

# THE PDP-8/A MINIPROCESSOR

digital



We know that you'd like to reach those customers with applications that need the full power of a microprocessor, but can't afford it. And they're attracted by the cost of the microprocessor, but it doesn't offer enough power.

We think that's precisely why you should take a good look at our new PDP-8/A, a radically new computer processor on a single board. It's a full-fledged minicomputer at a microprocessor price. Not only is the price right, but there's also quality and performance. For instance:

**Speed.** We're talking about the basic cycle times that determine data rates and logical manipulation speeds. The PDP-8/A's cycle time is just 1.5 microseconds. That's faster than many traditional minicomputers.

**Reliability.** The PDP-8/A is built from completely standard components whose durability is on the record books. As a member of the PDP-8 family, the 8/A has over 25,000 hard-working relatives all over the world. You can put the PDP-8/A into just about every imaginable nook and cranny, and get results.

**Software.** No token assemblers. Today's main-line minicomputers have high level language operating systems and a complete set of utilities. The PDP-8/A shares the same software as the PDP-8 family (200 programs in the software library alone). That includes the FORTRAN-based OS/8 operating system and the RTS/8 real-time executive.

Computing speed... proven reliability... and the availability of software. At an unbeatable price. The PDP-8/A miniprocessor.

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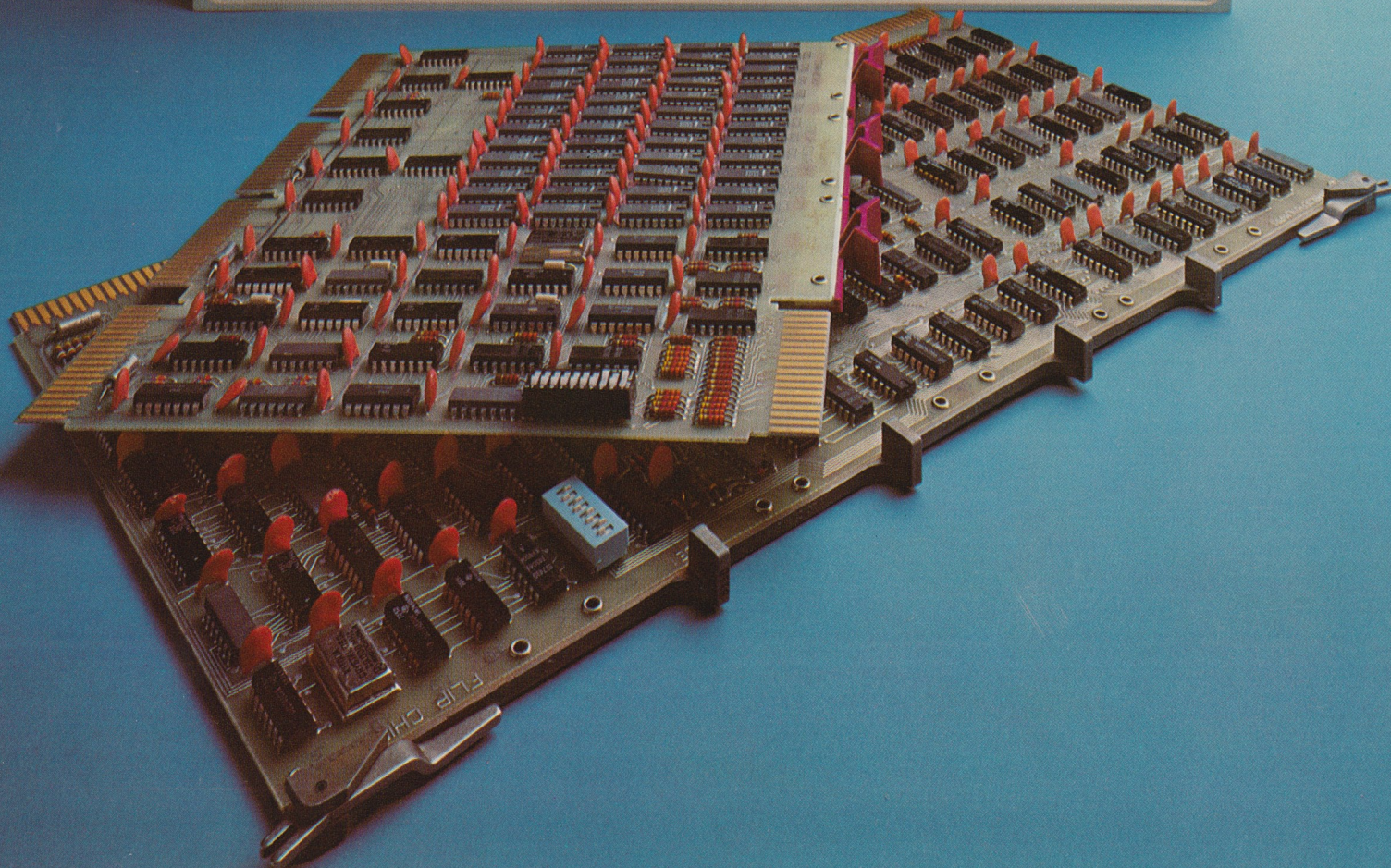
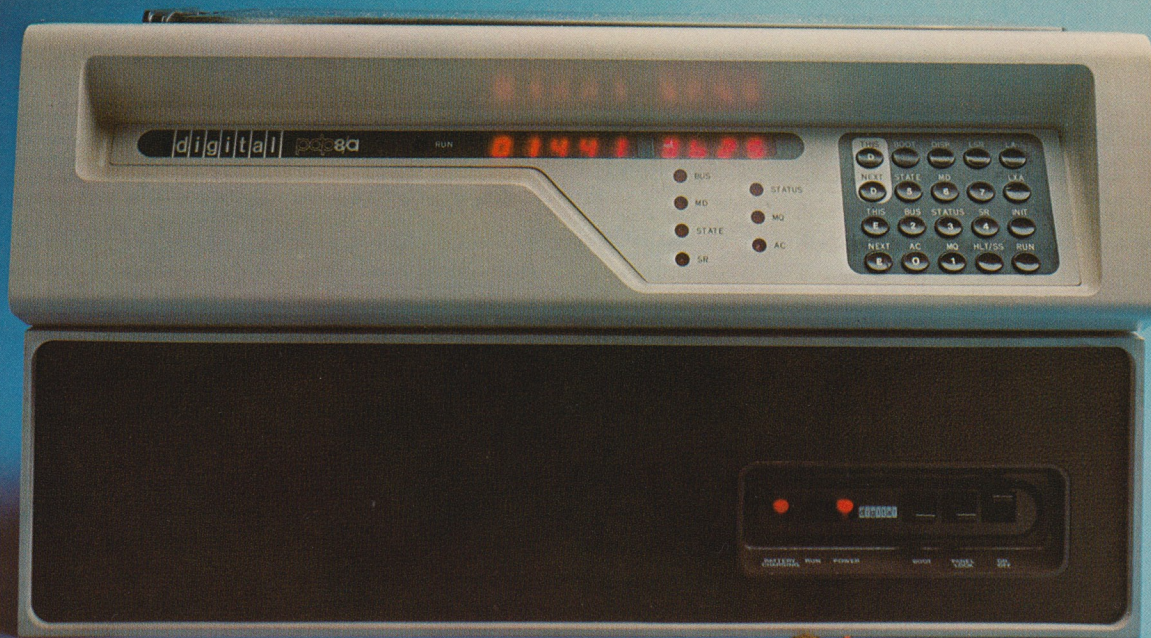
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# THE MINIPROCESSOR

## A FAST AND RELIABLE CPU

We've never sacrificed performance for low price. And we don't start with our PDP-8/A. The central processor cycle time is 1.5  $\mu$ s, with many instructions executing completely in a single cycle (those that directly reference data in memory execute completely in two cycles). This kind of speed means that the PDP-8/A can handle operations that slower microprocessors can't. It can handle more input lines; it can sample data more frequently and, therefore, more accurately. And it can perform extra processing on input data, providing instant error detection and correction.

The circuitry that makes the PDP-8/A fast also makes it reliable. The entire CPU is constructed of proven, reliable, currently-available TTL MSI logic chips. That's important, because no purchase is wise if it entails a struggle with the availability or maintenance of a yet-to-be-proven technology. It all fits neatly on one easy-to-replace module.

## PROVEN CAPABILITY

Will the PDP-8/A do the job...how much memory will it require...what sort of software investment is involved...what kind of an interfacing investment is required? When planning for the use of a computer, these are the kinds of questions that must be answered. The PDP-8/A not only has straightforward answers, but also offers some unique advantages.

The PDP-8/A is completely compatible with the more than 25,000 PDP-8 family computers already at work in locations around the world. Thousands of PDP-8 programs have been written. Thousands of PDP-8 interfaces have been implemented. And thousands of talented people have extended experience with PDP-8s. So when you start with the new PDP-8/A, you're not starting with an unknown.

## EXTENDED PROCESSOR FEATURES

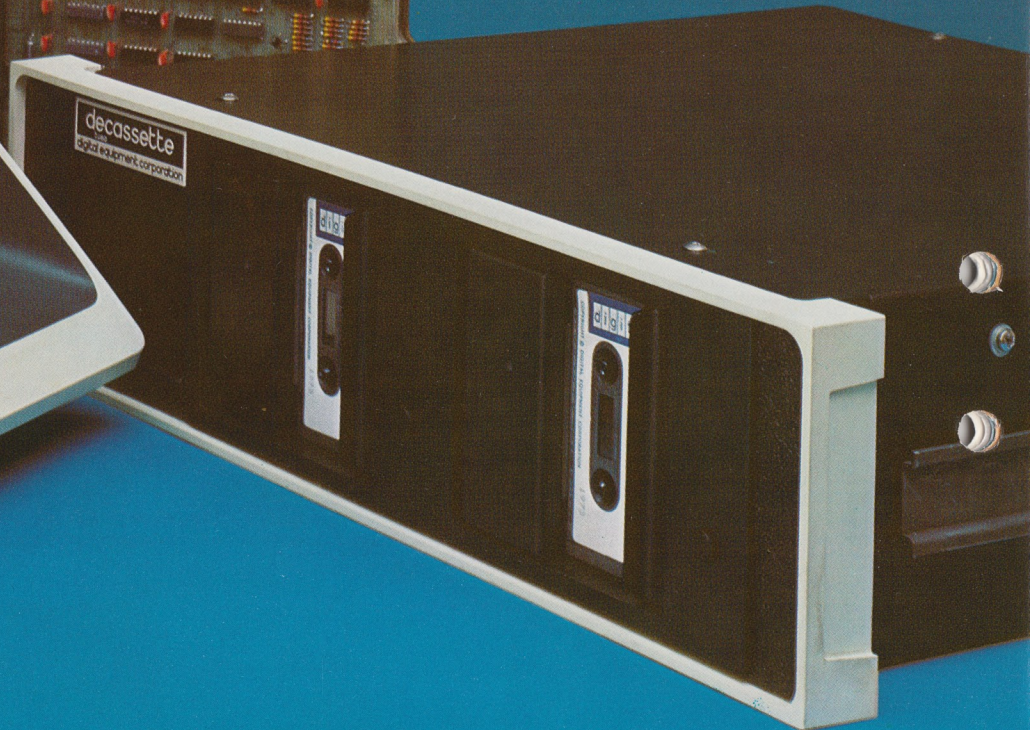
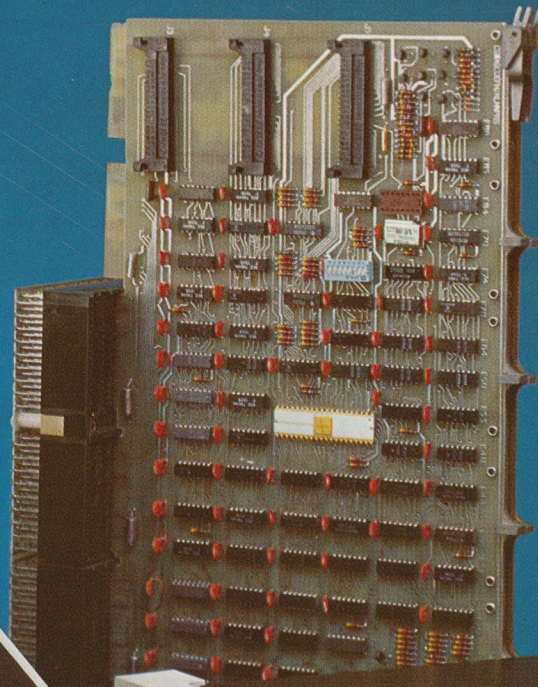
Simple plug-in option modules supply the PDP-8/A with additional capabilities beyond the built-in features of the central processor. The input/output option board (DKC8-AA) provides a serial line interface, a 12-bit parallel interface, a 100 Hz real-time clock, and control logic for the optional programmer's front panel. The serial interface is switch-selectable to any of 8 Baud rates, from 110 to 9600 Baud. The parallel interface includes signalling and interrupt lines to permit control of transfers in either direction.

The extended option board (KM8-A) provides power fail, auto restart, memory extension, and a 128-word ROM bootstrap program to facilitate system restarts. The power failure control interrupts the CPU on an AC power low condition and again on a battery empty condition. In emergency situations, these two flags signal both a change-over to battery power and return to regular power. The memory extension logic permits addressing of memory beyond 4K words. With the memory extension logic, the PDP-8/A can address up to 32K words of memory. The ROM bootstrap program permits reloading and restarting of paper tape and mass storage devices such as DECtape and cassette.

## TWO BASIC CONFIGURATIONS

The PDP-8/A is available either as a module set or as a packaged processor. The module set consists of a CPU module plus a memory module. The packaged processor includes the same CPU module and memory module mounted in a 10" x 10½" x 19" (25.4cm x 26.67cm x 25.4cm) chassis. The chassis includes an 8-slot OMNIBUS for mounting additional options. It also includes a power supply with integral battery backup. This battery provides the backup operation of the CPU and memory from one to seven minutes (depending on the configuration) allowing the system to ride out the transients and cycle dropouts that comprise 95% of all power failures. If the failure is prolonged, the backup operation provides the time for a systematic shutdown.

The front of the chassis contains: the power on/off and restart switches; panel lock switch; indicators for run, power on and battery charging states; plus mounting space for the optional programmer's console with its input keypad and LED octal readouts.



# THE MINIPROCESSOR PERIPHERALS

Peripherals are the tools that a computer uses to communicate with the "outside" world. Whether it uses a single serial interface or high-speed A/Ds backed by bulk storage devices, every computer must have some sort of I/O device if it is to perform useful work. And it must have an exceptional scheme of interfacing I/O devices if it is to do its work easily.

## THE PDP-8/A OMNIBUS

The PDP-8/A takes full advantage of the powerful OMNIBUS interfacing technique in handling a wide range of I/O interfaces. The OMNIBUS data path is a "master" printed circuit board to which a set of connector blocks is attached. These blocks are wave soldered to the master board so that random back-plane wiring and its accompanying problems are reduced, and the MTBF (Mean Time Between Failure) is greatly increased.

All I/O interfaces and peripheral controls plug right into the OMNIBUS slots. Because all slots on the OMNIBUS are electrically identical, any option may be plugged into any slot. Controllers, even those that transfer blocks of data in a single cycle direct memory access (DMA) mode, typically require only one module. The result is a simple, compact, and powerful method of I/O interfacing.

## INTERFACES TO REAL-TIME DEVICES

Although the PDP-8/A's interfacing ease can be taken advantage of in developing special purpose interfaces, it is rarely necessary. There is a host of standard PDP-8/A interfaces ready to do these kinds of jobs. If the job involves such tasks as controlling relays, solenoids, contact closures, limit switches, and counters, the universal digital controllers are available. They are designed for high noise immunity and extremely easy hookup via screw terminal connectors. If the job concerns analog data, analog input subsystems are available. Like the universal digital controllers, the analog input subsystems also provide high noise immunity and simple screw terminal connection.

## COMMUNICATIONS INTERFACES AND TERMINALS

When the PDP-8/A must communicate with people, DIGITAL supplies both the interfacing and the terminals. Asynchronous interfaces have switch-selectable Baud rates for maximum flexibility. Terminals like the LA36 (hard copy) and VT50 (display with optional hard copy) provide interactive capability at a price as attractive as the PDP-8/A itself.

In cases where the PDP-8/A must communicate with other computers, DIGITAL supplies both asynchronous and synchronous interfaces for local or remote (via modem) communications. These communications capabilities make the PDP-8/A the ideal tool for remote data gathering in support of a larger central computing facility.

## MASS STORAGE DEVICES

Mass storage devices are the PDP-8/A's means of collecting, organizing and retrieving large volumes of data. DIGITAL manufactures small mass storage devices tailored to the PDP-8/A customer's needs.

The TA60 dual cassette drive provides a total of 180,000 characters of on-line storage, at extremely low cost. Where higher capacity and speed are required, the TU56 dual DECtape unit is the appropriate device. Each TU56 provides 350,000 characters of on-line storage with a transfer rate of one 12-bit word every 133 microseconds.

PDP-8 handbook

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PDP-8 A  
INSTALLATION PP





# THE MINIPROCESSOR SOFTWARE

It's the software that distinguishes the PDP-8/A from a microprocessor. Software ties together the processor and peripheral capabilities of the PDP-8/A. Specifically, the PDP-8/A software is organized around two major operating systems: OS/8 for program development and RTS/8 for on-line real-time operation. These two systems are totally compatible, with the programs developed under OS/8 capable of being directly loaded for execution under RTS/8. And in larger configurations, OS/8 operates on-line as a background task under RTS/8, providing the full range of PDP-8/A systems power on a single system.

## RTS/8: THE REAL-TIME SYSTEM

RTS/8 makes the PDP-8/A a full-fledged multi-task, real-time system capable of handling many ongoing processes concurrently. And by allowing separate programming of each distinct function, it makes overall software development simple and modular.

RTS/8 is an executive that can handle and schedule up to 63 distinct programs or tasks. These tasks, having been developed using OS/8, are loaded into memory with an assigned priority of from 1 to 64. System operation is based on the interaction of tasks running within the system and events occurring in the outside world. When an event occurs, such as the arrival of new analog data or the triggering of an alarm, RTS/8 activates the program which receives that data and responds to it. When many such events occur simultaneously, RTS/8 schedules the appropriate programs by priority, assuring that the most urgent tasks are done first. Execution of individual tasks may be initiated by the system operator or by another task. They may be requested for immediate execution or scheduled for some future time (i.e., at 11:00). A scheduling command may optionally specify that the task be rerun periodically (i.e., at 11:00 and every two minutes thereafter). Since the RTS/8 system is extremely modular, it allows installations to be tailored precisely for the application. The executive itself requires less than 1K of memory. Handlers are available to support the following functions: system clock, console terminal, background terminal, line printer, DECtape, cartridge disk, fixed head disk, power fail, universal digital controller (UDC), cassette, operator control, and OS/8 background operation.

## OS/8: THE PROGRAM DEVELOPMENT SYSTEM

OS/8 is a full-scale operating system that places the power of large system software at the keyboard of a PDP-8. It provides all the facilities to make PDP-8 programming—both in FORTRAN and in assembly language—quick and efficient. All compilers, assemblers and utility programs are stored on mass storage devices and called out by simple keyboard commands. User-written programs are also stored on disk or tape to permit rapid editing, assembling and linking.

The advantage of OS/8 is that it permits program development resources to be concentrated on a single system. If a large amount of software is to be developed, a central PDP-8/E system with high-speed line printer and cartridge disk storage provides optimum efficiency. Smaller development efforts can make use of smaller configurations. In either case, the central development OS/8 system can produce fully compatible, fully checked program modules for execution on even minimum size PDP-8/As.



# A WORLD OF APPLICATIONS

Over 25,000 PDP-8 Family members are at work all over the world in just about every kind of application imaginable. Industrial Control. Data Communications. Graphic Arts. Education. Aerospace. Biomedicine. Geophysics. Navigation. Commerce. Within this vast scope, the PDP-8/A is beginning to carve its own unique reputation for reliability and performance. And its future is even more promising.

Since it would be impossible to adequately discuss all PDP-8/A applications areas, the following are three representative cases.

## SHIPBOARD NAVIGATION

The PDP-8/A is uniquely suited to harness satellite information. For example, shipboard navigation requires a real-time system to be connected to radio receivers monitoring communication satellites.

Aboard ship, the 8/A is in one of the most potentially harsh and most remote working environments. Requirements for maintenance and operating personnel must be minimal. The 8/A's modular design calls for a low inventory of spare parts, with all components able to be replaced in approximately five minutes. MTBF for the 8/A surpasses that of the PDP-8/E.

The PDP-8/A's compact measurements make it an efficient user of available space in a situation where space is nearly always critical. And once the 8/A is installed, there is virtually no need to move it since all modules can be replaced and plugged in from the front.

## POINT-OF-SALE TERMINAL

Typically, multiple point-of-sale terminals are linked together in a network that connects to a larger host computer. Where PDP-8/A based terminals might be scattered all across the country as part of a multi-division company, the combination of compact packaging and low cost is important. The synchronous and asynchronous interfacing capability of the PDP-8/A provides the critical communication link-up with the central computer.

Additionally, the point-of-sale application often requires sophisticated software and the 8/A user has the extensive capability of the PDP-8 family software at his disposal. DIGITAL's field service force of over 2,000 engineers located in 180 sales offices worldwide means that service is never out of reach.

## NUMERICAL CONTROL

Numerical control applications typically require a rugged, dependable, easily maintained turnkey control system. The environmentally packaged PDP-8/A is protected from the effects of harsh industrial atmospheres such as metal filings, coolants, high temperatures and humidity.

As a turnkey system, production line personnel are not required to be computer experts. MTBF is particularly critical in high-speed operations where the life span of the controlling equipment is a critical element in the prevention of extended downtime. And in those applications that call for quick communication from the PDP-8/A to a central computer that might be handling inventory control, the interfacing capability of the 8/A is highly significant. The PDP-8/A's compact dimensions demand very little space on the production floor. And since these kinds of repetitive operations require very little memory (usually less than 4K) the user isn't purchasing a computer with more memory than is actually needed.

## DIGITAL EQUIPMENT CORPORATION

Anyone who knows computers, knows DIGITAL. Although we've been around for 17 years, we think that the people, products and ideas that we are today are just as far-sighted and exciting as our very first memory module. So it won't be surprising to some that we can offer the PDP-8/A miniprocessor.

Besides small computers, we make the big hardware, too. Like our large scale timesharing DECsystem-10s. And just about everything in between small and large that you could possibly need.

We're responsible for over 30,000 computer installations—from deep beneath the sea, to the auto assembly line, to the small town regional high school, to the research laboratory, to the offices of a major bank. Approximately 18,000 people are responsible for this kind of production and service. 130 offices worldwide. 2,000 engineers all over the globe. 14 regional training centers.

And complacency isn't in our vocabulary. We think there are always ways to do things better, at lower cost for the customer. And if it's possible, we do it.

## RESOURCES

Sales specialists provide the expertise to match specific customer requirements with the appropriate computer system. Field service engineers install and maintain the computer hardware, providing continuing service on a contract or on-call basis. Software support specialists install and train customer personnel in the use of software systems. Additional training is provided by full-time hardware and software instructors who offer more than 100 different courses in 14 regional training centers. These centers train more than 20,000 satisfied customers every year.

Continuing support in the use of DIGITAL computers is available through DECUS, the Digital Equipment Computer Users Society. With a membership of more than 19,500 from some 40 countries, DECUS is the largest and most active society of its kind in the world.

DIGITAL EQUIPMENT CORPORATION, Corporate Headquarters: Maynard, Massachusetts 01754, Telephone: (617) 897-5111

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