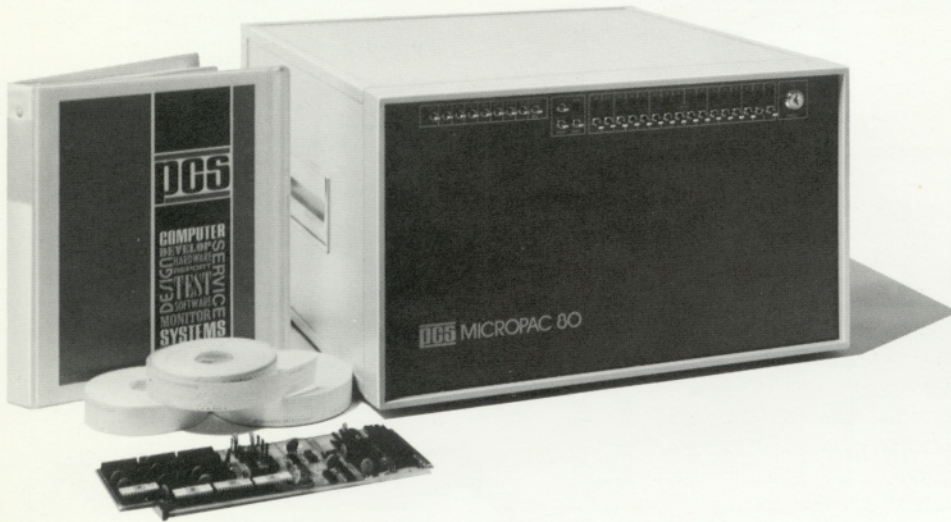# The world's first complete Micro-computer development system

MicroPac 80

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Here it is: all the hardware and development software necessary to prototype, develop or support a microcomputer-based system.


All the hardware. Logic, memory and communications interfacing, of course. But you also have the process interfacing you'll need for any application.

And all the software, so that you can develop your microcomputer program on the microcomputer. You don't need any other computers at all.

Once you've completed your development programs, you can put your MicroPac 80 to work in production, using the programs you've developed.

The Standard MicroPac 80
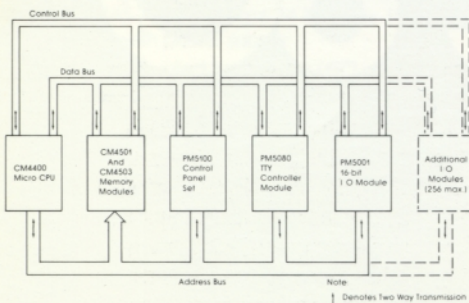
MicroPac 80 Simplified Block Diagram

Chassis and Enclosure.
MicroPac 80 comes standard in the attractive desk-top enclosure shown here. It's available at no additional charge in a rack mountable chassis.


The Backplane.
The bus oriented backplane is used as the data highway between logic, memory and process input/output modules.

This backplane is the only one on the market configured so as to give each module plugged into it its own unique address.

As a result of this "Card Address" design, you can interchange memory and input/output modules throughout the chassis.

The backplane in each chassis has 3 control, one terminator slot and 16 of these multipurpose addressable slots. Since only three of the 16 are used in the basic system, 13 slots are available for you to plug in any additional memory or interfacing you require.
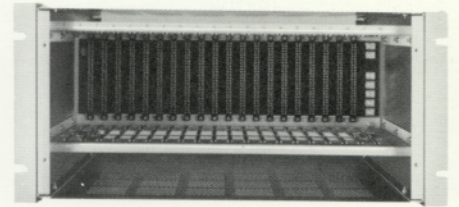

- · 16 PROCESS SLOTS
- · CONTROL PANEL MODULE
- · PM5080 TTY CONTROLLER
- · PM5001 16 BIT TTL DIGITAL I/O MODULE
- · ANY OTHER PROCESS MODULE OR MEMORY MODULE

Power Supply.
MicroPac 80 uses a semi-regulated ferroresonant device, the most reliable low-cost power supply available. Regulation begins at the power supply, and precise regulation is accomplished by individual solid-state 3-terminal voltage regulators built into each of the hardware modules plugged into the backplane.

Logic.
MicroPac 80 incorporates an Intel 8080 micro CPU into a standard PCS microprocessor module. The module includes the 8-bit parallel CPU with a repertoire of 78 instructions, 7 working registers, unlimited subroutine nesting and multiple interrupt handling capability. It directly accesses up to 64K bytes of memory.
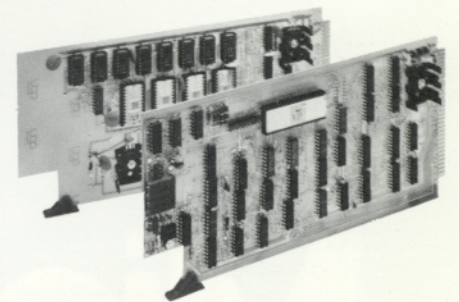
Memory.
Included with a standard system are 4K bytes of RAM and 1K Bytes of ROM. (Expandable to 64K bytes of either or of any combination of the two.) Switches located on each memory module enable you to select the base address of the memory.

Operator's Display & Control Panel.

The control panel allows hands-on operation of the micro CPU. Its versatile and convenient design makes it an available tool in debugging and trouble shooting new programs.

The control panel has an interrupting capability which may be enabled or disabled. It is entirely software driven, using standard programs provided with the system.

With the standard control panel driver, the contents of memory, registers, program counter and stack pointer can be examined and modified.

The panel contains 12 control switches, 16 data switches, 17 display LED's and a key lock switch for security. It includes START, STOP, CONTINUE and RESET functions and occupies one chassis slot with a control module.
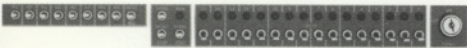
TTL Input/Out.

One of MicroPac 80's standard modules provides an interface with TTL compatible process or peripheral devices.

It contains 16 bits of digital input and 16 bits of digital output with flag and interrupt capabilities. Data outputs are fully buffered, allowing output data to be stored on the module.

TTY Input/Output.

MicroPac 80's standard teletypewriter (TTY) controller module provides an interface with any TTY or any other asynchronous low-to-medium speed (110-2400 baud) serial device.

Standard Software.

MicroPac 80 development software runs on the MicroPac 80 itself. So you don't need to buy or use a host computer. With your MicroPac 80 you receive all of the following software:
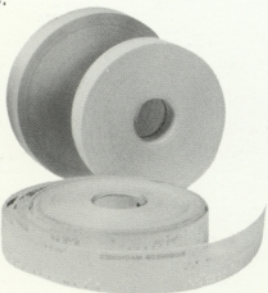
1. The basic operating system (BOS 80) permits you to control the execution of MicroPac 80 programs and operation through a TTY keyboard. It contains a loader, punch routine and drivers for the standard hardware included in the MicroPac 80 package.

2. A stand-alone microassembler (MAS 80) will permit you to generate tapes from source language programs for execution on the micro CPU (CM4400). This program resides in a minimum of 4K bytes of RAM and runs under BOS 80 control.

3. An interactive software debugging program (DBUG 80) checks out and debugs programs for use on the CM4400 micro CPU. The program permits multiple break point insertions and has the capacity to alter or display memory or registers.

4. The program tracing tool (TRAC 80) can trace up to eight points in a program. Each point traced can have up to eight variables displayed (registers, memory, etc.) so that 64 variables in a given program can be displayed dynamically with this powerful trouble shooting tool.

5. The MicroPac 80 text editor (EDIT 80) modifies source language programs for use with the microassembler (MAS 80). EDIT 80 is designed for use with a TTY under the BOS 80 operating system.

6. With the BPNF program you can punch a program in the BPNF format required for PROM burning.

7. MicroPac 80 software includes hardware diagnostics to exercise memory, micro CPU module and control panel functions.

Optional: 64K Memory And A Whole Lot More

MicroPac 80 can be ordered with extra memory and interfacing in practically any combination.

You can order additional memory in increments of 256 bytes for ROM and 1K bytes for RAM up to a maximum of 64 bytes, in RAM, ROM or any combination of the two (and the MicroPac 80 CPU can address 64K bytes directly).

Perhaps even more importantly, you can order your MicroPac 80 with any combination of up to 256 process input/output modules, analog or digital or both, using up to a maximum of 16 standard chassis.

PCS digital interfacing includes 16-bit TTL input/output modules, 16-bit high and low level digital input/output modules (these are also available optically isolated), 8-channel interrupt expanders and relay outputs, 16-bit up/down counters, real time clocks (available with power fail auto restart), interval timers and stepper motor outputs.

Standard off-the-shelf analog interfacing includes 2-channel D/A converters (12-bit), 16 channel A/D converters (12-bit) and DC excited transducer controllers.

As for communications, you can order TTY and RS-232 compatible controllers. Another module permits serial communications over a current loop with optical isolation (for long distance transmissions) at rates up to 80K baud.

If you wish, you can prototype your own special modules simply by ordering our standard PCS wire-wrap breadboards.

Plug In Anything Anywhere!

Once you begin to order these optional memory and interfacing modules, the "Card Address" backplane becomes a real time saver.

Since each module can be addressed individually, you can plug in the additions anywhere in the system, and get down to business — without having to disrupt the standard network of original modules.

Another benefit of the "Card Address" concept is the fact that you can treat input/output devices as additional memory locations, so that the CPU can do logical operations directly with I/O without having to transfer the data first to memory. This simplifies programming and increases the actual "memory" capability beyond the apparent 64K byte maximum!

100% Documented

With each MicroPac 80 comes a comprehensive user's manual which includes full documentation on all hardware and software in the system.

PCS also supplies manuals on each functional module shipped with the MicroPac 80 which is not part of the basic system.

OEM Solution

MicroPac 80 is designed for development and support of a microcomputer system. After the development software is finalized and debugged, an economical production system for the OEM is available using the same standard hardware, called MICROPAC OEM. Besides the packaging, the MicroPac OEM discount schedule provides the most liberal discounts available on a microcomputer based system.

Order Peripherals, Too

On the same PCS order form for MicroPac 80 you'll find you can order such peripherals as TTY, high-speed printers and CRT's.

You see, when we said MicroPac 80 was the world's first complete microcomputer development system, we meant complete!

To get started with your development project, just write "MicroPac 80" on a purchase order along with a listing of any standard additional modules you need (you can also order these later) and send it to PCS. That's all there is to it!

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5467 Hill 23 Drive Flint, Michigan 48507

Regional Offices:
Brick Town, New Jersey
Fullerton, California

Phone (313) 744-0225
TWX-810-235-8667

Suddenly, The Whole Business Of Industrial Control Has Changed.

MicroPac 80 General Specifications

Physical Characteristics

Supplied as a table-top unit complete with power supply and control panel. Rack-mountable units available on request.

Rack mounted chassis (19")
8.50" (21.59 cm) x 18.94" (48.10 cm) x 18" (45.72 cm) weight 34 lbs. 2 oz. (15.47 kgm) with power supply

Rack mounted front panel (19")
1.75" (4.45 cm) x 18.94" (48.11 cm) x 2.13" (5.41 cm)

Table top configuration
11.25" (28.57 cm) x 19.75" (50.16 cm) x 21.68" (55.06 cm) weight 57 lbs. (25.85 kgm) with power supply

Computer:

CPU: Intel's n-channel single chip 8-bit parallel microprocessor, the 8080
Instruction cycle: 2 microseconds

Instruction set: 78 instructions
Decimal and binary arithmetic
Direct load and store of accumulator
PUSH and POP stack instructions
Double length operations (16 bits)
Increment and decrement memory

Registers: six 8-bit data registers
8-bit accumulator
four 8-bit temporary registers
four testable flag bits

Maximum number of addressable I/O devices: 256

Interrupts: multi-level vectored interrupts

Bus: Printed circuit backplane with 20 slots (addressable slots), 8 address lines, 16 data lines, Interrupt & control line, 8 command lines, 3 power buses, (one spare power bus, user defined)

Clock: 2-phase non-overlapping 2-MHz clock

Memory:

5k bytes (4kB RAM, 1kB ROM) expandable to 64k bytes

Word Size:

8 bit word length
16 bit I/O word length

Electrical Requirements:

Ferroresonant power supply provides the backplane with +7 volts, 20 amperes and ± 20 volts, 2 amperes preregulated power
115 - 230 VAC, 60 Hz
230 VAC, 50 Hz (optional)
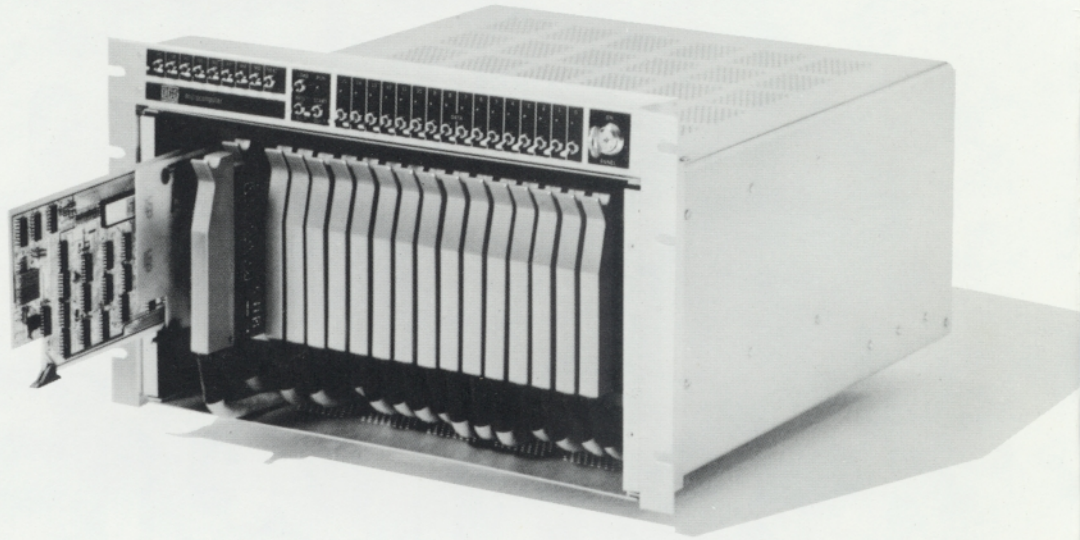110 VAC, 50 Hz (optional)

Environmental Requirements:

Operating—0° to 60° C (140° F) 90% R.H. maximum, non-condensing
Storage—0° to 85° C (185° F) 90% R.H. maximum, non-condensing

PCS Brings the Micro-computer To OEM Control Systems

MicroPac OEM

pcs

Now, finally, you can automate your equipment at a practical cost.

The PCS MicroPac OEM delivers the speed and flexibility you'd expect from a computer, along with all the process and communications interfacing and software support you'd expect to have to shop for all over town.

Custom designed from standard Modules.

One of the principle benefits of MicroPac OEM is that you can order it in any configuration you want without getting into custom design and documentation.

You can order from 1K to 64K bytes of memory. Order any process or communications interfacing. Order it packaged as shown, rack mounted, or in any number of other package designs.

Yet, it's still priced as a standard system. Here's why:

How it works.

The key to the MicroPac flexibility is its unique "card address" backplane. This printed circuit backplane, which serves as the bus, assigns an address to each card, or module, you plug into it.

The result is that you can assemble nearly any combination of memory and interfacing modules and plug them into the standard backplane — and you still have a system that requires no hard wiring. All you need to do is program the CPU to tell it the address of each card in the package.

One of the side benefits of the "card address" concept is the fact that you can treat input/output devices as additional memory locations, so that the CPU can do logical operations directly with I/O without having to transfer the data first to memory. As a result, actual "memory" capacity is expanded beyond the quoted 64K byte maximum.

The "card address" design also means that you can modify or expand your MicroPac OEM control system at any time in the future without expensive changeover costs.
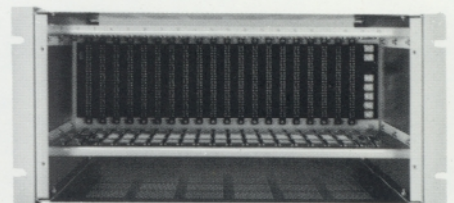
The Control Modules.

MicroPac OEM incorporates an Intel 8080 micro CPU into a standard PCS microprocessor module. The module includes the 8-bit parallel CPU with a repertoire of 78 instructions, 7 working registers, unlimited subroutine nesting and multiple interrupt handling capability. It directly accesses up to 64K bytes of memory.

Reprogrammable memory (PROM) and read only memory (ROM) are available in 256 byte increments, while random access memory (RAM) is available in 1K byte increments.

Switches located on each memory module allow you to select the base address of the memory.
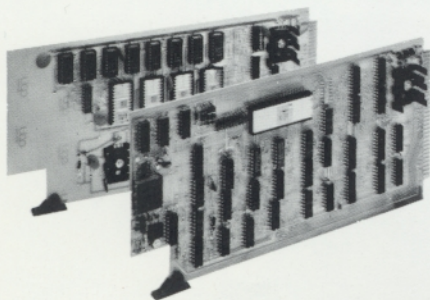

The Process Modules.

You can order your MicroPac OEM with any combination of up to 256 process input/output modules, analog or digital or both, using up to a maximum of 16 standard chassis.

PCS digital interfacing includes 16-bit TTL input/output modules, 16-bit high and low level digital input/output modules (these are also available optically isolated), 8-channel interrupt expanders and relay outputs, 16-bit up/down counters, real time clocks (available with power fail auto restart), interval timers and stepper motor outputs.

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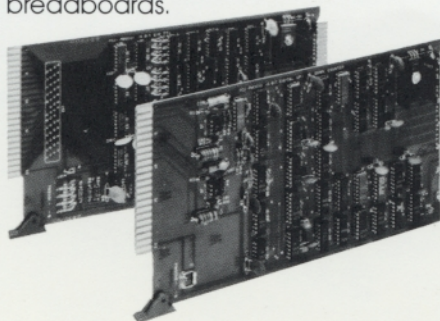
The Communication Modules.

These allow the use of CRT's, teleprinters and modem applications (RS-232 and RS-232C compatible) at baud rates of 110 to 2400 plus a 1 or 2 stop bit capability.

Another module permits serial communications over a current loop with optical isolation (for distances up to 1.5 miles) at rates up to 80K baud.
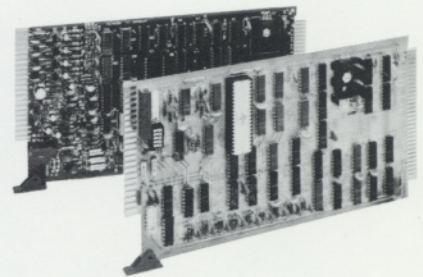
How to get started.

You can develop all of the programming you need right on the MicroPac. PCS offers a software development system called MicroPac 80 that provides the means.

MicroPac 80 comes standard in an attractive desk top enclosure, complete with a software driven control panel for manual control.

Like MicroPac OEM, the MicroPac 80 development system can accommodate nearly any configuration of additional PCS memory and interfacing modules, an important consideration for efficient development.

Once you've developed your program, you can strip down your MicroPac 80 and use the hardware as one of your MicroPac OEM units.

100% Documented.

Your MicroPac OEM system is completely documented. With each unit comes a comprehensive user's manual which includes full documentation on all hardware and software in the system.

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