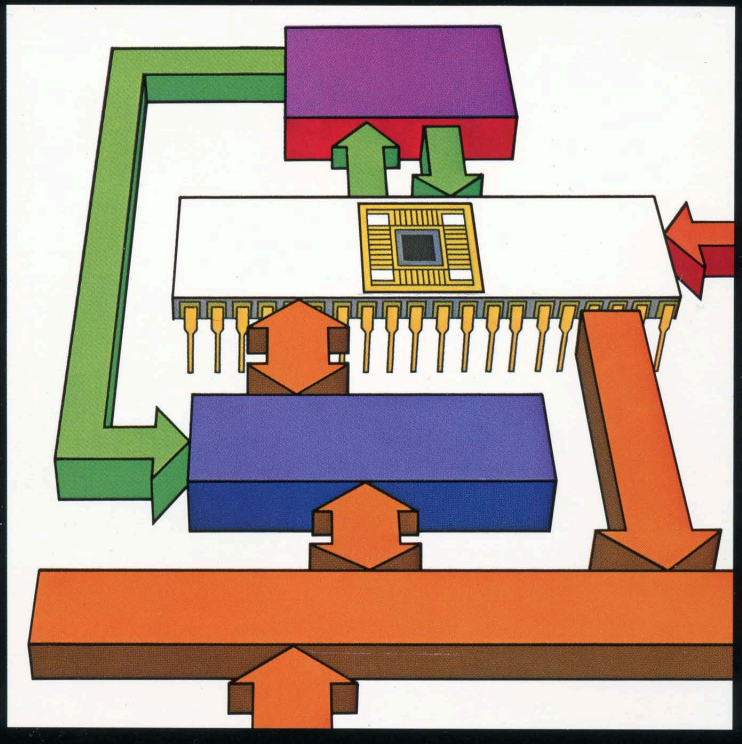
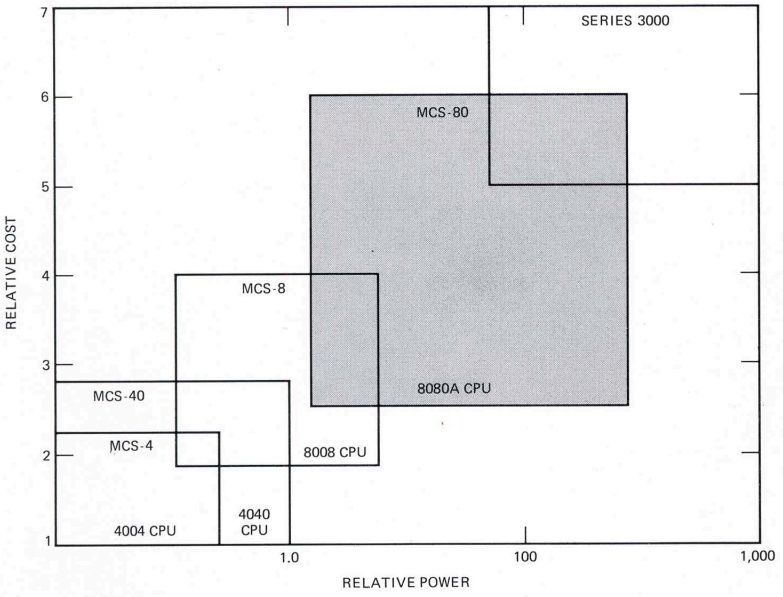
Why more engineers use the Intel 8080 system than all other microcomputers combined.



Intel microcomputer systems.

Since 1971, equipment manufacturers have used Intel microcomputer systems to reduce the cost and increase the versatility of their products. These LSI systems have replaced hardwired assemblies in hundreds of applications, such as POS equipment, intelligent terminals, analytical instruments, process controls, communications systems, rapid transit toll systems, word processors and business equipment.



Today, Intel delivers five microcomputer system families. Four are based on MOS central processor units and the fifth on Series 3000 Schottky bipolar LSI central processor elements. All the microprocessors are supported with optional I/O, peripheral and memory building blocks, which provide a large variety of system configurations in each family.

As indicated by the graph above, Intel systems cover the broadest possible cost-performance range. This lets you produce the most cost-effective design, whether your application calls for low cost replacement of electromechanical controls or high performance processing.

Why more engineers choose the 8080 system.

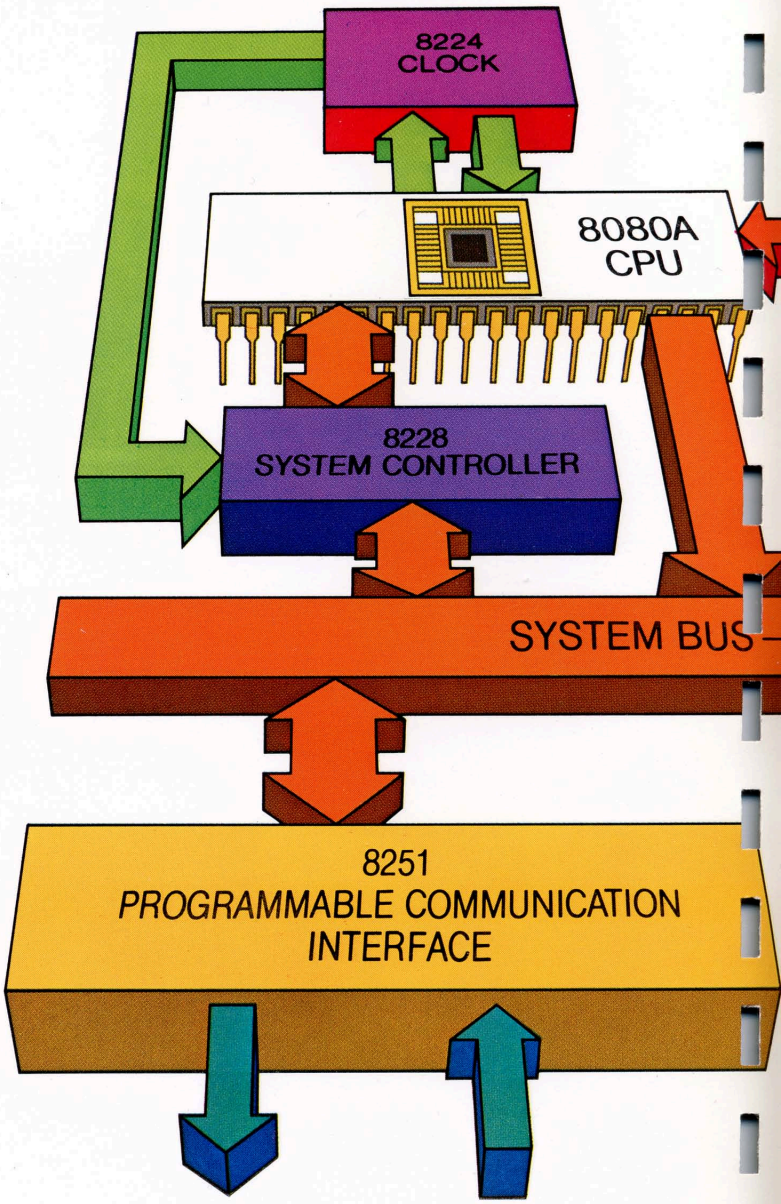
The broad center of the microcomputer cost-performance range is covered by the Intel® 8080 system—the 8080A CPU, other MCS-80™ system components, and nine software packages. First delivered in December, 1973, the 8080 system has become the basis for more new OEM products than all other microcomputers combined.

Some major reasons for the 8080 system's popularity are a powerful CPU group with four CPU options, five programmable I/O and peripheral devices, 21 other system components, production deliveries since April, 1974, major second sources, and the industry's most useful software and hardware development systems. These add up to higher profitability for the 8080 user.

How the 8080 system increases your profitability.

MCS-80™ systems feature a simple building block architecture and high performance, enabling them to replace hundreds of TTL packages and numerous discrete components in a great variety of control and processing applications.

With MCS-80™ building blocks, complete LSI systems are easy to design, program and modify. As a result, the 8080 system helps you get new products to market faster and at lower cost; sharply reduces documentation, production and maintenance overhead; and simplifies enhancement of your product line to meet changing market conditions.



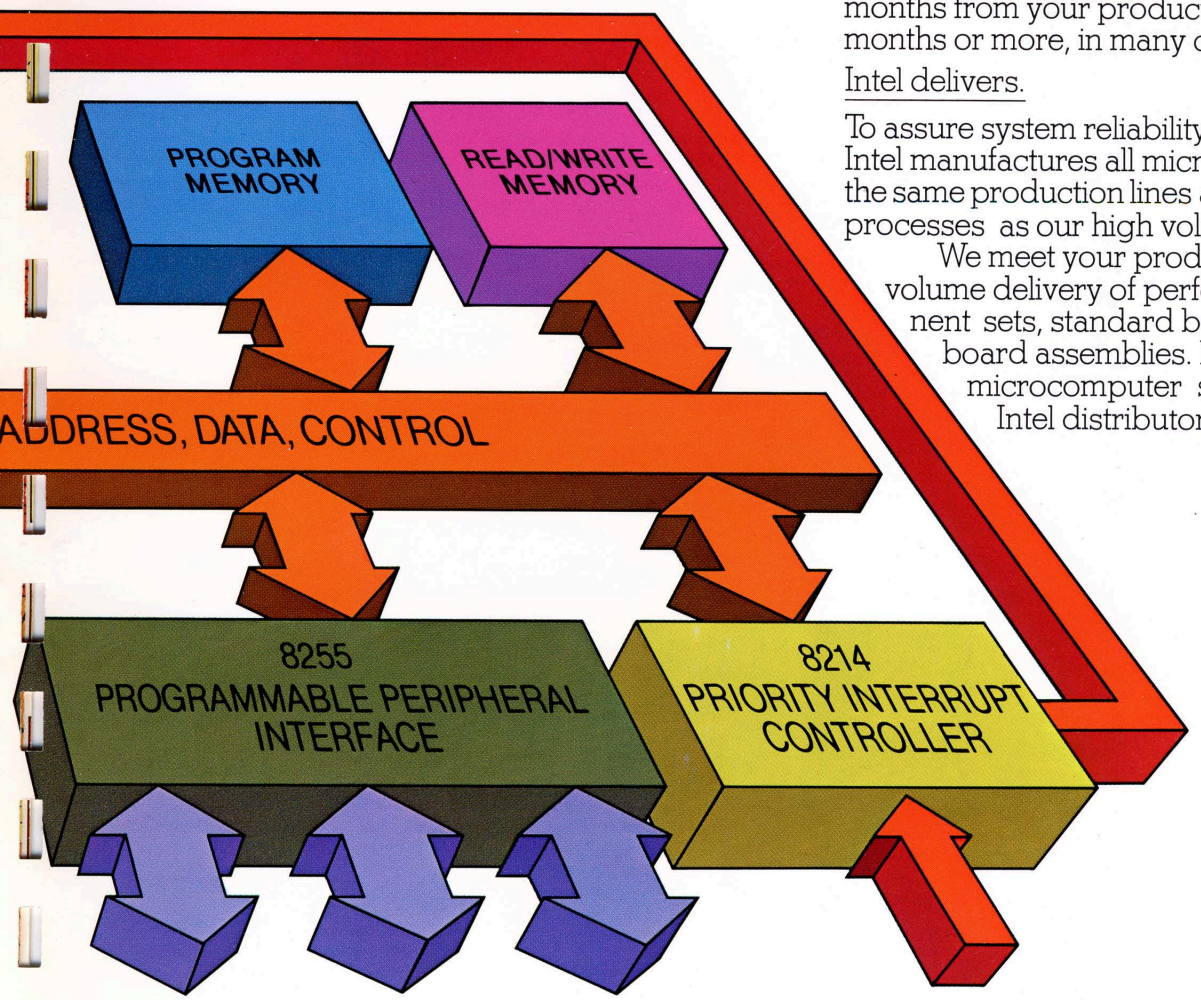
The system's completeness solves design problems.

MCS-80™ components form complete systems with many optional configurations. They eliminate the problems of hardwired design by integrating control and processing functions in LSI blocks that interface with one another through a standard system bus.

The systems building blocks include:

- The basic CPU Group, which defines and drives the bus—the 8080A CPU, 8224 Clock Generator and 8228 System Controller.
- Three CPU options for higher speed and extended temperature range applications.
- Twelve I/O and peripherals options, five are programmable LSI devices that control and communicate with external equipment in software selectable modes.
- Thirteen memory options, including 8K erasable PROMs, 16K ROMs, low power 1K CMOS RAMs, and low cost 4K RAMs—all with industry standard configurations for ease of use and economy.

You choose the blocks, program the CPU, check out the hardware and software, and then make the program part of the system by storing it in read-only memory. A program change is usually the only modification required to adapt the microcomputer system to changes and enhancements of your product line.



Intel support minimizes development time.

Intel has supported designers of microcomputer based products since 1971. Today, we back 8080 system users with:

- A third-generation microcomputer development system—the Intellec® MDS-800. It is the first system to support simultaneous development of hardware and software. Moreover, with the MDS-800 you can now develop your system in its actual operating environment.
- Nine software packages—six Intellec® resident products and three cross products for rapid program design with symbolic and high level languages.
- System design kits—the new MCS-80™ kit provides a complete system's hardware, circuit card, control program and documentation.
- Seven reference and programming manuals—complete documentation of 8080 hardware, software and development systems.
- User's program library—over a hundred programs developed by 8080 system users.
- Training for engineers and programmers—courses and workshops at Intel regional centers, or on-site.
- Applications assistance—provided in the field by the industry's most experienced staff.

These systems and services eliminate repetitious debugging and help prevent false starts. They can cut months from your product development cycle—six months or more, in many cases.

Intel delivers.

To assure system reliability, economy and delivery, Intel manufactures all microcomputer components on the same production lines and with the same processes as our high volume memory products.

We meet your production requirements with volume delivery of performance matched component sets, standard board systems, or custom board assemblies. In addition, we stock microcomputer systems world-wide at Intel distributors.

The most complete hardware system.

MCS-80™ system components are performance matched to make system design, assembly and modification as easy as possible. Higher performance options include CPU instruction cycle times down to 1.3 microseconds or operation at −55 to +125°C.

The components interface with each other through a standard system bus, defined and controlled by the CPU Group. The group simplifies timing throughout the system by making all CPU inputs asynchronous in nature. Combined with performance matching, this approach results in a simple, building block architecture.

To provide complete systems in scores of configurations, there are 27 I/O, peripherals and memory options. You just choose the blocks needed to interface, control and communicate with external equipment and connect them to the bus. All major blocks are software-configurable, so changes in product models usually require little or no change in an MCS-80™ system's hardware design.

Start with the powerful CPU Group.

The bus drive and system controls required for simple interface are built into the CPU Group, along with the auxiliary timing and control functions most designs require. Simple interface and high performance are assured by the use of two LSI technologies: silicon gate n-channel MOS in the 8080A CPU, and Schottky bipolar in the 8224 Clock Generator and 8228 System Controller.

The 8080A CPU is a byte processor with vectored interrupt, unlimited subroutine nesting and direc addressing of up to 512 I/O lines and 65 kilobytes of memory. An 8080 system can operate with almost an

	Part No.	MCS-80 System Components Descriptio
CPU GROUP	8080A 8224 8228	8 bit CPU, 2 μsec Cycle Clock Generator System Controller
CPU OPTIONS	8080A-1 8080A-2 M8080A	1.3 μsec cycle 1.5 μsec cycle 2 μsec cycle (−55 to +125°C)
I/O	8212 8251 8255	8-bit I/O Port Programmable Communications Interface Programmable Peripheral Interface
PERIPHERALS	8205 8210 8214 8216 8226 8222 8253 8257 8259	1 of 8 Binary Decoder Dynamic RAM Driver (8107B) Priority Interrupt Control Unit Bidirectional Bus Driver Bidirectional Bus Driver Dynamic RAM Refresh Controller (8107B) Programmable Interval Timer Programmable DMA Controller Programmable Interrupt Controller
PROMs	8604 8702A 8704 8708	512 x 8, 100 ns 256 x 8 Erasable, 1.3 μs 512 x 8 Erasable, 450 ns 1K x 8 Erasable, 450 ns
ROMs	8302 8308 8316A	256 x 8, 1μs 1K x 8, 450 ns 2K x 8, 850 ns
RAMs	5101 8101-2 8102A-6 8102A-4 8111-2 8107B	256 x 4 Static CMOS, 650 ns 256 x 4 Static, 850 ns 1K x 1 Static, 650 ns 1K x 1 Static, 450 ns 256 x 4 Static, Common I/O, 850 ns 4K x 1 Dynamic, 420 ns

number of peripherals because the CPU is ideal for applications involving multilevel priority interrupts and DMA (direct memory address).

The crystal controlled 8224 generates TTL & MOS clocks, power-on reset and other timing functions. A high current, bidirectional bus driver and single-level interrupt control are integrated with the asynchronous bus control logic in the 8228 System Controller.

Add more versatile I/O and peripheral blocks.

The system's five programmable I/O and peripheral blocks eliminate the hardwired design normally required to operate external equipment. Each is a general purpose replacement for up to 75—or more—TTL packages.

System software can reconfigure these blocks "on the fly," dynamically adapting the system to changes in control and communications modes, interrupt priorities and other functions. Or, you can program predefined modes. Either way you get a lower cost, more versatile system with minimum inventory requirements.

Large system requirements for additional bus drive and expansion of memory and I/O are handled by Schottky bipolar components.

For maximum economy and ease of use, all MCS-80™ memory circuits have industry standard configurations. They are Intel standard products, selected for lowest cost and matched to system performance. The 15 options range from low power CMOS RAMs to high density PROMs and ROMs.

Built into the CPU Group are the extra functions most designs require, as well as central logic and bus control:
- TTL & MOS crystal controlled clocks for system timing.
- Auxiliary timing functions and single level interrupt control.
- High current sinking capability to keep memory and I/O interfaces simple regardless of system size.

Implements virtually any 8-bit I/O function with parallel latch/buffer and bus service request logic, Schottky bipolar for 15 mA output drive.

Operates under program control in virtually all serial data transmission protocols in use today, including IBM Bi-Sync.

Three 8-bit ports, software configurable for interface to printers, keyboards, displays, motor drives . . .

Expands memory and I/O address capability, Schottky bipolar for high speed.

High voltage clock driver and quad address driver, two enable inputs simplify address or data decoding.

Provides eight levels of interrupt control, cascades for simple expansion, current status register saves memory.

Non-inverting 4-bit, Schottky bipolar driver, 50mA outputs drive long bus lines and terminations.

Inverting version of 8216 Bidirectional Bus Driver.

Controls refresh of large, asynchronous dynamic RAM system, has adjustable control oscillator and internal address multiplexer.

Controls three active intervals with independent 16-bit counters at DC to 3 MHz, counts binary or BCD.

Provides four channels of priority DMA request logic for direct access of peripherals & memories.

Eight-level interrupt controller, priority algorithms can be varied with software, expandable to 64 levels.

All PROMs can be automatically programmed with the Intellec® MDS PROM programmer peripheral.
- High speed programming—1ms/bit for 8604 bipolar Schottky PROM, and 8704, 8708 reprogrammable MOS PROMs.
- All 2048 bits of 8702A reprogrammable MOS PROM can be programmed in 2 minutes.

8302 2K ROM directly replaces 8702A PROM
8308 8K ROM directly replaces 8704 or 8708 PROMs
High density program storage with 8316A 16K ROM

CPU interfaces directly with static RAMs.
- 5101 CMOS RAM reduces standby power to 75nW/bit.
- Static RAMs are the low-cost, easy to use approach for small and medium systems.

Dynamic 4K RAM reduces cost and improves speed of large systems.
- System design simplified by use of Intel drivers and refresh controllers.

The most useful development systems.

Intel supplies 8080 system users with the industry's most advanced development and software systems, complete documentation, design kits, training courses and application assistance. They support product development from initial concept through prototyping and into production.

Intellec® MDS-800 microcomputer development system.

Months can be cut from a product development cycle with the Intellec® MDS-800. It provides all the programming, prototyping and diagnostic resources required for rapid development. It also serves as an automated instrument for troubleshooting production assemblies and for field engineering and programmin

As the first system to support simultaneous development of software and hardware, the Intellec® MDS-800 makes it practical to integrate hardware/software development early in the cycle. Furthermore, prototypes can be debugged in the actual product environment with the In-Circuit Emulator. These advances eliminate repetitious debugging and virtually guarantee that production models will operate properly

8080 software packages work as a system.

Choose the optimum method of programming your system.

Compose programs with an efficient, symbolic assembly language. The Intellec® MDS-800 and resident software translate the programs into code and provide real-time emulation on 8080 hardware for checkout.

MICROCOMPUTER DEVELOPMENT SYSTEM	Intellec® MDS	With its ICE-80 In-Circuit Emulator module, the Intellec® MDS supports programming, prototyping and hardware/software debugging in the product's own environment. The mainframe is an 8080 system with expandable memory and I/O, DMA, interrupt logic, multiprocessor bus, clocks, and power supplies. Peripherals include diskette system, bipolar ROM simulator, universal PROM programmer, high speed paper tape reader, and standard interfacing for a CRT console, teletype-writer, high speed tape punch and line printer.
COMPREHENSIVE SOFTWARE PACKAGES	System Monitor	Supports the system's comprehensive diagnostic aids, controls the system and drives peripherals. Enables programs to be checked out in real time and supports simultaneous software/hardware debugging. Allows use of Intellec® MDS-800 hardware as prototyping resources, provides linkage to special peripherals, and loads developed programs into PROMs via PROM programmer.
	Macro Assembler	You can compose 8080 programs in a symbolic assembly language, which the macro assembler translates to machine code. There's no need to rewrite similar program segments. Like MAC-80, this package provides full macro and conditional assembly capabilities.
	Text Editor	A comprehensive tool for program entry and correction. Edits characters or lines of text. Commands include string search, substitution, insertion and deletion. The monitor provides I/O and other facilities required for easy entry and editing.
	DOS	Intel's new diskette operating system substantially reduces the time required to assemble, edit and execute programs. It's comprehensive file management capabilities enable program and data files to be represented symbolically. Disk files can be created, edited, assembled and executed easily and quickly, through simple commands from the system console.
	ICE-80	The In-Circuit Emulator ICE-80 provides a unique powerful tool for total hardware/software system debug through the Intellec® MDS. ICE-80 allows all the resources of the MDS to be used directly in the prototype environment to run it, debug it and perform final production and field testing. It also allows software to be developed simultaneously with the prototype and to run on the prototype from the earliest possible time.
	ROM-SIM	The Rom Simulator is a high speed, random access memory which simulates Intel bipolar PROMs and ROMs. Its 130 ns access time eliminates the necessity to program and use bipolar PROMs/ROMs when ultra high speed memory is required during prototype development.

TRAINING	Intel regional training centers give courses in system design and programming, and also conduct weekly workshops that provide hands-on experience. On-site courses and seminars are also available.
APPLICATIONS ASSISTANCE	Call the nearest Intel sales office. Assistance is available in the field through Intel field applications engineers and field marketing engineers.
PRODUCTION SUPPORT	Intel delivers standard subsystems, standard boards and custom boards, as well as system components. Standard products are stocked world-wide at Intel distributors.

Design your software rapidly with Intel's PL/M high level language or cross macro assembler and simulator, using your own large computer or a time shared network.

Combine both methods. The resident and cross products work together as a system, using fully compatible assembly language and producing machine code which may be loaded on the Intellec® MDS-800.

Many 8080 system programmers prefer the third approach, since it allows high level design to be done with minimum computer charges and retains the advantages of integrated software/hardware development with the Intellec® MDS-800.

Design kits: the easiest way to get started.

The MCS-80™ System Design Kit contains all the components of a basic 8080 system, all board assembly parts including the PC board, a control program, and design manuals.

To order the MCS-80™ Design Kit call your nearest Intel franchised U.S. distributor: Almac/Stroum, Component Specialties, Cramer, Elmar, Hamilton-Avnet, Industrial Components, Liberty, Pioneer, Sheridan or L.A. Varah. In Europe or the Orient, contact the Intel Marketing Office listed in this brochure for the name of your nearest Intel distributor.

Intellec® MDS Development Systems, software and all documentation are available now.

MCS-80 SYSTEM DESIGN KIT

This kit contains all the components and software required to assemble and operate a basic 8080 system:

- CPU Group (8080A, 8224, 8228)
- Two Programmable I/O blocks (8251 and 8255)
- Two decoders (8205)
- PROM and RAM memory (8708, two 8111)
- Printed circuit board and connectors
- Clock crystal and other required components
- Control program (monitor stored in ROM)
- 8080 system user's and programming manual

CROSS PRODUCT SOFTWARE

		Time Sharing Networks
PL/M™ Cross Compiler	Developed by Intel in 1973, PL/M is the only high level program language for microcomputer system software design. It has significantly reduced programming costs. It produces code that can be stored in ROM. Should you ever need to use machine language coding, PL/M also provides the mechanism for linking to assembly language routines.	United States: United Computing GE Tymshare Europe: Tymshare Timesharing LTD Honeywell Japan: Dentsu Canada: GE Australia: Honeywell
MAC-80 Cross Assembler	This powerful macro assembler simplifies software design and eliminates the need to write redundant code. It has full macro capability, coupled with conditional assembly directives. The assembly language is fully compatible with the Intellec® resident assembler.	
INTERP/80 Simulator	INTERP/80 helps you to quickly debug your programs. It enables computers to simulate program execution by the 8080A CPU. The package has complete debugging facilities, including all timing details, breakpoints, full file buffered I/O, and a host of commands that permit you to examine and modify program execution.	
Availability	All three cross products are written in ANSI standard FORTRAN IV. All run on medium or large scale computers, 32-bit Integer format. They can be purchased from Intel on magnetic tape or used via the computer time sharing networks listed at the right.	

USER'S LIBRARY

This large library contains hundreds of 8080 programs, such as floating point math package, multiple precision arithmetic routines, a quick-sort program, a floating point I/O conversion package, BCD to/from binary, binary to ASCII and gray to binary conversion. Members receive a manual documenting programs in the library, plus frequent updates. Memberships are free to users who submit accepted programs.

DOCUMENTATION

- 8080 Microcomputer Systems User's Manual*
- Intellec® MDS Hardware Reference Manual
- Intellec® MDS Operator's Manual**
- 8080 Assembly Language Programming Manual**
- PL/M Programming Manual
- MAC-80 User's Manual
- INTERP/80 User's Manual

*Includes MCS-80™ system design information and data sheets for system components.
**Also documents resident software.