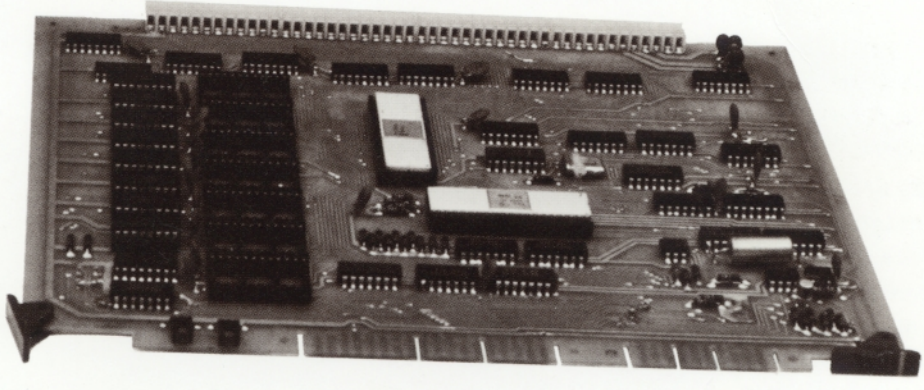
PCS 180 Industrial Microcomputers



PCS 180 MICROCOMPUTERS MEETING THE NEEDS OF INDUSTRY

Today's microcomputers have opened up new vistas in manufacturing and processing technology. Microcomputers, while reducing the need for costly human labor, provide an economical means to greatly improve quality control in a wide range of industrial applications.

- In a California pet-food plant, PCS microcomputers are controlling processing parameters more closely than federal and local laws require for the processing of foods intended for human consumption.
- In gasoline service stations, PCS microcomputers are metering fuel delivery more accurately than is possible by mechanical means, calculating retail fuel cost, allowing a single operator to control fuel delivery at many gas pumps simultaneously.
- In automotive assembly plants, hoods, deck lids, fenders, quarter panels, and doors are being measured to close tolerances by PCS microcomputers with speeds far beyond the capabilities of human QC inspectors.
- In an urban office building, PCS microcomputers are monitoring energy consumption and controlling heating, air-conditioning, and lighting equipment in a way that minimizes energy costs.
- In a foundry, sand castings are being cleaned under the watchful eye of a PCS microcomputer system that scrutinizes every phase of the blast cleaning operation. A monitoring system with 32 channels of analog input monitors the frequency of cleaning blasts, the duration of each blast, amount of abrasive fed into each blast, and conveyor motion during the cleaning operation.
- At a military warehousing facility, PCS microcomputers control an automated conveyor belt system over a mile long. Watching many packages simultaneously, the computer unerringly guides each to its assigned destination in the complex conveyor system.
- On a spray painting production line, a PCS microcomputer accurately controls both spray gun and conveyor belt speed to assure a perfect paint job every time — one with neither runs nor holidays.
- In a natural-gas pipeline, a PCS microcomputer monitors temperature, pressure and differential pressure to accurately gauge fuel flow, not simply in cubic feet per minute, but in BTUs per hour.

PCS microcomputers are on the job in hundreds of industries controlling machines and processes at lower cost and with greater speed than systems they replace.

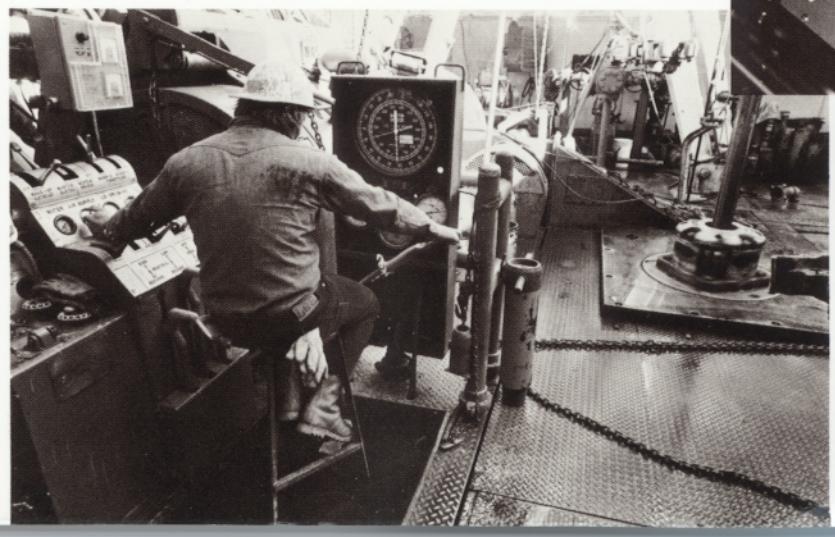
Industrial applications place demands on microcomputer hardware and software that far exceed the requirements of commercial and consumer applications.

Industrial microcomputer equipment must be designed to function in hostile environments — corrosive atmospheres, wide ranges of temperature, and high noise situations.

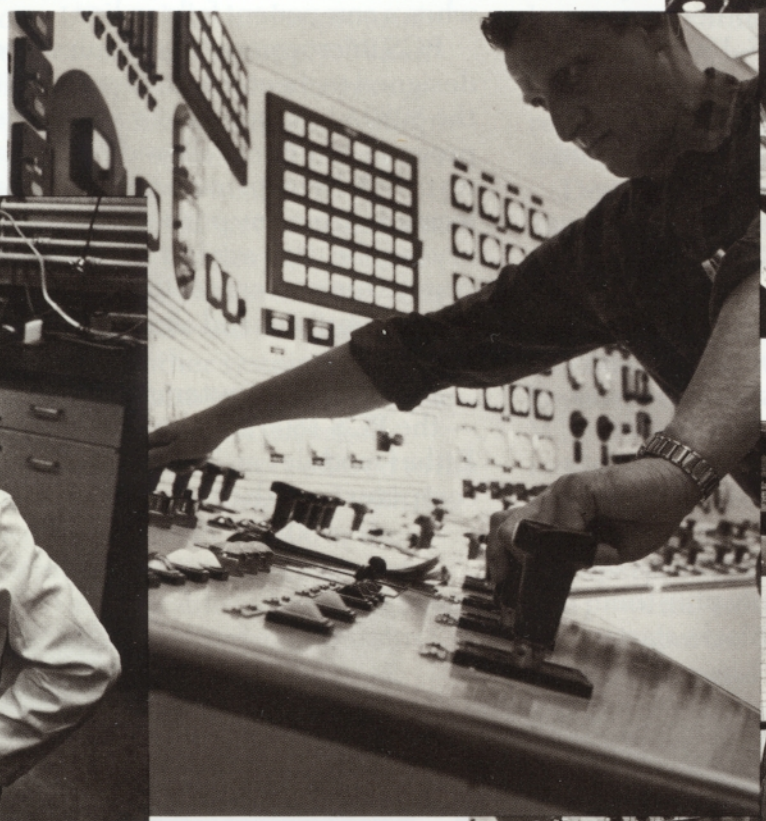
Because industrial requirements frequently change, the systems builder needs hardware that is modular, flexible, and inherently expandable. When systems requirements do change, modifications should be simple and inexpensive to implement without costly rewiring or expensive, prolonged equipment shutdown.

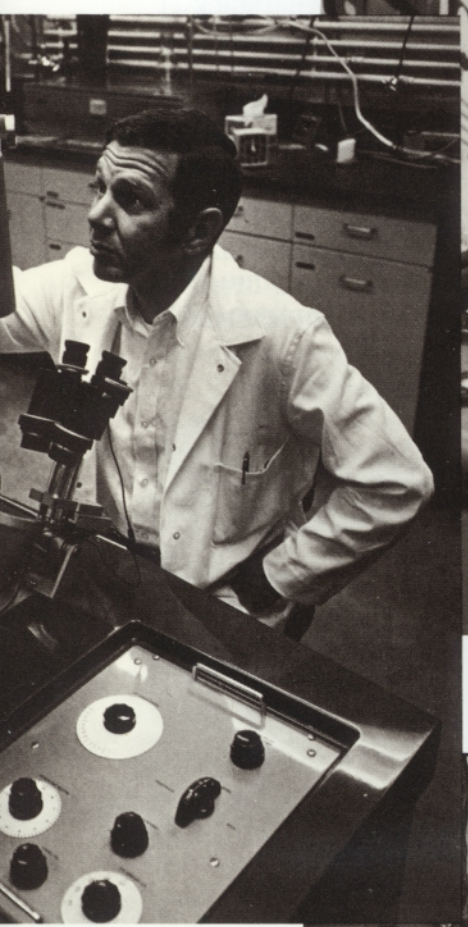
The industrial user needs to know that his microcomputer equipment will perform — and perform reliably. The cost of shutting down an assembly line is often measured in tens of thousands of dollars. Industrial microcomputer equipment must be reliable.

Hardware costs are only a part, frequently the smallest part, of the total cost of an industrial microcomputer system. Industrial users need hardware backed up by software that meets their often unique requirements. Moreover, to economically implement an industrial microcomputer system, the systems



builder needs to easily and economically interface to a wide variety of sensors, controllers, valves, potentiometers, strain gauges, and accelerometers. He must be able to monitor temperature, position, pressure, differential pressure, force and voltages. He must be able to communicate with a wide variety of peripheral devices and perhaps even with a larger host computer.





START WITH BASIC HARDWARE

PCS has been designing and building industrial microcomputer hardware and complete systems for years. The culmination of this experience is the PCS-180 family, the first integrated series of microcomputer products specifically designed for the industrial marketplace. And PCS-180 hardware is backed up by the software and I/O capabilities that industrial systems builders asked for.

Extensive use of CMOS and other low-power technologies allows PCS-180 hardware to be installed in sealed boxes for protection from tampering and the effects of dirty, corrosive environments. Without forced-air cooling, the excessive power dissipation of ordinary microcomputer hardware would produce unacceptable heat build-up in this type of enclosure. Moreover, CMOS technology gives PCS-180 hardware the ability to function in the presence of the high electrical noise levels produced by industrial motors, switches and relays.

PCS-180 hardware starts with the Flexibus II backplane. Unique to the 180 line, the Flexibus II allows systems builders to choose from an extensive line of modular microcomputer building blocks and simply plug them into a system. These building blocks start with two powerful microcomputer modules, including one with on-board battery backup of data in memory. To the basic microcomputer boards chosen for a system, the designer can add memory, I/O, and communications modules to configure any system he needs. All modules are available off-the-shelf. No waiting for custom boards when implementing your design. No waiting for replacement boards when a component fails on line.

PCS microcomputer modules, specifically designed to meet the needs of industry, use the 8080A microprocessor which has a 16-bit program counter to allow direct addressing of up to 64K bytes of memory. An external stack located within any portion of read/write memory may be used as a last-in, first-out stack to restore the contents of the program counter, flag accumulator and all six general purpose registers.

Two microcomputer modules are available — the PCS 1806 and the PCS 1810. Either module can be used as a stand-alone computer or with other 180-series components

to provide expanded capabilities.

The PCS 1810 board provides non-volatile memory and high-level digital input and output.

PCS 1806 and PCS 1810 microcomputer modules are designed for use, either as self-contained single-board computers, which include CPU, RAM, ROM, and multiple I/O ports, or as part of a larger system, with additional memory, I/O modules and appropriate backplane, chassis and power supply. When either board is incorporated into a larger system, it interfaces to additional modules simply and easily by using the tri-state TTL bus interface circuitry through the Flexibus II backplane. The Flexibus II system architecture allows memory boards, I/O devices, or interface modules to be addressed as memory locations — eliminating costly and unreliable rewiring necessary with other systems.

The PCS-180 family also includes Superpac 180 and Micropac 180, the first packaged, general-purpose microcomputers offered to the industrial market. Both are furnished with the user's choice of either the PCS 1806 or the PCS 1810 microcomputer modules in an attractively styled and durable industrial cabinet with front-panel control switches and status indicators.

Micropac 180 is a basic industrial microcomputer with four-slot chassis. Two slots are filled in the basic unit with two more available for expansion. In its standard form, Micropac 180 is designed for desk or benchtop use. An optional rack-mount configuration is also available.

For applications requiring a high level of operator interface and control capability, Superpac 180 provides both full ASCII keyboard and CRT display capability at a lower cost then many CRT displays alone. With up to 1024 directly addressable character locations, its 5-inch diagonal screen can display either 16 lines by 64 characters, 8 by 32, or 4 by 16 with programmable cursor, blink, and reverse video capabilities. Formats are selected by dynamic control through software.

Depending on your application, Superpac 180 can serve as a basic stand-alone microcomputer or as the intelligent front end of a more sophisticated system. In its most basic configuration, it includes a complete microcomputer, as well as a self-contained keyboard interface and CRT control module. Whenever the need arises, additional plug-in modules from the extensive PCS-180 hardware line can provide additional memory or I/O ports.

Superpac 180 is also an extremely flexible and powerful tool for software development when supported by the Micropac Development System and PCS development software.

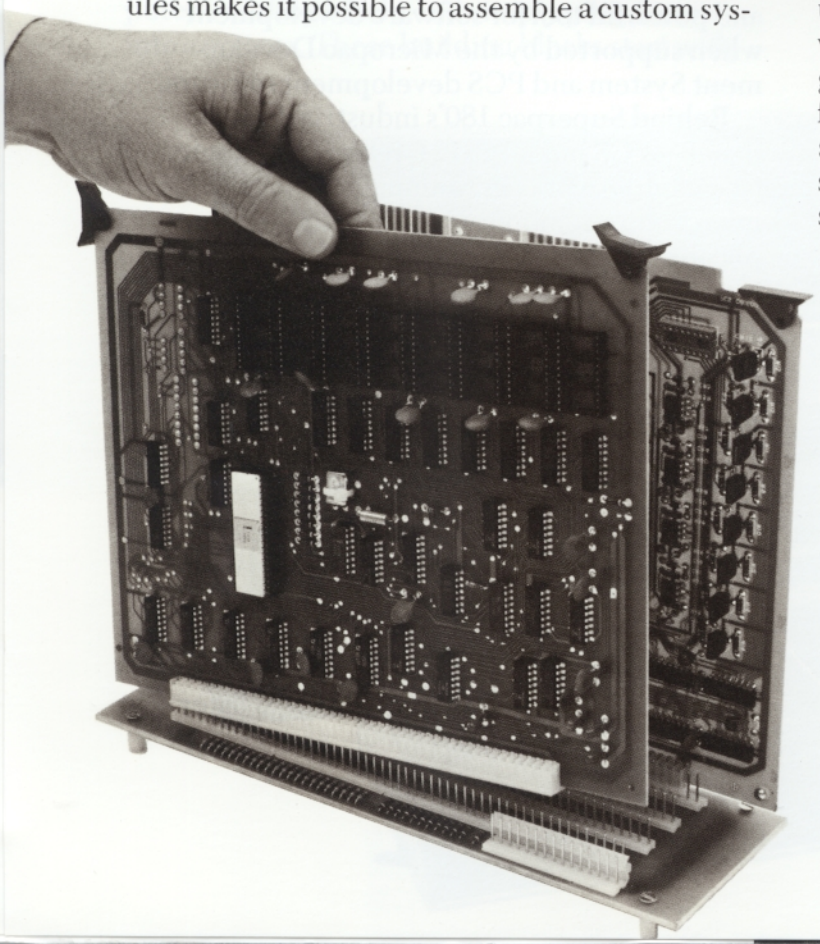
Behind Superpac 180's industrial front-panel, a PCS model 1812 CRT keyboard interface module works in conjunction with the microcomputer module required by your application to lower the cost of using a CRT screen to that of other display systems which are far less versatile and flexible. It also provides a cost-effective keyboard interface for operator communications.

For users who wish to implement their own keyboard/display system, the PCS 1812 interface module is available separately. Virtually any system which needs a numeric display or some other form of annunciator can now afford the power and flexibility of an alphanumeric CRT screen display. It is also possible to use more than one PCS 1812 to further increase the capabilities of a low-cost microcomputer system.

ADD BUILDING BLOCKS

To meet the changing needs of industry, a PCS 180 system is inherently expandable. If a process is changed, the modular nature of a PCS 180 allows expansion or modification simply by changing or adding building blocks.

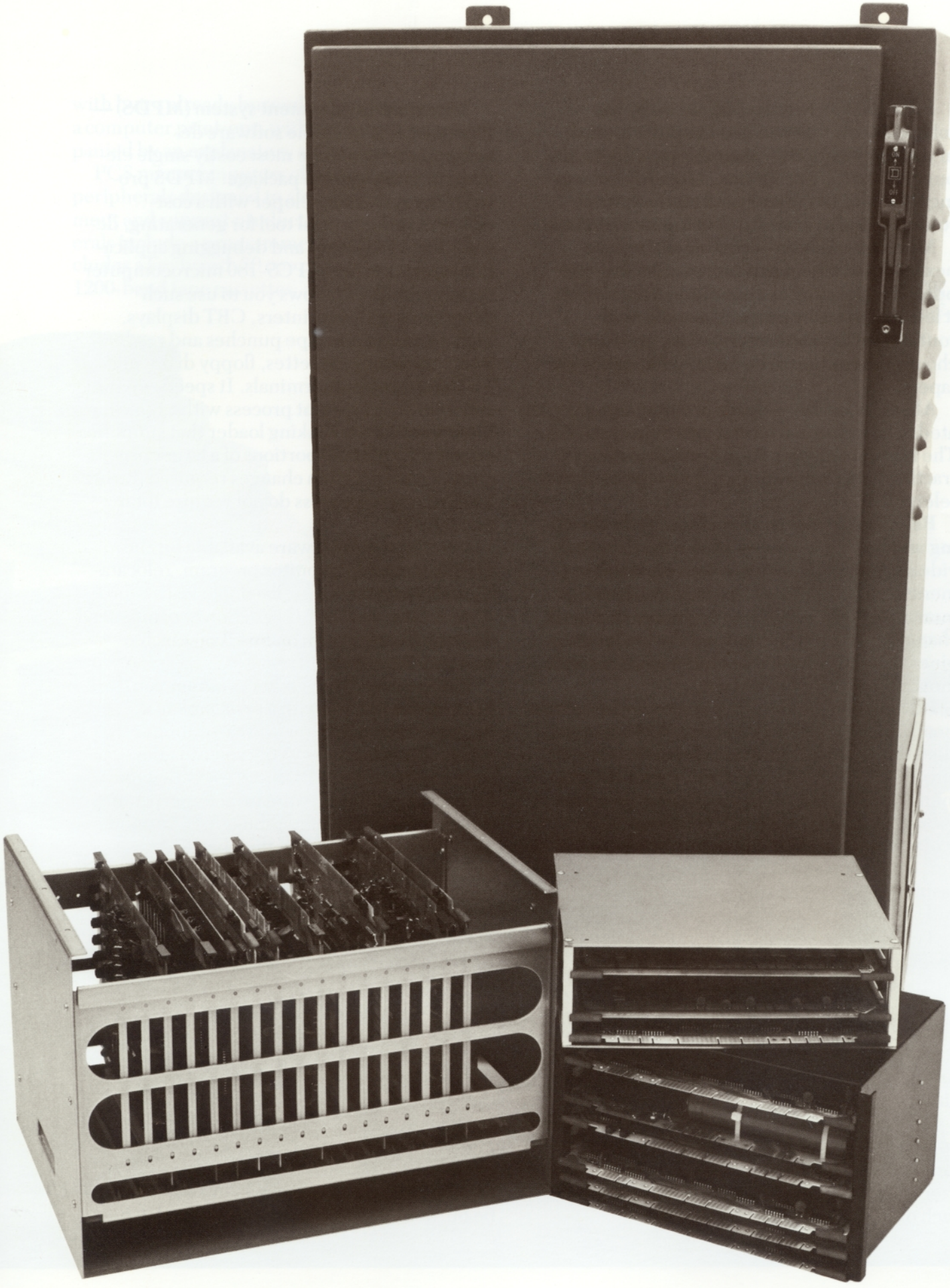
Other microcomputer manufacturers offer modular systems, but only PCS offers the Flexibus II backplane that allows the systems designer to take full advantage of the building block concept. Flexibus II eliminates the costly rewiring necessary when modifying or expanding other microcomputer systems. To add a module to an existing system — one that is under development or one already on line — just plug a new board into any empty slot. That's it. No connections to make; none to break. When a program calls up the newly inserted board, the microcomputer will search the bus until it finds it. Moreover, by eliminating wire-wrapped connections, Flexibus II improves system reliability. The Flexibus II backplane allows the systems designer to make changes quickly and easily, minimizing down time and eliminating the need for costly rewiring. And the industry's most extensive line of industrial microcomputer and microcomputer support modules makes it possible to assemble a custom system to meet virtually any industrial requirement simply by assembling off-the shelf building blocks.



Chassis configurations are available to meet the full range of industrial microcomputer systems requirements. For low-end, low-cost applications, a basic microcomputer is available with a simple four-slot chassis and power supply. Easily mounted in any OEM system, it is offered as a basic system with I/O modules and memory added, as needed, by the customer. To meet the requirements of larger systems, eight and 20-slot chassis versions are also available. With an optional bus extender cable, used in conjunction with a bus buffer card, you can use several chassis back-to-back for increased capacity.

Whatever number of building blocks are required to implement an industrial system, PCS can provide standard chassis or combinations of chassis to accommodate them. And all chassis are complete with Flexibus backplane and suitably rated industrial power supply.

To put your system on line, you can start with PCS standard software packages, then develop custom software to meet your unique requirements with the Micropac Development System and the PCS PROM programmer. And from initial conception through final development and beyond, PCS know-how stands behind the 180 line. In hardware, in software, in operator training, and in hardware support after your system is on line.



SUPPORT WITH SOFTWARE

PCS-180 hardware is backed up by the software tools that you need to put it to work in your application — assemblers, loaders, debuggers, editing programs, a steadily increasing library of I/O drivers and mathematical routines, and a powerful development system.

Macro assembler — produces absolute hexadecimal object and source assembly outputs. By operating as a conditional assembler, it lets the operator program a number of routines into the source program, and then choose the routine to be included in an object tape.

Absolute loader — loads program tapes generated in hexadecimal format into Superpac 180. The loader controls a 20-mA serial port for extracting data from either a paper-tape reader or teletype.

Relocatable macro assembler, and relocating and linking loader — allows the user to divide a large program into relatively small segments and subroutines. As program development proceeds, only those segments that need changing are reassembled and the loader combines the new relocatable object modules with those previously checked out.

PCS real-time operating system — includes a small multi-tasking supervisor, I/O supervisor, clock handler, and a variety of real-time input/output devices. This real-time, event-driven, memory-based operating system relieves the user from details of priority handling, task scheduling, standard I/O timing, and data buffering. It also provides asynchronous parallel processing capability plus inter-task communication and synchronization facilities.

Text editor — is used to create new source programs or to correct existing ones. With it, the user can create large amounts of alphanumeric text from paper tapes, cassettes, and disks.

Debug package — includes a wide range of routines that greatly simplify program debugging.

Software library — PCS-180 users are backed up by an extensive library of mathematical routines, drivers for 180-system modules, and exerciser routines to verify correct operation of each of the hardware modules.

Micropac development system (MPDS) — Designed to streamline software development—often the most costly single element in a total system package. MPDS provides the system developer with a cost-effective and powerful tool for generating, developing, modifying, and debugging applications software for the PCS-180 microcomputer systems family. It allows you to use such peripherals as line printers, CRT displays, high-speed, paper-tape punches and readers, teletypewriters, cassettes, floppy disks, and TI-733-type silent terminals. It speeds up the software development process with a relocatable assembler and linking loader that simplifies reassembly of small portions of a larger program. Small program changes required during the debugging process do not require total reassembly.

Development software available for the MPDS includes a monitor program, relocatable macro assembler, relocatable loader, program editor, and TRAC program to print out addresses of each function as well as selected memory locations and registers.

Using an up-down loader program you can hook up the MPDS with a serial link to a Superpac console. Now you can debug at either of two consoles. Now you can take software from the MPDS and execute it on Superpac or take software from Superpac and dump to the MPDS for debugging. Any and all MPDS periperals can then be used to debug and output a program under development and then dump back down to Superpac.

When using a teletypewriter, the loader both controls the TTY, picks up information from tape, and loads the memory of Superpac.

A desktop PROM programmer is available that may be used to program or copy a PROM or EROM in less than a minute. When used as part of the Micropac Development System, the unit detects errors or non-zero PROMs at the start and verifies each chip after each programming cycle. The PCS PROM programmer features dual chip sockets so that an original PROM and a duplicate may be examined directly. Each byte of a PROM to be burned-in is automatically checked. Chips

with bytes already burned-in are reported via a computer print-out, with each error accompanied by an explanatory statement.

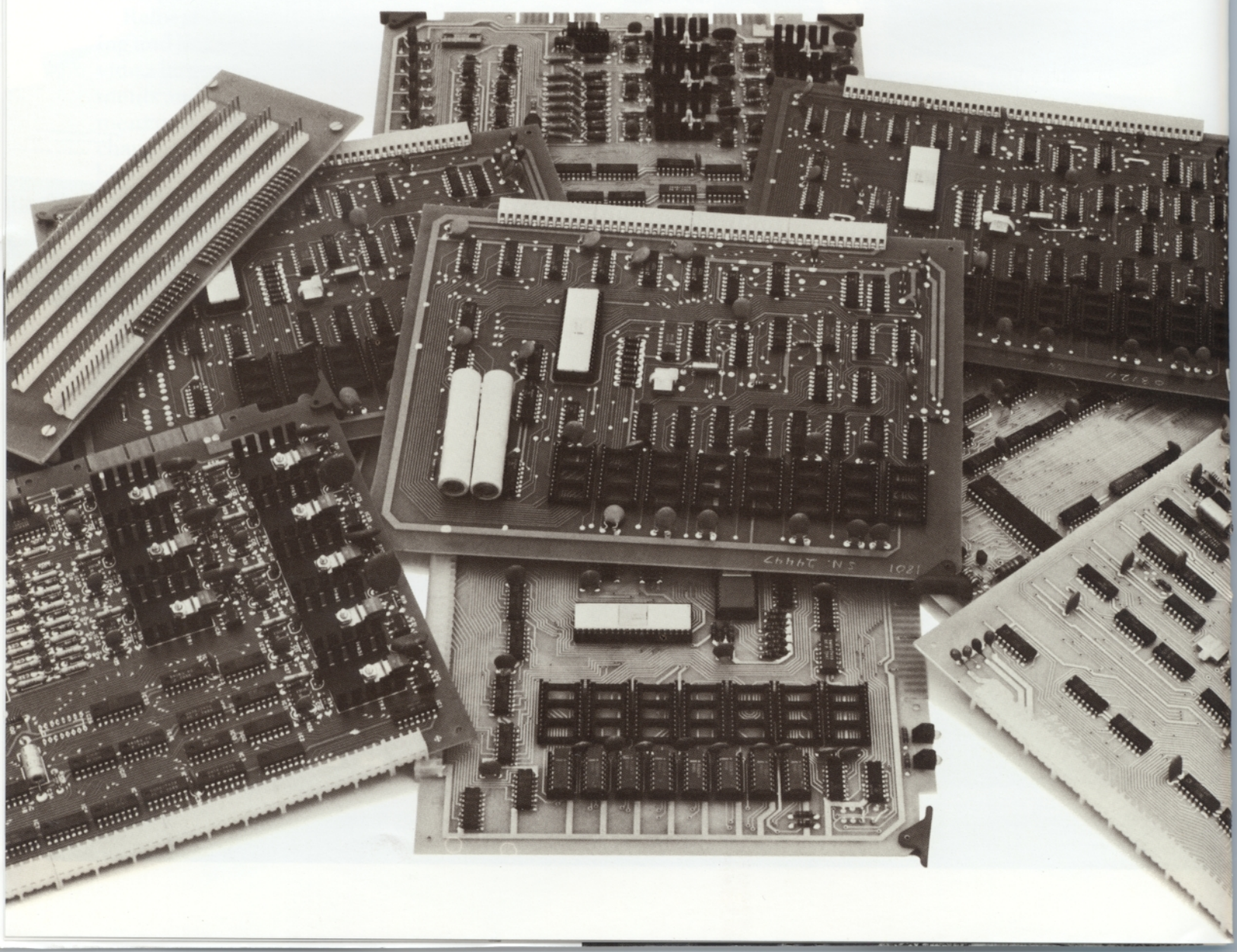
PCS microcomputers offer a full range of peripherals designed to aid program development and support production systems. Peripherals include a programmer's console that includes a keyboard, 30 cps printer, and dual 1200-baud tape cassettes; a display terminal with alphanumeric video display/keyboard, 1920-character display (24 lines × 80 characters), 64 ASCII character set that operates at 2400 baud via current-loop interface; paper-tape reader and punch; standard ASR33 teletypewriter; a fully buffered line printer with a speed of 60 to 200 LPM, 132 columns and a 64 ASCII character set; and a floppy disk system with a storage capacity of 1M bytes, (250K bytes per drive), and full sector read/write buffers that allow asynchronous data transfers to and from the microcomputer.

PUT YOUR SYSTEM ON LINE

The PCS-180 family is a blue-collar system — ready to tackle the toughest jobs in any industry. Backed up by an extensive line of interface modules, PCS hardware is easy to tie to any point in a process, to any kind of instrumentation, to anywhere that data must be collected, or to any point where control must be imposed. PCS-built hardware is already on the job in the automotive industry, in food processing, in materials handling, in laboratory instrumentation, in refineries, in pipelines, and at the corner gas station.

Three different configurations of analog-to-digital conversion modules are available to interface a wide variety of sensors and transducers. PCS A/D boards allow you to easily monitor the outputs of potentiometers, strain gauges, and rate-change transducers such as accelerometers. Whether your system requirements involve signal analysis or the measurement of temperature, position, motion, force, pressure, or differential pressure, PCS has an A/D module ready to do the job.

Still other PCS input/output modules are standing by to handle the full range of your I/O problems. Whether your interface needs are digital or analog, ac or dc, an off-the-shelf PCS module can handle the assignment.



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