EIS instructions)

Typical 6.0 μs
Interrupt service time 8.2 μs
DMA latency (worst case) 3.49 μs

Mounting box (BA11-N)
Dimensions (including bezel)
Width 48.3cm (19 in.)
Height 13.2cm (5.2 in.)

Operating humidity
10 to 95% with a minimum wet bulb temperature of 32°C (90°F) and a minimum dew point of 2°C (36°F)

Cooling
two self-contained fans providing 160 LFPM air flow
Output voltage
5V ± 5%  2-220 A load
12V ± 5%  0-11.0 A load

Output power
240 W
Input voltage
BA11-NC/NE  100-127V rms
BA11-ND/NF  47-63Hz

Input current
BA11-NC/NE  12 A max
BA11-ND/NF  6 A max
Circuit breaker rating
15 A @ 115 Vac or 230 Vac

LSI-11/23 models available (without software)
- 64K bytes of RAM, with no memory management unit, 2 boards (KDF11-HD)
- 128K bytes of RAM, memory management unit, 3 boards (KDF11-HF)
- 192K bytes of RAM, memory management unit, 4 boards (KDF11-HH)
- 256K bytes of RAM, memory management unit, 5 boards (KDF11-HK)

LSI-11/23 models available (including software license)
- 96K bytes of RAM, memory management unit, multi-function module, plus a license to copy our single-user run-time RT-11 or multiuser, multitasking RSX-11S operating systems, 3 boards (KDF11-RE, SE)
- 160K bytes of RAM, memory management unit, multi-function module, and the above software license, 4 boards (KDF11-RG, SG)
- 224K bytes of RAM, memory management unit, multi-function module, and the above software license, 5 boards (KDF11-RJ, SJ)

PDP-11/23 models available
- 128K bytes of RAM, memory management unit, 4-line EIA interface, bootstrap/diagnostics/terminator and user ROM area, 9-slot box (11/23AA, AB)
- All of the above, but with a total of 256K bytes of RAM (11/23AC, AD)
- Optional software: RT-11, RSX-11M and RSX-11S operating systems available as fully supported, on media only, or with a license to copy
Choice: the Digital advantage

Here you have it. A family of complementary microcomputers that offer you more choice for your applications. A choice of processor, a choice of memory, a choice of configuration, a choice of options. And tying it all together, a choice among the richest offering of software for your development or run-time products.

Choice. So you won't have to compromise performance, price or product.

Choice. Backed by the expertise of more than 10,000 field-based specialists worldwide, Digital's 21 years of experience in interactive computing, and nearly 150,000 computer installations.

More information about our microcomputer products can be obtained from any of the Digital sales offices listed on the back cover.
Digital Equipment Corporation
PK3/M-86
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