HEWLETT PACKARD

Series 80 Personal Computer Enhancements

Expanding your computing capabilities

Put Your Series 80 Personal Computer In Control

You can make your Series 80 personal computer the center of a large, sophisticated system with the help of Series 80 enhancements. Whether you want to interface your computer with a printer or plotter, or control as many as 13 high-technology instruments at once, Hewlett-Packard's Series 80 products supply you with the programming tools you need. Use HP firmware products and interfaces to connect your personal computer to:

- Printers
- Graphics devices
- Mass storage units
- Instruments for measure analysis, and data collection

Series 80 enhancements include read-only-memories (ROM's), interfaces, data communications products, a CP/M® module, and special programming aids.

ROM's. ROM's are firmware modules that plug easily into the computer via the HP 82936A ROM Drawer. You can use HP ROM's to integrate peripherals into a Series 80 system or to enhance the capabilities of Series 80 software.

Interfaces. Interfaces link peripherals to Series 80 mainframes or help you set up input/output (I/O) control systems suited to many applications. These devices relieve you of complex interfacing so you can concentrate on solving problems and accomplishing tasks.

Data Communications. The Series 80 Modem gives you the capability to communicate with industrial data bases and commercial time-share services. HP's Data Communications Pac is your answer when you must transmit large amounts of information to other computers at high speeds.

CP/M® System. With an HP 82900A CP/M System, you open the door to a whole new world of software solutions. The CP/M operating system also gives you ready access to other computer languages, including PASCAL and FORTRAN.

Special Programming Aids. Special firmware programming aids can enhance the capabilities of HP BASIC and give you added power in the development and debugging of Assembly language programs.

Series 80 Personal Computers. Before getting into specifics on the products mentioned above, let's take a quick look at the foundation of the Series 80 family, the powerful HP-85, HP-86, and HP-87 Personal Computers.

HP-85. The HP-85 is an integrated system, complete with tape drive, CRT display, thermal printer, built-in memory, and an HP BASIC operating system. All of this is designed into a portable 20-pound package that you can take with you wherever you go.

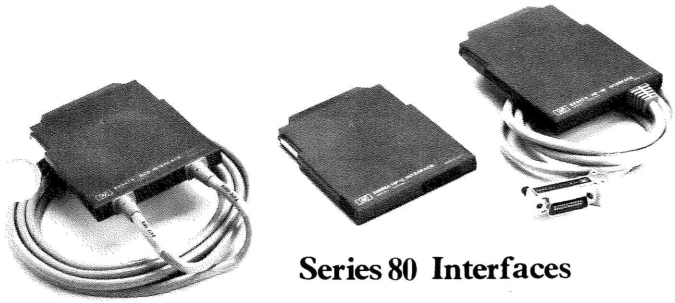
HP-86. If you need a modular system, start with the HP-86. This newest member of HP's Series 80 family is a cost-effective personal computer that gives you flexible problem-solving power. The HP-86 has 64K bytes of built-in user memory, expandable to 576K bytes. Dedicated disc and printer interfaces are built into the HP-86 to make system configuration easy and low-cost.

HP-87XM. The HP-87XM Personal Computer tops the Series 80 line with 128K bytes of built-in user memory. This RAM can be expanded to as much as 640K bytes for the computing power you require to solve your toughest problems. And, if you need a large, complex system, the built-in HP-IB interface simplifies connections to Series 80 peripherals and numerous instruments or data collection devices. The HP-87XM also features an integrated, high-resolution CRT that is perfect for displaying graphics.

For more information about Series 80 systems and what they can do for you, ask to see the following literature at your HP dealer or HP sales office:

- Series 80 Personal Computer Systems brochure
- Series 80 Personal Computer Software brochure
- Series 80 Software Catalog
- Series 80 Price List

Table Of Contents



Series 80 Interfaces

Series 80 Interfaces

HP 82937A HP-IB Interface

The HP-IB is an easy-to-use hardware and software interface system that permits bidirectional, asynchronous communication among a wide variety of instruments and peripherals. It implements the IEEE 488-1978 Standard Digital Interface for Programmable Instrumentation and allows your mainframe to communicate with as many as 14 HP-IB compatible instruments per interface, with a total of up to 20 meters of cable. A unique three-wire handshake allows the bus to communicate at a speed that all listening devices can maintain. (If a slow device is not addressed, it will not hamper the speed of the remaining devices.) The HP-IB uses an interface processor for efficient management of the interface bus protocol.

Specifications

DATA INPUT/ OUTPUT . . . . . eight bidirectional data lines

CONTROL LINES. . . . . three-line handshake (DAV, NRFD, NDAC)

INTERFACE MANAGEMENT five lines (IFC, ATN, SRQ, REN, EOI)

INTERFACE FUNCTIONS

Level of implementation in terms of IEEE 488-1978 mnemonics follows. The Device Trigger, Device Clear, and Remote/Local state responses are achieved by programming the mainframe for end-of-line interrupts on those conditions.

Source handshake SH1
Acceptor handshake. AH1
Talker. T6
Listener L4
Service request. SR1
Remote/Local RL1
Parallel poll PP2
Device clear DC1
Device trigger. DT1
Controller:
- System control C1
- IFC & Take charge. C2
- REN C3
- Respond SRQ C4
- Miscellaneous control. C5

Extended talker. . . . . TE0†
Extended listener . . . . . LE0†

†The HP-IB allows for interrupts on secondary commands. This lets a user program the mainframe to respond to TE4 and LE2 extended talker and listener.

TRANSFER RATES (maximum)

Type	Input (bytes/sec)	Output (bytes/sec)
TRANSFER INTR	400	400
ENTER & OUTPUT	1.4K	3K
TRANSFER FHS	26.2K	25.5K

ADDRESSING

There are 32 valid addresses, 0 through 31. (Electrically, IEEE 488 systems can support only 15 devices including the controller.)

INTERRUPT CAPABILITY (with I/O ROM)

Active controller
Active talker
Active listener
Service request (SRQ)
Interface clear (IFC)
Device clear (DCL, SDC)
Device trigger (GET)
Secondary command (SCG)

SWITCH CONFIGURATION

The following switches can be configured by opening the interface:
- Select code
- Interface bus address
- System controller

JUMPER CONFIGURATION

The HP 82937A can be configured by a jumper wire to respond to a parallel poll. The designated bit is then asserted in response to a parallel poll when the interface is asserting SRQ. The card is configured with a parallel poll response on bit 0 of the data lines.

ACCESSORIES

The HP 82937A is shipped with a 2-m (6.6-ft) interface cable terminated with the standard HP-IB connector and metric fasteners. Additional lengths of interface cables can be purchased.

HP-IB INTERFACE STATEMENTS

The I/O ROM adds a set of statements to the mainframe that accesses capabilities determined by the interface being used. The following describes how the HP-IB Interface interprets these statements.

ABORTIO—Sends Interface Clear if system controller, else sends My Talk Address if active controller, else stops handshaking data.
ASSERT—Provides access to bus management lines.
CLEAR—Sends Selective Device Clear or Device Clear.
HALT—Stops an interrupt type TRANSFER.
LOCAL—Go To Local or Remote Disable.
LOCAL LOCKOUT—Sends Local Lockout message.
PASS CONTROL—Passes active control.
PPOLL—Returns the value of a parallel poll.
REMOTE—Remote Enable.
REQUEST—Allows the programmer to set service request line and the serial poll response byte.
RESUME—Drops the attention line (ATN).
SEND—Allows sending of arbitrary data/ command sequences.
SPOLL—Returns the value of a serial poll.
TRIGGER—Sends Group Execute Trigger.

STATUS REGISTERS—7

One each for bus address, system controller setting, card state (talker, listener, etc.), received secondary command, state of data and control lines, card identification number* (1 for HP-IB), and interrupt cause register.*

CONTROL REGISTERS—12

One each for parity, HP-IB data lines, control lines, interrupt mask,* end-of-line character count,* and seven registers for the end-of-line characters* (end-of-line sequence is sent at end of each OUTPUT or TRANSFER).

NOTE: An HP-IB Interface with all of the above-mentioned capabilities is built into the HP-87 Personal Computer. An HP-IB cable is included with the HP-87.

*Common to all Series 80 I/O interfaces.

HP 82939A Serial Interface (RS-232C)

The Serial Interface is the RS-232C compatible interface for Series 80 personal computers. It provides bit-serial asynchronous data communication and is a common means of communicating between a computer and peripherals such as terminals and printers. The Serial Interface is also common in applications where two computers are communicating, such as remote data acquisition. This interface supports operation with a Series 80 mainframe acting as the computer or as the peripheral. It also supports current-loop operation—a mode of serial operation used by devices such as mechanical teletypes. Information can be sent and received (in true full-duplex mode) in EIA RS-232C compatible voltage levels or with 20-mA current loop configurations. Two 20-mA current sources in the interface allow connection to virtually any current loop device. Terminal emulation using the Serial Interface is available with HP Series 80 Data Communications software (00085-13044).The HP 82939A uses an interface processor to provide efficient management of the Serial Interface.

Specifications

DATA RATES AND FORMATS

All signals present at the connector conform electrically to EIA RS-232C and CCITT V .24 specifications. The interface operates in an asynchronous mode providing 5-, 6-, 7- or 8-bit data formats with 1 or 2 stop bits and odd, even, zero, one, and no parity modes.

Standard data rates available are:

50	75	110	134.5
150	200	300	600
1200	1800	2000	2400
3600	4800	7200	9600

In addition to these standard baud rates, the user can select one from a set of 65,533 different baud rates ranging from 1.76 baud to 38,400 baud. The standard baud rates are either switch selectable or programmable. The optional 65,533 baud rates are only programmable.

MODEM CONTROL LINES—6

RTS—Request To Send
CTS—Clear To Send
DSR—Data Set Ready
DTR—Data Terminal Ready
DCD—Data Carrier Detect
DRS—Data Rate Select

TRANSFER RATES (maximum)

Type	Input (bytes/sec)	Output (bytes/sec)
TRANSFER INTR	1K	400
ENTER & OUTPUT	1.4K	1.5K
TRANSFER FHS	none	none

These data rates mean that the Serial Interface can support incoming data rates of 9,600 baud (with interrupt mode transfers) and 15,000 baud with ENTER (into a string variable).

ADDRESSING

The I/O ROM allows address information to be sent to all interfaces. The HP 82939A Serial Interface does not use this addressing information and will generate an error if used.

INTERRUPT CAPABILITY (with I/O ROM)

BREAK received
Framing error
Parity error
Received data available
Auto disconnect
Change of modem line DCD or RTS:
  Data Carrier Detect (on Opt. 001 interface)
  Request To Send (on standard interface)
Change of modem line DSR or DRS:
  Data Set Ready (on Opt. 001 interface)
  Data Rate Select (on standard interface)
Change of modem line CTS or DTR:
  Clear To Send (on Opt. 001 interface)
  Data Terminal Ready (on standard interface)

SWITCH CONFIGURATION

The following switches can be configured by opening the interface:

Select code	Parity
Baud rate	Auto handshake
Line characteristics	

OPTIONS

The HP 82939A is shipped with a 2-m (6.6-ft) interface cable terminated with the standard RS-232C female (DCE) connector. The HP 82939A Opt. 001 is shipped with a 2-m (6.6-ft) interface cable terminated with a RS-232C male (DTE) connector. The HP 82939A Opt. 002 is shipped with a 4-m (13.1-ft) unterminated interface cable for current loop operation.

SERIAL INTERFACE STATEMENTS

The I/O ROM adds a set of statements to the mainframe that accesses capabilities determined by the interface being used. The following describes how the Serial Interface interprets these statements.

ABORTIO—Aborts all TRANSFERs in progress (to the specified card) and drops all modem lines.
ASSERT—Writes into modem control register.
HALT—Aborts all TRANSFERs in progress (to the specified card) but leaves all modem lines unchanged.
REQUEST—Sends a BREAK using the parameter to determine the length of the BREAK.
RESUME—Enables the transmitter.
SEND—Sends arbitrary data sequences.

CONTROL AND STATUS REGISTERS

The HP 82939A Serial Interface has 12 status registers and 22 control registers implemented. The status registers include direct state of the modem control lines, cable type, line characteristics (parity, number of bits/character, number of stop bits), current 16-bit baud rate divisor, reason for termination of ENTER or TRANSFER, card identification number* (2 for serial) and the interrupt cause register.*

The 22 control registers consist of standard baud rate selection, line characteristics selection, 16-bit baud rate divisor selection (for non-standard baud rates), direct control over the modem lines, termination character selection for up to four different characters, interrupt mask,* seven end-of-line characters,* and the end-of-line character count.* (The end-of-line sequence is sent at the end of each OUTPUT or TRANSFER.) One of the registers allows for a replacement character to be sent to the mainframe when an incoming character has a parity or framing error.

*Common to all Series 80 I/O interfaces.

HP 82940A GPIO Interface (Parallel)

The GPIO Interface is a general purpose byte (8-bit) or word (16-bit) oriented interface. It has two output-only 8-bit ports and two bidirectional 8-bit ports. They can be used as separate 8-bit ports or as 16-bit ports. The parallel interface is commonly used with printers, paper tape readers, paper tape punches, card readers, and special instrumentation.

The HP 82940A provides the mainframe with 16 bits of latched output data and 16 bits of bidirectional data (latched output, non-latched input). The HP 82940A uses an interface processor for efficient management of the interface.

Specifications

DATA INPUT/OUTPUT

There are 16 bidirectional data lines and 16 output-only data lines. The output-only lines provide high current capability, using open-collector transistors.

ELECTRICAL CHARACTERISTICS

Electrical Characteristics for Bidirectional Lines
(Input characteristics also apply to FLG and ST lines)

Parameter	Min.	Max.	Units
Input Low Voltage	0.0	0.8	V
Input High Voltage	2.0	5.0	V
Input Low Current		0.6	mA
Output Low Voltage @ 4.5 mA		0.45	V
Output High Voltage @ −450 µA	2.4		V
Output Low Current		4.5	mA
Output High Current		−450	µA

Electrical Characteristics for Output-Only, CTL, $\overline{\text{OUT}}$, and $\overline{\text{RES}}$ Lines

Parameter	Min.	Max.	Units
Output Low Voltage @ 20 mA		0.5	V
Output High Voltage (open collector)		5.0	V
Output Low Current		20	mA
Output Leakage Current		40	µA

CONTROL LINES

Twelve lines provide control information beween the peripheral and the computer. The outgoing lines are electrically equivalent to the open-collector, output-only data lines. The incoming lines are electrically equivalent to the bidirectional data lines. The control lines and their meanings are:

$\overline{\text{OUTA}}$, $\overline{\text{OUTB}}$—Indicates the direction of the data transfer on ports A and B.
CTLA, CTLB, CTL0, CTL1—Indicates that the computer is ready for input or that data is ready for output.
FLGA, FLGB—Indicates that the peripheral has completed its operation.
ST0, ST1—Indicates that the peripheral has completed its operation.
$\overline{\text{RESA}}$, $\overline{\text{RESB}}$—Used to reset peripherals under program control.

TRANSFER RATES (maximum)

Type	Input (bytes/sec)	Output (bytes/sec)
TRANSFER INTR	400	400
ENTER & OUTPUT	1.4K	3K
TRANSFER FHS	18K	19K

ADDRESSING

The I/O ROM allows address information to be sent to all interfaces. The HP 82940A GPIO Interface uses this addressing information to select which port is being used for the data transfer, the width of the data path (8 or 16 bits), and which handshake lines are to be used. There are a total of 16 valid addresses—0 through 15.

INTERRUPT CAPABILITY (with I/O ROM)

FLGA
FLGB
ST0
ST1
Received parity error

SWITCH CONFIGURATION

The following switches can be configured by opening the interface:

Select code
Data line sense
Flag line sense
Control line sense
Handshake mode
Output enable
Address

GPIO INTERFACE STATEMENTS

The I/O ROM adds a set of statements to the mainframe that accesses capabilities determined by the interface being used. The following describes how the GPIO interface interprets these statements.

ABORTIO—Aborts current TRANSFER; returns handshake lines to their idle state.
ASSERT—Allows access to control lines.
CLEAR—Sets RESET-A or RESET-B line.
HALT—Stops an interrupt TRANSFER leaving handshake and data lines undefined.
SEND—Sends arbitrary data sequences.

CONTROL AND STATUS REGISTERS

The HP 82940A GPIO Interface has ten status registers and 18 control registers implemented. The status registers allow for reading back the values of control registers. The interface identification number (4 for parallel) and the interrupt cause register complete the set. The control registers allow direct access to CTL and RESET lines, logic sense (for FLG, CTL, data lines) and handshake mode. Control registers also allow skipping incoming characters until a character meets a relation (<, =, > or some combination of conditions) with a trigger character. Also included are the registers for interrupt mask, seven end-of-line characters, and the end-of-line character count. (The end-of-line sequence is sent at the end of each OUTPUT or TRANSFER.)

HP 82941A BCD Interface (Binary Coded Decimal)

The BCD Interface supports interfacing with BCD instrumentation. A BCD instrument presents digits on a set of parallel lines. Common instruments with BCD interfaces are voltmeters, multimeters, medical equipment, and weighing systems. The HP 82941A provides the mainframe with 11 digits of 4-bit BCD input or output data plus four sign bits for one or two channels. It uses an interface processor to provide efficient management of the interface and can achieve data transfer rates of up to 1.4K readings/sec.

Specifications

DATA INPUT/OUTPUT

Twelve bidirectional ports, of four lines each, provide data input and output.

Electrical Characteristics for Data Lines

Parameter	Min.	Max.	Units
Input Low Voltage	0.0	0.8	V
Input High Voltage	2.0	5.0	V
Input Low Current		0.6	mA
Output Low Voltage @ 4.5 mA		0.45	V
Output High Voltage @ –450 µA	2.4		V
Output Low Current		4.5	mA
Output High Current		–450	µA

CONTROL LINES

Six lines allow for control information to be passed between the peripherals and the computer. The output control lines are implemented with standard TTL gate 7405 open-collector drivers.

I/OA, I/OB—Indicates the direction of the data transfer on channels A and B.
CTLA, CTLB—Ready for input or output.
FLGA, FLGB—Peripheral has completed its operation.

ELECTRICAL CHARACTERISTICS

Electrical Characteristics for CTL and I/O Direction Lines

Parameter	Min.	Max.	Units
Output Low Voltage @ 13 mA		0.4	V
Output High Voltage @ -1.0 mA	2.4		V
Output Low Current		13	mA
Output High Current		–1.0	mA

Electrical Characteristics for FLG Lines

Parameter	Min.	Max.	Units
Input Low Voltage	0.0	0.8	V
Input High Voltage	2.0	5.0	V
Input Low Current		4.0	mA

DATA FORMATS

The HP 82941A supports a wide variety of user-configurable data formats and two predefined data formats:

Single channel . . . . 8-digit signed mantissa with 1-digit signed exponent and a 1-digit function code
Dual channel . . . . . each channel consists of a 4-digit signed mantissa and a 1-digit function code

TRANSFER RATES (maximum)

Type	Input (bytes/sec)	Output (bytes/sec)
TRANSFER INTR	400	400
ENTER & OUTPUT	1.4K	3K
TRANSFER FHS	20K	22K

ADDRESSING

The I/O ROM allows address information to be sent to all interfaces. The HP 82941A BCD Interface uses this addressing information to select which channel is being used for the data transfer and which of the fields are being read—numeric data (mantissa, exponent, and sign information) or function code. There are a total of seven valid addresses—0 through 6.

INTERRUPT CAPABILITY (with I/O ROM)

For each channel used, you can select an interrupt mask for the high order function digit from 16 possible masks. The event type interrupts on the BCD card are detected upon entering the function digits. These digits may be entered alone with apartial field specifiers 305 or 306, or with mantissa, exponent, and function digits with partial field specifiers 301 or 302. Exponent and function digits may also be entered through the default 300.

DEVICE CONTROL

The HP 82941A Interface allows the user to control a BCD device via one of the BCD digits. To OUTPUT control information to the device would require opening the card and reconfiguring it by setting a switch. To avoid this, Port 10, accessed via ASSERT, allows the user to control the device without this reconfiguration.

SWITCH CONFIGURATION

The following switches can be set by opening the interface:

Select code	Sign bits sense
Format	Control line sense
Handshake	Flag line sense
Data line sense	Output enable

BCD INTERFACE STATEMENTS

The I/O ROM adds a set of statements to the mainframe that accesses capabilities determined by the interface being used. The following describes how the BCD Interface interprets these statements.

ABORTIO—Aborts the current TRANSFER and returns the interface lines to a tri-state high impedance state.
ASSERT—Allows access to control lines and Port 10.
HALT—Stops any TRANSFER; leaves the handshake and data lines unchanged.
SEND—Sends arbitrary data sequences.

CONTROL AND STATUS REGISTERS

The HP 82941A BCD Interface has 11 status registers and ten control registers implemented. The status and control registers allow a user to set and examine the logic sense for the handshake, data digit, function digit, and sign bit lines. The registers also allow access to the number of digits allocated to channels A and B for the mantissa, exponent, and function. There are also two status registers common to all cards that contain the card identification number (3 for BCD) and the interrupt cause register. The common end-of-line count and character registers, and the interrupt mask register are not implemented on the BCD card.

HP 82949A Printer Interface

The HP 82949A Printer Interface permits Series 80 customers to drive printers requiring a standard parallel Centronics-type interface. This output-only interface consists of a plug-in module which is inserted into any of the rear ports of a Series 80 personal computer and a captive cable which is terminated by a standard Amphenol-type, 36-pin connector. A Centronics-type printer interface is built into the HP-86; HP-IB is built into the HP-87XM.

Specifications

CONTROL AND STATUS REGISTERS

The HP 82949A has ten control registers, three status registers, and one combined control/status register (register 3). Addressable control registers include enable and disable for printer fault interrupt, out-of-paper indicator, and select state interrupt, plus printer reset and handshake normalization. The status registers include interface identification, interrupt cause, and printer status registers.

ADDRESSING

With the HP-85, the HP 82949A requires one of two available ROMs: either the Plotter/Printer ROM (00085-15002) or the I/O ROM (00085-15003).

The Plotter/Printer ROM is recommended for use with the Printer Interface and HP-85. The Plotter/Printer ROM provides the ability to specify the peripheral printer as the destination device for all PRINT output and also allows certain formatting instructions to be programmed into the Printer Interface. The SET I/O statement enables the user to write to any of the ten control registers, registers 1, 2, and 16 through 23, and also to the control/status register 3.

With the HP-86 and HP-87, these capabilities are built in, so a ROM is not required for printing applications.

The CONTROL, ASSERT, and ENABLE INTR statements provided by the I/O ROM allow access to the interface control registers. The STATUS statement accesses status registers 1 and 2 (and control/status register 3). With the I/O ROM, the interface is capable of implementing a number of I/O operations consistent with its output-only, full handshake function. The I/O ROM cannot control the page width of the printer.

ELECTRICAL CHARACTERISTICS

Electrical Characteristics for Acknowledge, Out of Paper, Select, Fault Lines

Parameter	Min.	Max.	Units
Input Low Voltage	0.0	0.8	V
Input High Voltage	2.0	5.0	V
Input Low Current		0.4	mA

Electrical Characteristics for Strobe, Input Prime Lines

Parameter	Min.	Max.	Units
Output Low Voltage @ 16 mA		0.4	V
Output High Voltage @ −400 μA	2.4		V
Output Low Current		16	mA
Output High Current		−400	μA

Electrical Characteristics for Data 1-8 Lines

Parameter	Min.	Max.	Units
Output Low Voltage @ 24 mA		0.5	V
Output High Voltage @−15 μA	2.0		V
Output Low Current		24	mA
Output High Current		−15	mA

HP 82938A HP-IL Interface

HP-IL (Hewlett-Packard Interface Loop) is a bit-serial interface that combines low power, small size, and low cost. With HP-IL you can interface as many as 30 devices with up to 10 meters of cable between each device. The small two-wire cables are easy to use and connect. Three unique features of this loop structure are auto address assignment, device identification, and power ON/OFF control. The dynamic addressing abilities allow immediate re-configuration of your system. And, this loop structure is so versatile that you can even link an HP-41 handheld computer to your HP Series 80 personal computer system.

Specifications

TRANSFER RATES (maximum)

Type	Input (bytes/sec)	Output (bytes/sec)
TRANSFER INTR	400	400
ENTER & OUTPUT	1K	1K
TRANSFER FHS	3K	5K

ADDRESSING

There are 32 valid addresses, 0 through 31. The controller assumes address 0 and assigns addresses to devices in the loop.

INTERRUPT CAPABILITY (with I/O ROM)

Active controller
Active talker
Active listener
Service request (SRQ)
Interface clear (IFC)
Device clear (DCL, SDC)
Device trigger (GET)
Device dependent command (DDC)

SWITCH CONFIGURATION

The following switches can be configured by opening the interface:
Select code
System controller

ACCESSORIES

The HP 82938A is shipped with a 1-m (3.3-ft) interface cable terminated with the standard HP-IL connectors. Additional lengths of interface cables can be purchased.

HP-IL INTERFACE STATEMENTS

The I/O ROM adds a set of statements to the mainframe that accesses capabilities determined by the interface being used. The follow-

HP 82950A Modem

Series 80 Data Communications

SPECIFICATIONS, CONT.

ing describes how the HP-IL Interface interprets these statements.

ABORTIO—Sends Interface Clear if active controller, else stops handshaking data.
ASSERT—Provides direct access to loop.
CLEAR—Sends Selective Device Clear or Device Clear.
HALT—Stops a loop data transfer.
LOCAL—Sends Go To Local or Not Remote Enable.
LOCAL LOCKOUT—Sends Local Lockout message.
PASS CONTROL—Passes active control.
PPOLL—Returns the value of a parallel poll.
REMOTE—Sends Remote Enable.
REQUEST—Allows the programmer to set service request line and the serial poll response byte.
RESUME—Sends the Send Data (SDA) message.
SEND—Allows sending of arbitrary data/command sequences.
SPOLL—Returns the value of a serial poll.
TRIGGER—Sends Group Execute Trigger.

FRAMES SENT

Data or End—Sends or transfers data messages.
Commands—Perform interface functions such as Device Clear or Trigger.
Ready frames—Perform interface management such as starting and ending data transfers.
Identify—Aids parallel polling and helps to detect service request.

STATUS REGISTERS—8

One each for interrupt cause register,* received frame control bits, received frame data bits, loop address, interface state, received device dependent command, device count register, and interface identification.*

CONTROL REGISTERS—13

One each for interrupt mask,* control bits, data bits, loop address, asynchronous request enable, end-of-line count,* and seven registers for end-of-line characters (end-of-line sequence is sent at end of each OUTPUT or TRANSFER).

*Common to all Series 80 I/O interfaces.

HP 82950A Modem

The HP 82950A Series 80 Modem is a serial, asynchronous, full-duplex modem that lets you and your Series 80 personal computer become part of nationwide computer networks. Use the Modem and your Series 80 computer to communicate with industrial data bases or commercial time-sharing systems such as the Dow Jones News/Retrieval Service, The Source, and CompuServe. You can get timely production reports, send electronic mail to other computer users, or conduct literature research.

The Modem is easy to use, too. Simply plug it into one of the expansion slots in the back of a Series 80 computer and connect it directly to your telephone. Compared to modems that use acoustic coupler connections, you'll find this link to the telephone is easier to connect and use.

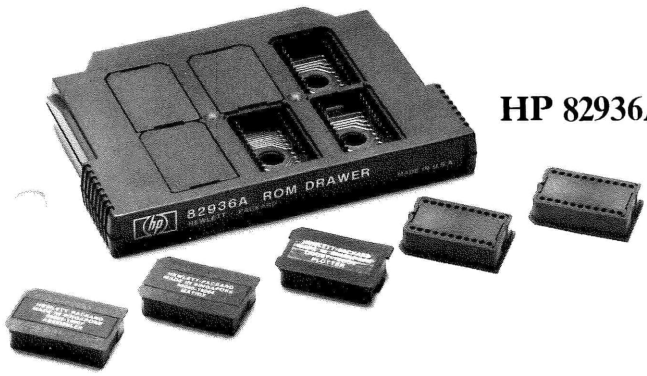
Menu-driven modem communications software that utilizes Series 80 soft keys is included with the Modem to put special functions at your fingertips. The HP 82950A Modem is compatible with Bell 103/113 modems and lets you communicate with the majority of time-sharing computers in the United States. It operates at speeds of 110 to 300 baud. Together, these features make the HP 82950A Modem an excellent choice for communications over the telephone lines.

HP Data Communications Software Pac

For hardwired (RS-232) data communications, the HP 82939A Serial Interface and Series 80 Data Communications software (00085-13044) combine to make a high-performance solution. You can use the Data Communications Pac when you need to send large amounts of information at high speeds to another computer system. For more information about this software product, consult the Series 80 Software brochure.

Specifications

Transmission mode	Serial, asynchronous, full duplex
Modulation	Binary phase coherent FSK
Baud Rate	Up to 300 bits/sec
Modes	Originate and answer
Modem Compatibility	Bell 103/113
Connectors	Two miniature six-position jacks with four conductors; one four-conductor cable with two miniature six-position plugs
Dialing	Automatic or manual
Dimensions	Approximately 16.5 x 12.7 x 3.2 cm (6.6 x 5.0 x 1.3 in.)
Cable length	210 cm (7 ft)
Operating temperature	0° to 55°C (32° to 131°F)
Storage temperature	–40° to 65°C (–40° to 150°F)
Ringer equivalence	1.0 B
Jacks which may be used	RJ11C and RJ11W RJ12C and RJ12W RJ13C and RJ13W



HP 82936A ROM Drawer

Series 80 ROM's

These enhancements include ROM's (read-only memories) and ROM drawers. HP ROM's are used to integrate peripherals into a Series 80 system or to enhance the capabilities of Series 80 software. These firmware modules plug into the computer via the HP 82936A ROM Drawer. The drawer fits any of the four computer ports and has slots for up to six ROM's. A Series 80 Personal Computer will accept only one ROM drawer at a time. In the descriptions that follow, please note that ROM's with a numerical prefix of 00085 are for the HP-85 Personal Computer only, while ROM's with a 00087 prefix operate only with the HP-86 and HP-87 Personal Computers.

HP Mass Storage ROM (00085-15001)

The Mass Storage ROM lets you interface your HP-85 Personal Computer with HP mass storage units for powerful storage capabilities. With this ROM, disc memory is totally integrated into the system, so you're ready to go when you turn on the computer. Consumes only 150 bytes of available user memory.

Specifications

STATEMENTS AND FUNCTIONS

In addition to the mass storage statements and functions built into the operating system of the HP-85A/HP-86A/HP-87XM,* this ROM includes:

CHECK READ—Performs record-by-record data verification during file read/write operations.

COPY—Copies files or entire storage media.

ERROM—Returns the ROM number of the device that issued an error message.

ERRSC—Determines the select code of the interface module that received an illegal operation.

GLOAD—Loads the contents of a special extended-type file into the graphics display.

GSTORE—Stores the contents of the graphics display onto the mass storage system.

INITIALIZE—Clears, tests, and prepares a flexible disc medium for use in the mass storage system.

MASS STORAGE IS—Defines the default mass storage device. Allows use of mass storage ROM commands without specification of a device.

PACK—Removes null files from the disc system.

TRANSLATE—Translates tape-based programs to disc-based programs to allow them to automatically take advantage of the mass storage system.

TYP—Returns the type of the next datum of a data file.

VOLUME—Establishes a volume label for a disc medium. Volume labels let you refer to a disc medium by a name that you specify.

NOTE: With the exception of the TRANSLATE command, all of these statements and functions are built into the HP-86 and HP-87 Personal Computers.

*See Series 80 Systems brochure for a list of built-in statements and functions.

HP Plotter ROM (00087-15002)

The HP-86 and HP-87 Personal Computers include built-in print and graphics commands that allow you to transfer data to an HP printer. If you want to transfer data from your mainframe to an HP plotter you will need the HP Plotter ROM. The Plotter ROM also provides single commands to dump CRT graphics and alpha screens to any HP dot-matrix printer. Consumes 1392 bytes of available user memory.

Specifications

STATEMENTS AND FUNCTIONS

DUMP GRAPHICS—Dumps graphics portion of the CRT screen to the printer located at the PRINTER IS address.

DUMP ALPHA—Dumps one page of alpha memory. This page is rotated 90° counter-clockwise.

HP Plotter/Printer ROM (00085-15002)

This ROM lets you interface your HP-85 Personal Computer with HP's high-resolution graphics plotter and full-width line printers. It also adds several graphics enhancements to the standard Series 80 CRT graphics. Consumes only 373 bytes of available user memory.

Specifications

STATEMENTS AND FUNCTIONS

AXES—Draws a pair of axes with optional tic marks.

BLINK—Turns off the CRT while BPLOT statements write information to the graphics display.

BPLOT—Byte plot. Allows plotting any series of dots on the graphics display by conversion to an alphanumeric string.

BREAD—Byte read. Reads the contents of the graphics display into the specified string variable, enabling you to read and store the entire graphics display in one variable.

CLIP—Defines plotting boundaries (soft-clips) in current units mode, enabling you to highlight or make windows around specified areas of your graph.

CRT IS—Defines default display device, directing all output that defaults to the CRT to the specified device. An optional line length parameter can be used to select line length formatting for the device.

CSIZE—Character size. Specifies the height, width-height aspect ratio, and slant of characters used in labels.

CURSOR—Stores the values of the current cursor coordinates in the specified variable names.

DIGITIZE—Enables point digitizing from an external plotter.

DRAW—Drops the pen and draws to the specified coordinate position.

ERROM—Returns the number of the ROM that issued an error message.

ERRSC—Returns the select code of the interface module that received an illegal operation.

FXD—Establishes the label format for automatic axes labeling with the LAXES and LGRID statements.

FRAME—Draws a box around current plotting area.

GCLEAR—Clears the graphics display.

GRAPHICS—Switches the CRT to graphics mode if it is not already there.

GRID—Draws a full-scale grid with optional tic marks on the grid lines.

IDRAW—Lowers the pen and draws a line of specified incremental length from the current pen position.

IMOVE—Lifts the pen and moves it an incremental distance from the current pen position.

IPLOT—Provides incremental plotting with pen control from the last plotted point.

LABEL—Used like the PRINT statement to draw labels on an external plotter or the graphics display.

LABEL USING—Used like the PRINT USING statement to draw formatted labels on the plotting device. The image format string determines the exact form of the labels.

LAXES—Label axes. Draws and labels a pair of axes. Labels are placed outside the plotting area, within the graphic limits, at each major tic mark.

LDIR—Label direction. Specifies the angle at which subsequent labels will be drawn.

LGRID—Label grid. Draws and labels a grid. Labels are placed outside the plotting boundaries, within the graphic limits, on each grid line.

LIMIT—Defines the graphic limits beyond which the pen is not allowed to move. When the optional parameters are not included, two corner points of the plotting area can be digitized to define the graphic limits.

LINETYPE—Selects one of eight solid or dashed line types.

LOCATE—Specifies the plotting boundaries upon which SCALE or SHOW will map. Lines drawn or plotted in user units will not be allowed to cross the plotting boundaries specified by LOCATE. Useful for creating a window for your plot, saving space outside the window for labels.

LORG—Label origin. Determines where subsequent labels are drawn relative to the current pen location. Useful for positioning or centering labels.

MOVE—Lifts the pen and moves it to the specified coordinate position.

MSCALE—Scales the current plotting area in millimeters.

NOBLINK—Places the computer in a mode such that BPLOT statements write their information to the CRT with the CRT remaining on.

PDIR—Plot direction. Sets the angle of rotation for relative and incremental plotting.

PEN—Specifies the number or color (1 through 4) of the pen to be used.

PENUP—Lifts the pen.

PLOT—Provides absolute data plotting and pen control.

PLOTTER IS—Specifies the target of all plotter statements and operations.

PRINTER IS—Defines the default printer, directing all output that initially defaults to the internal printer to the specified device. An optional line length parameter can be used to select the line width formatting for the device.

RATIO—Returns a value equal to the ratio of the physical dimensions of the graphic limits, i.e., the x dimension divided by the y dimension.

RPLOT—Relative plot. Enables relative plotting and pen control from the last pen position determined by a statement other than RPLOT. The direction may be rotated with the PDIR statement.

SCALE—Defines the user units that are mapped onto the plotting area or LOCATE rectangle.

SETGU—Sets graphic units as the current units mode.

SET I/O—Enables you to write information directly to the registers in an interface module.

SETUU—Sets user units as the current units mode.

SHOW—Defines an isotropic scale (one unit of x equals one unit of y) in user units within the plotting boundaries.

TRANSLATE—Provides an easy means of translating CRT-directed graphics programs into programs that use the Plotter/Printer ROM routines for plotting to an external device.

UNCLIP—Sets the plotting boundaries (which are set by LOCATE or CLIP) equal to the graphic limits.

WHERE—Assigns the coordinate values of the last plotted or moved-to point and the pen's up or down status to the specified variables.

XAXIS—Draws a horizontal axis at the specified y-intercept.

YAXIS—Draws a vertical axis at the specified x-intercept.

HP I/O ROM (00085-15003 or 00087-15003)

HP's BASIC language capability in Series 80 personal computers is enhanced with straightforward I/O commands by the I/O ROM. It provides all the commands necessary to access the features of each of the Series 80 interfaces. The I/O ROM adds 8,192 bytes of read-only memory to the operating system and uses 416 bytes of read/write memory on the HP-85 and 818 bytes on the HP-86 and HP-87XM.

Specifications

GENERAL STATEMENTS

The I/O ROM adds bit manipulation, base conversion, keyboard masking, and error determination capabilities to Series 80 personal computers.

BINAND—Logical AND of two 16-bit values.
BINCMP—Binary complement of a 16-bit value.
BINEOR—EXCLUSIVE OR of two 16-bit values.
BINIOR—INCLUSIVE OR of two 16-bit values.
BIT—Value of a specified bit.
BTD—Decimal value of a binary string.
DTB$—Returns a string with a binary representation of a decimal number.
DTH$—Returns a string with a hexadecimal representation of a decimal number.
DTO$—Returns a string with an octal representation of a decimal number.
ENABLE KBD—Disable/enable sections of the keyboard.
ERROM—Returns number of last option ROM that caused an error.
ERRSC—Returns the select code of the last card that caused an error.
HTD—Returns the decimal value of a hexadecimal string.
OTD—Returns the decimal value of an octal string.

UNIVERSAL I/O STATEMENTS

The I/O ROM adds a set of interfacing capabilities to a Series 80 mainframe which are common to all interfaces. These capabilities provide for data transfers, data conversions, interface control, interrupts, and end-of-line branching.

CONTROL—Access to I/O card control registers or I/O buffer control registers.
CONVERT—Sets up conversion tables for ENTER or OUTPUT on a specified select code or an I/O buffer. The conversion can be an indexed table or a pairs lookup table.
ENABLE INTR—Interrupt on a specified condition.
ENTER—Formatted or free-field data from an I/O card or I/O buffer.
IOBUFFER—Turns a string variable into an I/O buffer.
OFF EOT—Turns off the end of transfer end-of-line branch.
OFF INTR—Turns off the ENABLE INTR end-of-line branch.
OFF TIMEOUT—Turns off the SET TIMEOUT end-of-line branch.
ON EOT—Specifies destination on end of transfer.
ON INTR—Specifies destination on interrupt.
ON TIMEOUT—Specifies destination on handshake timeout.
OUTPUT—Formatted or free-field output to I/O card or buffer.
RESET—Hardware reset of the I/O card.
SET TIMEOUT—Causes handshakes to an I/O card to be timed; if timeout occurs, then branch is taken to service routine.
STATUS—Access to I/O card or buffer.
TRANSFER—Allows for fast handshake (FHS) or interrupt data transfers between an I/O buffer and an I/O card.

Statements specific to interfaces are listed in the section: Series 80 Interfaces.

HP Matrix ROM (00085-15004)

The Matrix ROM gives you a powerful set of statements and functions for working with arrays—both matrices (two-dimensional arrays) and vectors (one-dimensional arrays). It lets you perform calculations with more convenience, speed, and accuracy than you could using your HP-85 Personal Computer alone. Consumes only 69 bytes of available user memory.

Specifications

STATEMENTS AND FUNCTIONS

ABSUM—Sum of absolute values of elements in array.
AMAX—Value of largest element in array.
AMAXCOL—Column number of largest element in array most recently specified in AMAX function.
AMAXROW—Row number of largest element in array most recently specified in AMAX function.
AMIN—Value of smallest element in array.
AMINCOL—Column number of smallest element in array most recently specified in AMIN function.
AMINROW—Row number of smallest element in array most recently specified in AMIN function.
CNORM—Largest sum of absolute values of elements in each column of array (column norm).
CNORMCOL—Column number with largest sum of absolute values in array most recently specified in CNORM function.
DET—Determinant of matrix.
DETL—Determinant of last matrix inverted in MAT INV statement or specified as first argument in MAT SYS statement.
DOT—Sum of products of corresponding elements of vectors (dot product or scalar product).
ERROM—Number designating last plug-in ROM to generate error message.
FNORM—Square root of sum of squares of elements in array (Frobenius norm or Euclidean norm).
LBND—Lower bound of array subscript.
MAT =—Assigns value of numeric expression or values of all elements of operand array to elements of result array. Alternatively, assigns specified elements of operand array to specified elements of result array.
MAT (+, –, ·, /, or *)—Performs specified arithmetic operation between array and scalar (number, numeric variable, or numeric expression) or between two arrays. Alternatively, performs matrix multiplication.
MAT = * + *—Adds two products of a scalar and an array.
MAT CON—Assigns value 1 to all elements of array.
MAT CROSS—Finds cross product (vector product) of two 3-element vectors.
MAT CSUM—Adds values of elements in each column of array.
MAT IDN—Assigns value 1 to all diagonal elements of matrix, and assigns value 0 to all other elements.
MAT INV—Finds inverse of matrix.
MAT INV *—Multiplies inverse of matrix by another array.
MAT RSUM—Adds values of elements in each row of array.
MAT SYS—Solves matrix equation Ax = B for unknown array x, given any square matrix A and any other array B.
MAT ZER—Assigns value 0 to all elements of array.
MAT TRN—Finds transpose of array.
MAT TRN *—Multiplies transpose of array by another array.
MAT = * TRN—Multiplies array by transpose of another array.
MAT DISP—Displays elements of array(s).
MAT DISP USING—Displays elements of array(s) according to format string specified in this statement or in IMAGE statement whose statement number is specified.
MAT INPUT—Assigns values input from keyboard to elements of array(s).
MAT PRINT—Prints elements of array(s).
MAT PRINT USING—Prints elements of array(s) according to format string specified in this statement or in IMAGE statement whose statement number is specified.
MAT READ—Assigns values listed in DATA statement(s) to elements of array(s).
MAXAB—Largest absolute value of any element in array.
MAXABCOL—Column number of element with largest absolute value in array most recently specified in MAXAB function.
MAXABROW—Row number of element with largest absolute value in array most recently specified in MAXAB function.
REDIM—Changes working size of array(s) to size specified.
RNORM—Largest sum of absolute values of elements in each row of array (row norm).
RNORMROW—Row number with largest sum of absolute values in array most recently specified in RNORM function.
SUM—Sum of elements in array.
UBND—Upper bound of array subscript.

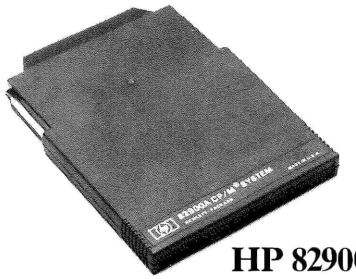
HP Advanced Programming ROM (00085-15005)

The functions, statements, and commands of this ROM give you extended control over data, programs, and your HP-85 system operations. You can execute subprograms; create string arrays; use the entire keyboard for branching operations; position the cursor during program execution; read string information directly from the display; find and replace program variables; cross-reference both program statements and program variables; merge programs; and set, clear, and test 64 program flags. Consumes only 132 bytes of available user memory. Not compatible with the HP 9915.

Specifications

STATEMENTS AND FUNCTIONS

ALPHA—Moves cursor to a specified row/column on the ALPHA screen.
AREAD—Fills string variable or substring with screen contents.
AWRIT—Displays contents of string.
CALL—Transfers program execution to specified subprogram.
CFLAG—Clears specified flag to 0.
CRT OFF—Turns display screen off. Speeds up PRINT#ing and READ#ing data during mass storage operations.
CRT ON—Turns display screen on.
CURSCOL—Returns number of cursor's column location.
CURSROW—Returns number of cursor's row location.
DATE$—Returns system clock reading as year/month/day.
DIRECTORY—Displays length of main program, names and sizes of subprograms in memory, and relative positions in memory.
ERRM—Displays most recent error message.
ERROM—Returns number of last plug-in ROM that generated an error message.
FINDPROG—Locates specified subprogram.
FLAG—Returns 1 if specified flag (1 through 64) is set, a 0 if not.
FLAG$—Returns 8-character string whose binary representation shows all 64 flag settings.
GET$—Returns string array element specified.
HGL$—Underlines characters in given string.
HMS—Converts hours/minutes/seconds string to equivalent number of seconds.
HMS$—Converts specified number of seconds to hours/minutes/seconds format.
KEYLAG—Sets time delay before key output starts repeating. Sets rate of repetition.
LINPUT—Assigns input from keyboard to a string or substring.
LWC$—Converts uppercase letters of a string to lowercase.
MDY—Converts month/day/year string to equivalent Julian day number.
MDY$—Converts specified Julian day number to month/day/year format.
MERGE—Retrieves specified program from mass storage, renumbers it, and merges it with current main program.
NPAR—Returns number of parameters passed in CALL statement to the subprogram.
OFF CURSOR—Suppresses cursor while program is running.
OFF KYBD—Deactivates keys in string so they no longer cause immediate branching.
ON KYBD—Declares keys active for branching during a running program.
PAGE—Sets number of lines per page for a PLIST operation.
READTIM—Number of seconds counted by a system timer after timer has been set in a program.
REPLACEVAR—Replaces variable name with another.
RENUM—Renumbers program or subprogram.
REV$—Reverses order of character string.
ROTATE$—Wraps string around on itself, shifting characters in a specified direction.
RPT$—Concatenates string with itself a specified number of times.
SARRAY—Declares string variables to be string arrays.
SCAN—Locates and displays next line containing a specified string or variable.
SCRATCHBIN—Clears binary program in memory.
SCRATCHSUB—Deletes specified subprogram.
SFLAG—Sets specified flag (1 through 64) to 1.
SLET—Puts string expression into string array at specified location.
SMAX—Returns highest subscript number of specified string array.
SUB—First line of specified subprogram. Designates parameters whose values are received from calling program.
SUBEND—Last line of subprogram. Returns execution to calling program.
SUBEXIT—Returns execution to calling program from anywhere within a subprogram.
TIME$—System clock reading in hours/minutes/seconds format.
TRIM$—Removes leading and trailing blanks from string expressions.
XREF L—Generates table of line numbers referenced by other program statements.
XREF V—Generates table of program variables, showing line numbers of statements that reference them.



HP 82900A CP/M® System

HP 82900A CP/M® System

Add the CP/M System to your HP-86 or HP-87XM Personal Computer and you'll open the door to a whole new world of software solutions. This plug-in module extends the HP-86 or HP-87XM system by adding a Z-80 processor and 64K bytes of dedicated RAM (CP/M user memory). With the CP/M operating system loaded from the disc, your HP-86 or HP-87XM will accept the vast library of software written under the CP/M operating system. The CP/M operating system also gives you ready access to other languages, including PASCAL and FORTRAN.

Specifications

PROCESSOR Z-80
CLOCK RATE ..... 4M Hz
MODE ..... Switch between Z-80 and HP-86 or HP-87 mode. CP/M operating system loads automatically from disc. Boot CP/M System to return to HP-86/87 mode
COMPATIBILITY . CP/M System module supports serial printers, parallel printers, HP-IB disc and printers
I/O HANDLING . . HP-86 and HP-87 microprocessors handle I/O in Z-80 mode
MEMORY REQUIREMENTS 7K RAM of built-in CP/M RAM
CP/M PROGRAMS . . . CP/M System will run standard CP/M programs that are supplied on or converted to HP disc format

SYSTEM UTILITIES
PIP—General purpose file transfer
STAT—Program for tracking important system information
SUBMIT and XSUB—Allow execution of batch processing jobs
ED—Text editor
ASM—Assembler

UTILITY FORMAT Formats CP/M discs and copies CP/M system software

CP/M® is a registered trademark of Digital Research, Inc.

Series 80 Firmware Programming Aids

You can enhance the power of a Series 80 personal computer by adding to it your own Assembly language programming in the form of PROM's (programmable read-only memories). Create new system commands, new BASIC keywords, new statements, and new functions by using your computer, an HP Assembler ROM (00085-15007 or 00087-15007), and the HP 82928A System Monitor.

By using programmable firmware instead of memory-resident binary routines, you can take advantage of safeguards that protect your program from being copied or destroyed. And, unlike flexible disc drives, PROM's do not require a separate power supply, so your programs are less affected by environmental conditions. PROM's are user friendly, too. Since you don't have to load your programs from a disc, your commands (which you wrote in the style that best fits your applications) are available to you as soon as you turn on your Series 80 personal computer. Lastly, programmable firmware requires no user memory, leaving you with plenty of problem-solving power.

To convert programming to firmware, you burn it into a PROM, or EPROM (erasible PROM). PROM's can then be placed in the HP 82929A Programmable ROM Drawer, which will plug into any of the four ports on your Series 80 personal computers.

Specifications for the Assembler ROM, System Monitor, and Programmable ROM Drawer follow. For the creation of PROM's, you also need the following:

1. Appropriate I/O ROM (00085-15003 or 00087-15003)
2. HP Serial Interface
3. PROM Programmer (must be purchased outside HP)
4. Model 2732 or 2764 EPROM's (must be purchased outside HP)

HP Assembler ROM (00085-15007 or 00087-15007)

The Assembler ROM provides you with the capability to write customized Assembly language programs that can be executed from RAM memory or burned into PROM's or EPROM's. You can write programs that allow you to: create customized BASIC keywords; redefine existing BASIC commands and functions; expand input/output control; increase speed in various applications; and store both source code and object code on either tape cartridges or discs. Consumes only 124 bytes of available user memory on the HP-85 and 220 bytes on the HP-86 and HP-87XM.

Specifications

STATEMENTS AND FUNCTIONS

ALOAD—Loads Assembly language source code.
ASSEMBLE—Assembles source code and stores object code.
ASSEMBLER—Enters Assembler mode.
ASTORE—Stores Assembly language source code.
BASIC—Returns to BASIC mode.
BKP—Sets breakpoint.
CLR—Clears breakpoint.
DEC—Decimal value of octal number.
FLABEL—Finds label.
FREFS—Finds label references.
MEM or MEMD—Dumps contents of computer RAM or ROM memory to CRT. Optional parameters allow you to address ROM's, to specify number of bytes to dump (default is 64), and to change contents to other values.
OCT—Octal value of decimal number.
REL—Returns absolute address of relative address in a binary program.
SCRATCHBIN—Scratches binary program.
TREM—Toggles remark output on listings.*

*Statement specific to the HP-85.

HP 82929A Programmable ROM Drawer

The Programmable ROM Drawer carries the PROM's or EPROM's you create, incorporating your programming into a Series 80 personal computer. It contains two sockets that accommodate either one or two 4K byte Model 2732 EPROM's or one or two 8K byte Model 2764 EPROM's. A single Programmable ROM Drawer supports 8K bytes to 16K bytes of memory. Up to three Programmable ROM Drawers may be installed at one time, allowing a maximum of 24K bytes (with all 2732 EPROM's) to 48K bytes (with all 2764 EPROM's of storage).

HP 82928A System Monitor Specifications

The System Monitor will help you develop and debug the Assembly language programs you create for your Series 80 personal computer. This programming aid permits the user to monitor program flow by providing two break points to be set in any portion of memory. Interrupts generated by these break points will allow examination of the following:

MEMORY CONTENTS

Octal and ASCII representation of a user-specified number of ROM or RAM memory locations.

CPU STATUS INDICATORS

Output includes the following CPU status registers:

Program counter
Address register pointer
Data register pointer
Break point addresses
Overflow flag
Carry flag
Status of most significant bit
Left-digit zero flag
Zero flag
Right-digit zero flag
Status of least significant bit
Decimal flag
Extend register

CPU REGISTERS

Octal contents of all CPU registers are displayed. With the HP 82928A System Monitor, the user can single step and trace through the operation of code at any point in memory and alter any register, status bit, or memory location. Together, the Assembler ROM, System Monitor, and Programmable ROM Drawer provide you with an Assembly language software development package.

For More Information

For additional information and a personal demonstration of Hewlett-Packard's versatile Series 80 computing systems, see your nearest HP dealer or local Hewlett-Packard representative. To locate the HP dealer nearest you or any HP sales office, call TOLL FREE 800-547-3400. (In Oregon, Alaska, and Hawaii, call 503-758-1010.) TTY users with hearing or speech impairments, please dial 503-758-5566.

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