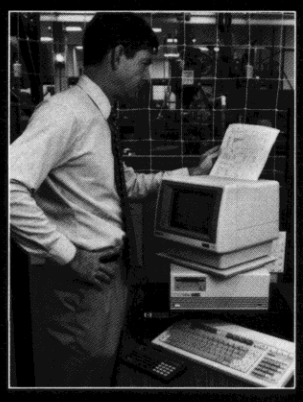
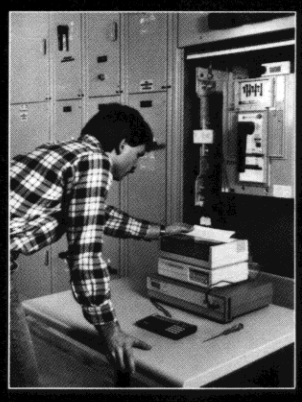
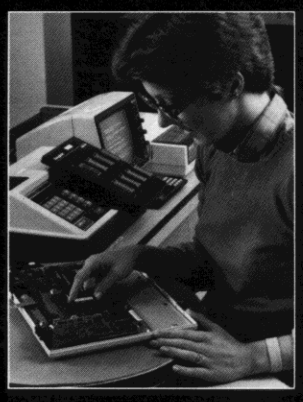
HEWLETT-PACKARD

HP-71 Instrument Control Systems







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HP-71 Handheld Computer Applications

In this fast-paced world of changing technology, you know that to keep up with the competition, you need to modernize and streamline your production operation.

Hewlett-Packard Wants To Help You

The HP-71 Handheld Computer has the "right stuff" for your industrial needs:

- Durability, to stand up to daily use in an industrial environment.
- "Intelligence" for your equipment, instruments, and test controllers. With a 64K-byte operating system and statistics functions built in, the HP-71 can make logic decisions for your equipment. Program it to choose which data to collect, and to run statistical analysis on the data while it is being collected.
- Compact footprint – it takes up only inches of space on the production line.
- Networking capabilities that rival those of much larger computers.

The HP-71 can even be built into your products or equipment. Independent Custom Consultants can work with you to show you how it's done.

A Big Computer In a Small Package

Don't let the small size (7.5 x 3.8 x 1.0 in.) of the HP-71 fool you. This is a powerful, highly flexible computer than can be integrated into a wide variety of industrial applications, equipment, and products.

The HP-71 can be programmed with BASIC language, Assembly or FORTH. It has four RAM/ROM ports so you can expand Random Access Memory or Read Only Memory. Or you can add Custom ROM modules designed for your particular needs.

When used with the Hewlett-Packard Interface Loop, the HP-71 can:

- Interface with other computers.
- Interface with electronic measuring instruments.
- Add a variety of peripherals for data storage and output.

And the HP-71 is constructed with the top-of-the-line, high quality workmanship that people worldwide associate with Hewlett-Packard products.

Warranty, Service, and Support

The HP-71 is covered by Hewlett-Packard's ONE-YEAR warranty and HP maintains service centers in most countries throughout the world.

A renewable one-year support agreement is available at the end of the warranty period.

HP offers a phone-in consulting service to answer questions ranging from operational problems to difficulties in using software application pacs and peripherals.

Applications

How can the HP-71 fit YOUR needs? Here are a few examples of how the HP-71 can be used by manufacturers to increase productivity and profitability.

Build a Quality Control System

As you survey the production floor of your shop, are you wondering how things are going? What kinds of problems are occurring? What's causing those problems? Do the workers have enough material to finish the job? Are the parts being made to the specifications?

These questions are running through the mind of a plastic molding shop manager who has 10 molding machines. He wants to set up a quality control system that is cost effective, easy to use, and easy to integrate into the shop. The manager selects an HP-71 for its small size, networking capabilities and low cost.

HP-IL Links Your Equipment to the HP-71

Using HP-IL convertors, each plastic molding machine is linked to an HP-71 via HP-IL. An HP-71 at each machine monitors and calculates:

- parts produced
- cycle time
- parts left to produce
- amount of material needed to complete the job

Immediate On-Line Quality Control

By using electronic measuring tools linked to the HP-IL by an HP 82164A HP-IL/RS-232C Interface, the operators now:

- Input part dimensions with the push of a button.
- Recalculate yields automatically, as each part is made.
- Take corrective action as soon as the yield drops below specified limits.

(Continued)

An HP-71 is used at each machine in a plastic molding shop. Operators enter part dimensions using electronic measuring tools, and HP-IL ties the system together so the shop manager can check each machine's output at a glance.

The machine operators also input part data by pressing HP-71 keys that have been redefined to represent each type of part defect tracked. And custom keyboard overlays are used so each operator can easily identify which key to press.

Information When You Need It, Where You Need It

The fabrication shop uses an HP ThinkJet Personal Printer at each molding machine to automatically print out process information and control charts from the previous day.

The status of all the molding machines in the shop is simultaneously displayed on HP 150 Touchscreen Personal Computers in the shop office and on the supervisor's desk.

With the HP-71 system in place, quality control in the shop has been streamlined with the following features:

- Materials are monitored automatically.
- Part counts and cycle time are computed automatically.
- Throughput yields are calculated automatically.
- Defect information, such as a scratched part, is entered with a single keystroke.
- Control charts are printed at each machine.
- The status of all the machines is displayed where you can see it, in the office.

Now the operators can pay more attention to their jobs instead of trying to be statisticians. Product quality will improve, and production will increase through improved yields. And the manager can spend more time managing the shop and less time worrying about quality.

Test Instrument Control

The networking capabilities of the HP-71 and its powerful computing capacity make it ideal for test instrument control applications.

Is your production line really a series of stations or "nodes," each performing a unique task? Do you need to tie these nodes together for a smooth operation?

A manufacturer has a series of tests to run on sub-assemblies before installing them in the final product.

Link Test Nodes with HP-IL

Each test station (node) is controlled by an HP-71 and an HP 3421A Data Acquisition/ Control Unit linked by HP-IL.

All of the test stations are tied into an HP-86 by HP-IL. The HP-86 is linked to an HP 82913A video monitor and an HP 9121D disc drive.

Operator Prompting

At each test station the HP-71 asks for the operator's initials, then prompts the operator with test instructions such as:

- Part inserted?
- New part?
- Same part?
- Test?
- Retest?

A custom overlay on each HP-71 identifies which keys to press in response to specific prompts.

When the operator has responded to the prompts, the test is run.

Store Test Data Automatically

The data from each test node is stored automatically on a disc in the HP 9121D disc drive. At the end of each day, the disc is removed and labeled with the date and the line supervisor's initials. It is then stored for future use. The next morning, a fresh disc is inserted in the disc drive.

The disc can now be used to print control charts and production reports using an HP-86 Personal Computer and an HP ThinkJet Personal Printer.

Production Equipment Control

In another production area, the electronics manufacturer needs to copy a computer program onto Erasable/Programmable ROMs (EPROMs). Also, a serial number is generated and programmed on each EPROM. The serial number is then printed on a label to be placed on the appropriate EPROM.

With an HP-71, the manufacturer can:

- Control the EPROM programmer.
- Interface with a printer and disc drive.
- Prompt production workers with instructions.

Sound complicated? Not for the HP-71.

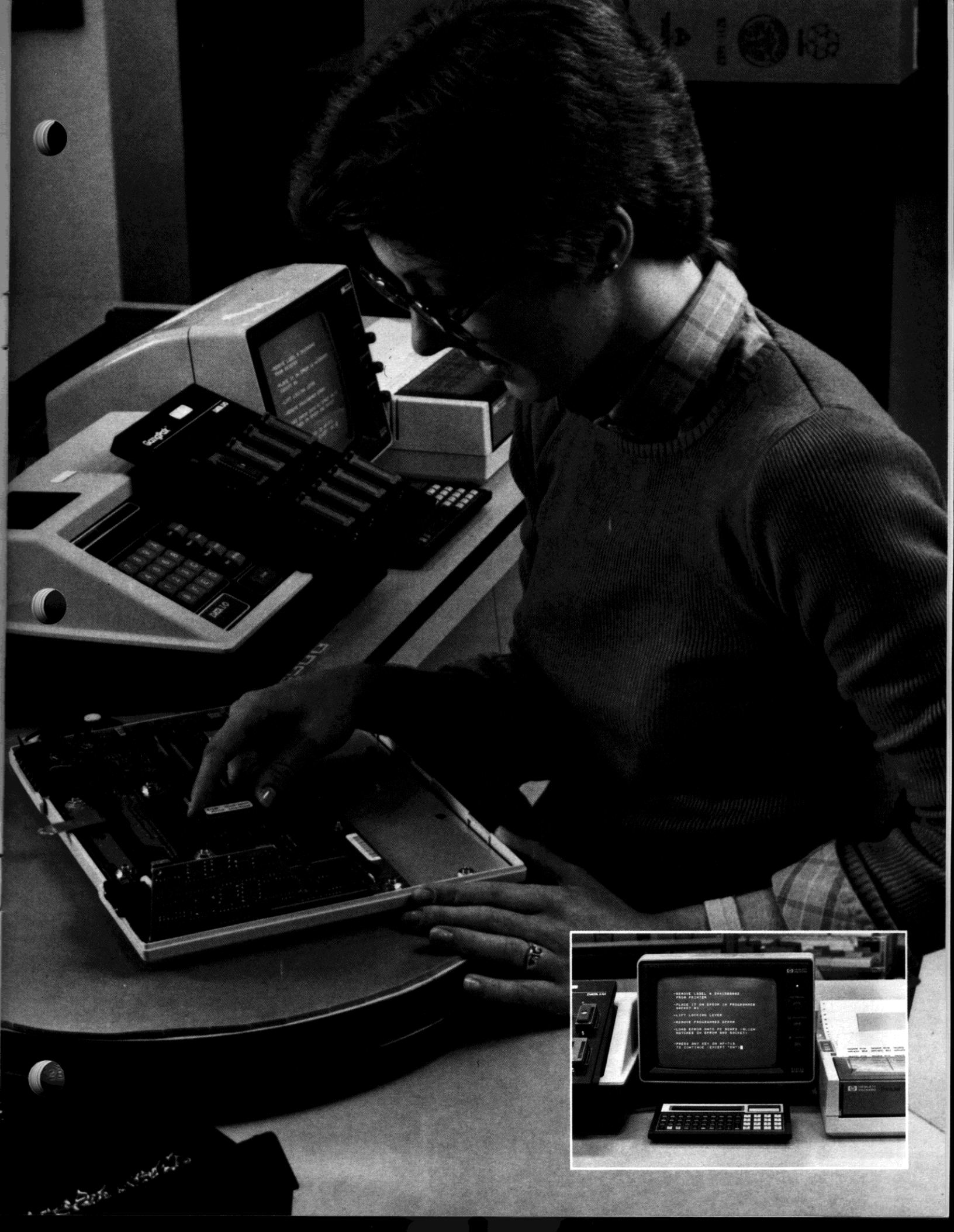
The EPROM programming device is connected to an HP-71 with an HP 82164A HP-IL/RS-232C Interface. The HP-71 updates the serial number for each program copied, then signals the printer to print out a new serial number label.

On-line Operator Instructions

After each task is completed, instructions for the next task are flashed on a video display connected to the HP-71 via HP-IL. This way the operator always knows which task was completed last.

(Continued)

A production worker inserts an EPROM into a sub-assembly. An HP-71 controls the EPROM programmer, then prompts the operator and generates serial numbers that are printed on a ThinkJet printer.



Data Acquisition

The HP-71, HP 3421A Data Acquisition/Control Unit, HP 9114A Portable Disc Drive and ThinkJet Personal Printer provide a completely portable data acquisition system that is easy to set up and will fit in a suitcase.

This system provides many key features for data acquisition:

- Measure:
  DC and AC voltage
  Temperature
  Frequency
  Resistance
- Read and write digital information.
- Actuate control signals.
- Do statistical analysis as you log data.
- Flag out-of-range data.

The HP-71/HP 3421A data acquisition system has been used in a wide variety of applications ranging from measuring the efficiency of water pumps to gathering data from windmill power generators and solar panels.

Consider the following application.

Electric motors in a manufacturer's factory are failing frequently. The maintenance department suspects power irregularities to be the cause. The manufacturer is also planning to expand the facility and needs to know what the power requirements will be.

The manufacturer sets up the HP-71 system where the power supply enters the plant. He leaves it there for a month. Since the factory operates only one shift, the HP-71 is programmed to shut the data acquisition system off at night and "wake it up" in the morning.

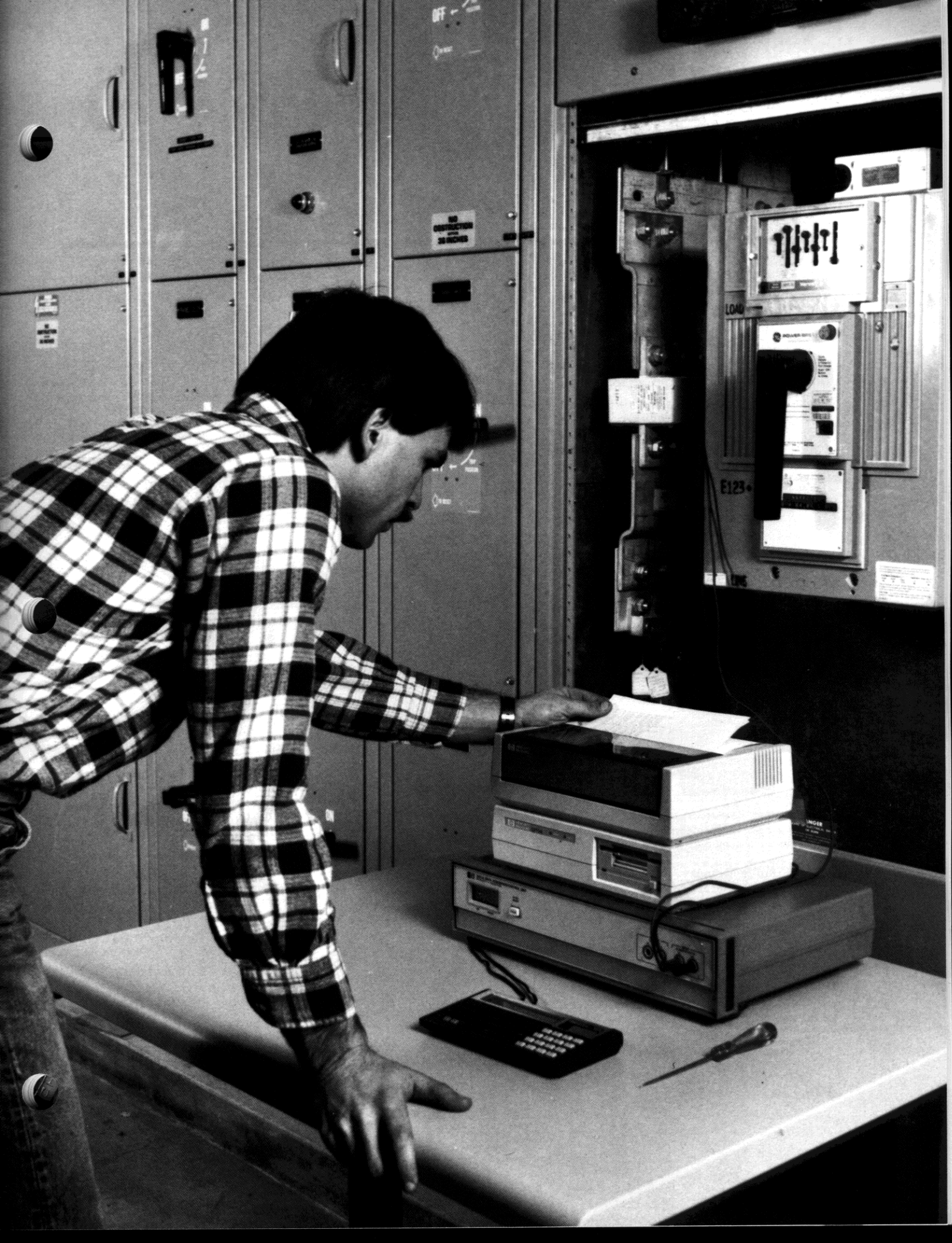
Analyze Data As You Collect It

As the HP 3421A collects the data on the line voltage, the HP-71 records the data and works the statistical analysis on it. The analyzed information is accessible immediately.

The manufacturer can now connect the HP-71 to the ThinkJet Personal Printer and get hard copies of the analyzed data to use in finding a solution to the power problem. The manufacturer can also hook up the HP 9114A Portable Disk Drive to permanently store the data for future use.

The HP-71/HP 3421A team gives the manufacturer the flexibility to set up the system in the field, at the source of the problem. It also provides the speed and accuracy of electronic measurement that would be impossible to obtain manually.

The HP-71, HP 3421A Data Acquisition/ Control Unit, HP 9114A Portable Disc Drive, and ThinkJet Printer provide a complete, portable data acquisition system.


OFF
LOAD
E123

Hewlett-Packard
HP-71 Key Features

HP-IL Interface
option for connecting to a wide variety of battery-powered devices for mass storage, display, printing, plotting, test and measurement.

BASIC Language
powerful programming language.

Liquid-crystal Display
22-character window on a 96-character line displays upper- and lowercase letters with true descenders. Use cursor keys to step through programs one line at a time. Create your own special characters. Scroll to view the entire line of large, easy-to-read characters. Display annunciators at both ends of the display serve as mode indicators.

Card Reader
option to use small, inexpensive, magnetic cards for mass storage and easy program loading.

Battery Power
four 1.5V, AAA size batteries assure portability. Or, use the optional AC adapter.

Continuous Memory
turn your HP-71 off and return later without losing calculations and programs.

Four Ports
accept any combination of memory modules or application software to increase computation power.

Typewriter-like Keyboard
enter alphabetical information quickly and easily. Redefine the keys to suit your changing needs, and store the redefinitions to use later.

CALC Mode
cut your one-time calculations down to size.

Five-level Command Stack
recall any of your last five commands for editing and reuse.

10-digit Key Pad
fast, easy input of numeric data.

Hewlett-Packard
HP-71 Handheld Computer

The HP-71 Handheld Computer – a portable, 12-ounce package that puts a powerful calculation mode, BASIC language, and expansion potential right at your fingertips. The HP-71 offers a built-in operating system larger than many desktop computers. Use it alone or configured as part of an HP-IL (Hewlett-Packard Interface Loop) system.

Features	Benefits
■ Compact size	Takes only a few inches of work space.
■ Battery powered	Retains memory if power fails. Low power requirements. Portable.
■ Built-in operating system	Optimized for fast processing of binary-coded decimal data to 12-digit accuracy. Runs your application programs quickly, accurately.
■ Optional FORTH/Assembly capability	Switch between FORTH, BASIC, and Assembly without program or data loss. Programs written in one language can call programs in the other.
■ Internal Design Specifications	Build the HP-71 into your products. Make add-on boards or cards, or other modifications to fit your needs. For additional details, refer to HP-71 Development Systems.
■ Optional HP-IL Interface	Lets you tap the resources of larger computers. Control instruments without being present. Print, store, and expand display capabilities by adding up to 930 peripherals and accessories.
■ Optional Card Reader	Convenient and inexpensive off-line storage of data and programs. Easy program loading.

HP-71 Features.

- **BASIC Programming Language.**
  The HP-71 uses an enhanced BASIC that runs nearly as fast as compiled BASIC. The BASIC words are translated into tokens to reduce the amount of memory needed and to speed up program execution. This enhanced BASIC has over 240 functions, statements, and operators, making it powerful enough to handle nearly all of your programming needs. To help increase your programming versatility and flexibility, create subprograms. Parameters can be passed from main programs to the subprograms. The enhanced HP-71 BASIC supports the IEEE Radix Independent Floating-Point Math Standard to give you more control and accuracy in your computations.
- **Internal Design Specifications.**
  HP has documented the internal specifications to make the HP-71 an "open machine" and provide you with entry points, source code and schematics so you can develop your own hardware and interfaces to fit your application needs.
- **Built-in Operating System.**
  The powerful, calculation-oriented 64K-byte operating system allows for high-level programming in addition to repetitive calculations.
- **Five-level Command Stack.**
  Your last five commands are stored in HP-71 memory so that you can recall any of them to modify and reuse. That's a real time saver when you're executing a series of commands, or when you need the combined results of several equations.
- **Expandable.**
  The HP-IL interfacing option opens the door to a broad array of accessories, peripherals, instruments, and other computers. Print, store, retrieve, and display information, as well as communicate with larger computers.
- **Four RAM/ROM Ports.**
  Plug in up to four 4K-byte RAM modules to increase your memory and storage capacity by 16K bytes. The HP-71 is capable of directly addressing 512K bytes.* And, you can add ROM software modules for speedy execution of specific solutions. Customize your applications with plug-in Custom ROM Modules to add unique problem-solving capabilities and a means of permanent, private storage. Any of the internal or external RAM can be set aside for program or data storage so you can locate files quickly and protect them from some memory reset conditions. You can also remove memory modules without disturbing files in the rest of RAM.

(Continued)

*Includes 64K-byte operating system, 32K bytes reserved memory, .5K-byte reserved configuration area, and 16K bytes built-in user memory.

- **Typing Aids.**

  Often-used keywords or instructions can be displayed simply by pressing a shifted key. Reduce your program and data entry time by using these built-in typing aids.

- **Redefinable Keyboard.**

  Each key on the keyboard can be redefined (except the blue and gold shift keys) to increase your calculating efficiency. Redefine the shifted key functions, too, and further expand the number of functions available to you. Assign your own typing aids to any convenient key, execute a particular statement or program from the keyboard, and simplify data entry while you're running a program.

- **Multiple File Structure.**

  The number of files in HP-71 memory is limited only by the amount of available RAM. Seven different file types are supported: BASIC, BIN, LEX, DATA, TEXT, KEY, and SDATA.

- **Clock/Calendar.**

  A built-in quartz-crystal clock can be set with an accuracy of 1 second per month or better. It runs even when your HP-71 is turned off. Create and use clock/calendar dependent programs that must begin and run when you can't be there to control the process. Three independent timers are available for your use.

- **Software.**

  HP-written software in a variety of applications is available to give you ready-to-go solutions. Each application pac comes with a convenient plug-in module and complete documentation.

Physical Specifications

DIMENSIONS . . .19 cm (7.5 in) x 9.7 cm (3.8 in) x 2.5 cm (1.0 in)

WEIGHT . . . . . .340 g (12 oz) with batteries

POWER

Batteries . . . . . .four 1.5V, size AAA alkaline batteries (replaceable by user)

Battery current . . .10 mA (operating)
.75 mA (idle)
.03 mA (off)

Average alkaline battery life . . . .60 operating hours (battery life depends upon use)
AC adapter (82059D) optional. (Does not recharge batteries.)

OPERATING REQUIREMENTS

Operating temperature . . .0° to 45°C (32° to 113°F)

Storage temperature . . . −40° to 55°C (−40° to 131° F)

Humidity . . . . . .0% to 95% relative humidity

DISPLAY

Liquid-crystal display

Character font . . .6 x 8 dot matrix

Capacity . . . . . .96 characters per line

Window size . . . .22 characters (scroll on 96 character line)

Character set . . . .256 characters

CHARACTER RANGE

A-Z, a-z, 0-9, plus 65 special characters.

NUMBER RANGE

Real precision . . . −9.99999999999E499 to −1E-499, 0, 1E-499 to 9.99999999999E499

Short precision . . . −9.9999E499 to −1E-499, 0, 1E-499 to 9.9999E499

Integer precision . . −99999 to 99999

Variable types . . .Numeric, String, Numeric array, String array

Numbers are shown with a maximum of 12 digits, or a 12-digit mantissa and a three-digit exponent. Calculations are accurate to 12-digits.

CLOCKS & TIMERS

Perpetual clock calendar; 24-hour format. Time function returns time to the nearest hundredth of a second.

Accuracy range . .15 seconds/month to 3 minutes/month

Adjustable clock speed . . . . ±10%

BEEPER

The beeper is programmable with parameters for duration and tone. The frequency range is approximately 5 to 6200 Hz.

REDEFINABLE KEYS 159

MULTIPLE FILE STRUCTURE

The number of files in HP-71 memory is limited only by the amount of available RAM.

Seven different file types are supported:

BASIC—Contains BASIC programs.

BIN—Assembly language programs to be executed as programs or subprograms.

LEX—Add new BASIC keywords.

DATA—Store numeric and string data.

TEXT—Transfer or receive files from other computers as string data.

KEY—Store and retrieve redefined key assignments.

SDATA—Transfers data to and from an HP-41 Advanced Calculator.

LANGUAGE

Extended HP BASIC (over 240 instructions)

ROM/RAM

Built-in operating system ROM . . .64K bytes
Four 16K, 32K, 48K, or 64K byte plug-in ROMs make an additional 256K bytes ROM possible.

Built-in user RAM . . . . .17.5K bytes

Enhancement Memory Module (HP82420A) . . .4K bytes

Maximum system RAM (with four Memory Modules . . . . . 33.5K bytes

CONTINUOUS MEMORY

Retains data and programs even when the computer is turned off.

HP-71B HANDHELD COMPUTERS COME COMPLETE WITH:

- HP-71 Owner's Manual
- HP-71 Reference Manual
- Quick Reference Guide
- Blank Keyboard Overlay
- Four AAA Batteries
- Users' Library/Third Party Software Card
- Carrying Case

HP-71 FUNCTIONS LIST

PROGRAM ENTRY/EDITING

AUTO—Numbers lines automatically.
DELETE—Deletes program line(s) from current file.
EDIT—Assigns "current file" status to specified file.
FETCH—Displays any line of current program.
LIST—Displays listing of specified lines in a file.
NAME—Names the workfile.
PLIST—Prints listing of specified lines in a file.
PRIVATE—Limits access to file and restricts changes in its protection.
REM (!)—Enables entry of comments in program lines for program documentation.
RENUMBER—Renumbers lines in current file.
SECURE—Protects file from being altered or purged.
TRANSFORM—Transforms BASIC file to TEXT file, or reverse.
UNSECURE—Clears file access restriction set by SECURE.
@—Appends a statement in a multiple-statement line.

PROGRAM EXECUTION

CALL—Transfers program execution to subprogram.
CHAIN—Purges current file, copies specified file into main RAM, and executes that file.
CONT—Continues execution of suspended program.
RUN—Executes a BASIC or binary program.

PROGRAM CONTROL

BYE—Turns computer off.
CALL—Transfers program execution to subprogram.
CHAIN—Purges current file, copies specified file into main RAM, and executes that file.
DEF FN—Indicates beginning of user-defined function definition.
END—Terminates a subprogram, user-defined function, or program.
END DEF—Causes normal return from a multiple-statement user-defined function.
END SUB—Causes normal return from subprogram invoked by CALL statement.
FN—Transfers program execution to specified user-defined function.
FOR . . . NEXT—Defines loop that is repeated until loop counter exceeds specified value.
GOSUB—Transfers program execution to subroutine.
GOTO—Transfers program execution to specified statement.
IF . . . THEN . . . ELSE—Provides conditional execution.
OFF—Turns computer off.
OFF ERROR—Disables any previous ON ERROR statement.
OFF TIMER—Deactivates corresponding ON TIMER # statement.
ON ERROR GOSUB—Executes specified subroutine when an error occurs.
ON ERROR GOTO—Executes specified branch when an error occurs.
ON TIMER #—Interrupts program at specified time and causes specified branching to occur.
ON . . . GOSUB—Transfers program execution to selected subroutine.
ON . . . GOTO—Transfers program execution to selected statement or line.
ON . . . RESTORE—Selects which DATA statement will be used by next READ statement.
PAUSE—Suspends program execution.
POP—Cancels pending return of program execution from current subroutine.
RETURN—Returns program execution to the statement following the GOSUB statement.
STOP—Terminates a subprogram, user-defined function, or program.
SUB—Identifies beginning of subprogram.
WAIT—Causes program execution to wait for specified number of seconds.

DEBUGGING

CONT—Continues execution of suspended program.
DEFAULT—Sets math exception traps to specific values.
ERRL—Returns line number of most recent error or warning.
ERRM$—Returns message text of most recent error or warning.
ERRN—Returns error number of most recent error or warning.
ON ERROR GOSUB—Executes specified subroutine when an error occurs.
ON ERROR GOTO—Executes specified branch when an error occurs.
PAUSE—Suspends program execution.
TRACE—Traces program execution and variables in a running program.

STORAGE ALLOCATION

CLAIM PORT—Returns independent RAM to main RAM status.
DESTROY—Deletes variables and arrays from memory.
DIM—Allocates memory for string or REAL variables and arrays.
FREE PORT—Switches a portion of main RAM to independent RAM status.
INTEGER—Creates INTEGER variables and arrays.
MEM—Returns number of bytes available in memory.
OPTION BASE—Specifies subscript's lower bound for arrays.
REAL—Creates REAL variables and arrays.
SHORT—Creates SHORT variables and arrays.
SHOW PORT—Displays type and size of all plug-in memory devices and independent RAMs.
STAT—Selects or creates a statistical array.

LOGICAL AND RELATIONAL OPERATORS

AND—Performs logical And of its operands.
EXOR—Performs logical Exclusive Or of its operands.
NOT—Performs logical Not of its operand.
OR—Performs logical Or of its operands.
=—Performs Equality test on its operands.
#—Performs Inequality test on its operands.
<>—Performs Less Than or Greater Than test on its operands.
<—Performs Less Than test on its operands.
<=—Performs Less Than or Equal To test on its operands.
>—Performs Greater Than test on its operands.
>=—Performs Greater Than or Equal To test on its operands.
?—Performs Unordered Comparison test on its operands.

ARITHMETIC OPERATORS

+—Addition.
−—Subtraction.
*—Multiplication.
/—Division.
DIV—Divides one argument by another and returns integer portion of quotient.
^—Exponentiation.
%—Percent.

GENERAL MATH

ABS—Returns absolute value of its argument.
CEIL—Returns smallest integer greater than or equal to specified argument.
CLASS—Returns value indicating class of argument.

(Continued)

DVZ—Returns divide-by-zero flag number (−7).
EXPONENT—Returns exponent of its normalized argument.
FACT—Returns factorial of non-negative integer argument.
FLOOR—Returns greatest integer less than or equal to argument.
FP—Returns fractional part of numeric value.
INT—Returns greatest integer less than or equal to argument.
INX—Returns inexact result flag number (−4).
IP—Returns integer part of argument.
IVL—Returns invalid operation flag number (−8).
LET—Assigns value to variable.
MAX—Returns larger of two values.
MIN—Returns smaller of two values.
MOD—Returns remainder of modulo reduction.
OPTION ROUND—Selects roundoff setting.
OVF—Returns overflow flag number (−6).
RANDOMIZE—Specifies a "seed" for the RND function.
RED—Returns remainder of argument reduction.
RES—Returns value of most recently executed numeric expression.
RMD—Returns remainder of division.
RND—Returns next real number in a pseudo-random number sequence and updates current seed.
SGN—Returns −1, 0, or 1 if argument is less than zero, equal to zero, or greater than zero, respectively.
SQR—Returns square root of argument.
SQRT—Alternate spelling for SQR.
UNF—Returns underflow flag number (−5).

LOGARITHMIC OPERATIONS

EXP—Returns the number $e = 2.718281828\ldots$ raised to power given by argument.
EXPM1—Returns value of $e^{argument} - 1$.
EXPONENT—Returns exponent of normalized "X".
LGT—Alternate spelling for LOG10.
LN—Alternate spelling for LOG.
LOG—Returns natural logarithm (base *e*) of argument.
LOGP1—Returns $\ln(1 + argument)$.
LOG10—Returns logarithm (base 10) of argument.

TRIGONOMETRIC OPERATIONS

ACOS—Returns arccosine of its argument.
ACS—Alternate spelling for ACOS.
ANGLE—Returns polar angle determined by (*x*,*y*) coordinate pair.
ASIN—Returns arcsine of its argument.
ASN—Alternate spelling for ASIN.
ATAN—Returns arctangent of its argument.
ATN—Alternate spelling for ATAN.
COS—Returns cosine of its argument.
DEG—Converts argument in radians to degrees.
DEGREES—Sets unit of measure for expressing angles to degrees.
OPTION ANGLE—Selects unit of measure for expressing angles.
RAD—Converts arguments expressed in degrees to radians.
RADIANS—Sets unit of measure for expressing angles to radians.
SIN—Returns sine of its argument.
TAN—Returns tangent of its argument.

STATISTICS

ADD—Adds coordinates of a data point to data set represented by summary statistics in current statistical array.
CLSTAT—Clears all elements in current statistical array.
CORR—Returns sample correlation coefficient between a specified pair of variables.
DROP—Removes coordinates of a data point from the data set represented by summary statistics in current statistical array.
LR—Specifies current linear regression model and computes intercept and slope for that model.
MEAN—Returns sample mean of specified variable.
PREDV—Returns predicted value of dependent variable.
SDEV—Returns standard deviation of specified variable.
STAT—Selects or creates statistical array.
TOTAL—Returns total of specified variable.

CONSTANTS

EPS—Returns HP-71's smallest positive, normalized number (1.0 E−499).
INF—Returns machine representation of positive infinity.
MAXREAL—Returns maximum positive finite number that the HP-71 can represent (9.99999999999E499).
MINREAL—Returns smallest positive number that HP-71 can represent (0.00000000001E−499).
NAN—Returns signaling NaN.
PI—Returns 12-digit value representing π.

STRINGS

&—Concatenation operator.
CHR$—Converts numeric value into ASCII character.
LEN—Returns length of specified string.
NUM—Returns ASCII numeric code for first character of string.
POS—Returns position of given substring.
STR$—Returns string representation of value of argument.
UPRC$—Converts lowercase letters to uppercase.
VAL—Converts a numeric expression within a string expression to a numeric value.
VER$—Indicates versions of system ROMs and LEX files.

INPUT/OUTPUT

ASSIGN #—Associates symbolic channel number with specified file and opens that file.
BEEP—Causes specified tone to sound.
BEEP OFF—Disables beeper.
BEEP ON—Enables beeper.
CONTRAST—Adjusts display contrast.
COPY—Copies information from source file to destination file.
CREATE—Creates a data file.
DATA—Contains data that can be read by READ.
DELAY—Sets line and character scroll rates in display.
DISP—Displays numeric and string data.
DISP USING—Displays items according to specified format.
DISP$—Returns string containing all readable characters in display.
ENDLINE—Specifies end-of-line sequence used in PRINT and PLIST statements.
ENG—Selects engineering display format.
FIX—Selects fixed display format.
GDISP—Sets specified dot pattern in display.
GDISP$—Returns 132-character string reflecting dot pattern in display.
IMAGE—Controls format of displayed and printed output.
INPUT—Enables assigning values to program variables from keyboard.
KEYDOWN—Returns 0 or 1, depending on whether key is being pressed.
LC—Selects between uppercase and lowercase lock on keyboard.
LINPUT—Assigns display line to string variable.
LIST—Displays listing of specified lines in a file.
ON . . . RESTORE—Selects which DATA statement will be used by next READ statement.
PLIST—Prints on print device a listing of specified lines in a file.
PRINT—Causes print list to be sent to print device.
PRINT USING—Causes print list to be sent to print device according to specified format.
PRINT #—Writes data items to data file in memory.
PUT—Enters a specified key code into key buffer.
PWIDTH—Defines line length of PRINT and PLIST statements.
READ—Assigns values from DATA statements to variables.
READ #—Reads data items from data file.

RESTORE—Specifies which DATA statement will be used by next READ operation.
RESTORE #—Sets specified file pointer to indicated record number.
SCI—Selects scientific notation display format.
STD—Selects standard BASIC display format for numbers.
TAB—Moves DISP or PRINT position ahead to specified column. (Refer to the **DISP** or **PRINT** keyword entry.)
UPRC$—Converts lowercase letters to uppercase.
USER—Activates or deactivates user-defined key assignments.
WIDTH—Defines line length for DISP and LIST statements.
WINDOW—Sets display window size and location.

GRAPHICS

GDISP—Sets specified dot pattern in display.
GDISP$—Returns a 132-character string reflecting dot pattern in display.

FILE MANAGEMENT

ADDR$—Returns string representing hexadecimal address of specified file.
CAT—Gives catalog of file information.
CAT$—Returns catalog information for a specified file.
CLAIM PORT—Returns independent RAM to main RAM status.
COPY—Copies information from source file to destination file.
CREATE—Creates a data file.
EDIT—Assigns "current file" status to specified file.
FREE PORT—Switches a portion of main RAM to independent RAM status.
MEM—Returns number of bytes available in memory.
MERGE—Merges all or part of file into another file.
NAME—Names system workfile.
PRIVATE—Limits access to file and restricts changes in protection.
PROTECT—Write-protects one track of a magnetic card.
PURGE—Deletes file from RAM.
RENAME—Changes name of file.
SECURE—Protects file from being altered or purged.
SHOW PORT—Displays type and size of all plug-in memory devices and independent RAMs.
TRANSFORM—Transforms BASIC files into TEXT files, or the reverse.
UNPROTECT—Removes the write- protection from one track of a magnetic card.
UNSECURE—Clears file access restriction set by SECURE.

TIME AND DATE

ADJABS—Performs an absolute adjust on system clock.
ADJUST—Changes clock time and specifies clock speed correction.
AF—Returns current value of clock accuracy factor and gives option of setting new adjustment factor.
DATE—Returns current clock date as an integer (*YYDDD*).
DATE$—Returns current clock date in year/month/day format.
EXACT—Calibrates system clock and tells HP-71 that time currently stored is the correct time.
RESET CLOCK—Nullifies effect of executing EXACT.
SETDATE—Sets date on system clock.
SETTIME—Sets time on system clock.
TIME—Returns time of day in seconds since midnight.
TIME$—Returns time of day in *HH :MM :SS* format.

SYSTEM SETTINGS AND FLAGS

CFLAG—Clears specified user and/or system flags.
DEFAULT—Sets math exception traps to specific values.
DEGREES—Selects degrees as unit of measure for angles.
DELAY—Sets line and character scroll rates in display.
DVZ—Returns divide-by-zero flag number (−7).
FLAG—Returns current value (0 or 1) of specified flag, and optionally selects new flag setting.
INX—Returns inexact result flag number (−4).
IVL—Returns invalid operation flag number (−8).
OPTION ANGLE—Specifies unit of measure for expressing angles.
OPTION BASE—Specifies subscript's lower bound for arrays.
OPTION ROUND—Specifies round-off setting.
OVF—Returns overflow flag number (−6).
RADIANS—Selects radians as unit of measure for angles.
RESET—Resets user and system flags and traps to their system default settings.
SFLAG—Sets specified user and/or system flags.
TRAP—Returns trap for specified flag number and optionally selects new trap setting.
UNF—Returns underflow flag number (−5).

CUSTOMIZATION, KEYBOARD, AND DISPLAY CONTROL

ADDR$—Returns string representing hexadecimal address of specified file.
CHARSET—Specifies alternate character set in ASCII code range of 128 through 255.
CHARSET$—Returns string representing current alternate character set.
CONTRAST—Adjusts display contrast.
DEF KEY—Assigns character string to specified key.
DELAY—Sets line and character scroll rates in display.
DTH$—Converts decimal number to string representing its five-digit hexadecimal value.
FETCH KEY—Displays specified key assignment for editing.
FIX—Sets fixed display format and number of fractional digits to be displayed.
HTD—Converts string argument representing hexadecimal number to decimal number.
IMAGE—Controls format of displayed and printed output.
KEY—Assigns character string to specified key.
KEY$—Returns and deletes oldest key or keystroke combination from keyboard buffer.
KEYDEF$—Returns redefined value of a key.
KEYDOWN—Returns 0 or 1, depending on whether key is being pressed.
LC—Selects between uppercase and lowercase lock on keyboard.
LOCK—Sets password. Causes HP-71 to prompt for that password the next time computer is turned on.
PEEK$—Returns contents of specified section of memory.
POKE—Writes to memory at specified hexadecimal address.
PUT—Enters a specified code into key buffer.
STARTUP—Defines command string to be executed when HP-71 is turned on.
USER—Activates or deactivates user-defined key assignments.
WINDOW—Sets display window size and location.

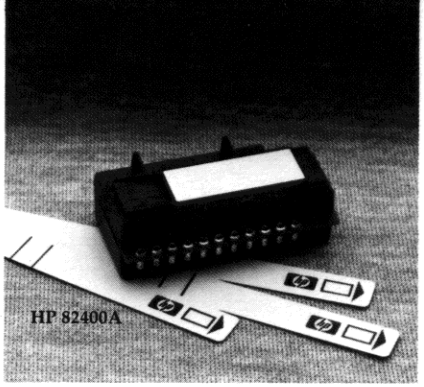
HP 82420A MEMORY MODULE

This module gives you an additional 4K bytes of programmable memory. Up to four modules plug into front ports on the HP-71 to give you a maximum of 16K bytes of additional RAM.

HP-71B ACCESSORIES

- Owner's Manual (00071-90001)
- Reference Manual (00071-90010)
- Quick Reference Guide (00071-90019)
- Blank Overlay Kit (five blank overlays) (HP 82462A)
- 30 Blank Magnetic Card Pack (HP 82707A)
- 100 Blank Magnetic Card Pack (HP 82708A)
- Carrying Case (HP 82461A)
- AC Adapter/Power Supply (HP 82059D)

Hewlett-Packard
HP-71 Card Reader



HP 82400A Card Reader

The HP 82400A magnetic Card Reader offers an inexpensive means of storage for your programs and data. Snap it into a specially designed slot; the card reader will not change the external dimensions of the HP-71.

Encode your cards as a private file so that they may be copied and executed, but not viewed or edited. Automatic verification assures the accuracy of the information on the cards. And, simple encoding protects your cards from being overwritten.

Features	Benefits
■ Powered by HP-71 batteries.	Allows small size and maximizes portability.
■ Snaps into a special slot.	Leaves RAM/ROM ports free for memory and software modules. Outside dimensions of the HP-71 don't change.
■ 1.3K-byte magnetic cards.	Programs and data are easily modified. Cards are inexpensive to duplicate. Label contents on face of card. Store easily in a small space.

Physical Specifications

DIMENSIONS . . .5.3 cm (2.1 in) x 2.8 cm (1.1 in) x 2.2 cm (.9 in)

WEIGHT . . . . . .23 g (.8 oz)

COMPATIBILITY

Snaps into the HP-71. Cards are the same dimensions as those used in the HP-75; however, programs are not interchangeable.

OPERATING REQUIREMENTS

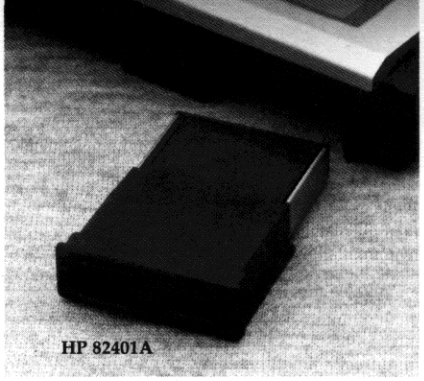
Supply voltage . . . . . .4.25 to 6.5 volts

Current . . . . . .7 mA (RUN mode)
18 mA (WRITE mode)
1 mA (STANDBY mode)

Operating temperature . . .0° to 45° C (32° to 113° F)

Storage temperature . . . −40° to 65°C (−40° to 149° F)

Hewlett-Packard Interface Loop


HP 82401A

The Hewlett-Packard Interface Loop (HP-IL) is a bit-serial interface designed for low cost, battery-operable systems. HP-IL lets you use your HP-71 as system controller, capable of transmitting and receiving data, and performing a wide variety of information management and instrument control functions. In this system, devices are connected by two-wire cables leading from the output port of one device to the input port of the next, until all devices form a closed loop. This loop structure provides a unique capability through auto address assignment, device capability identification, power ON/OFF control and error checking.

HP 82401A HP-IL Interface

The HP-IL Interface plugs into a specially designed port at the upper left corner of your HP-71, establishing a link to the world of instruments and peripherals. Connect directly to any HP-IL product, and to HP-IB, RS-232C and GPIO interfaces using convertors.

The HP-IL Interface gives your HP-71 simultaneous control of up to 30 devices on the loop, and through secondary addressing, up to 930 devices. The 16K bytes of ROM in the Interface provide for printer, display, mass storage and general input/output (I/O) operations. Multiple HP-71s can be connected on the interface loop.

Features	Benefits
■ Battery powered.	Completely field portable. Runs during power failure.
■ Simple connector system.	Keyed cables for easy, error-free connection.
■ Auto addressing.	Devices can be connected in any order.
■ Manual addressing.	Control of two similar devices can be determined programmatically.
■ Device-powered loop.	Each device powers its section of loop, allowing 30 devices and up to 10 meters between devices (up to 100 meters with twisted, shielded pairs).
■ Automatic error checking.	Assures that the message sent was received correctly.
■ Bit-serial, loop structure.	Allows automatic error checking.
■ STANDBY mode.	Conserves battery life as programs control power up/power down.
■ Common mode rejection.	Eliminates unwanted voltage transients.

Physical Specifications

DIMENSIONS . . .5.2 cm (2 in) x 3.7 cm (1.5 in) x 1.3 cm (.5 in)

WEIGHT . . . . . .18 g (.7 oz)

OPERATING REQUIREMENTS

Operating temperature . . .0° to 45°C (32° to 113°F)

Storage temperature . . . – 40° to 55°C (– 40° to 131° F)

Relative humidity . . . . .0 to 95%

DATA TRANSFER RATE

6,000 bytes per second

HP-IL INTERFACE FUNCTIONS LIST

SYSTEM SETUP

ASSIGN IO—Associates assign codes with HP-IL devices.

LIST IO—Lists all defined assign codes and their HP-IL addresses.

OFF IO—Suspends I/O operation.

RESET HPIL—Resets the HP-IL interface to a known condition.

RESTORE IO—Enables I/O operations to occur on HP-IL.

PRINTER AND DISPLAY OPERATIONS

DISPLAY IS—Assigns one HP-IL device to be the display device.

PRINTER IS—Assigns one HP-IL device to be used for all printing operations.

MASS STORAGE OPERATIONS

ASSIGN #—Associates an I/O channel number with a file and opens the file.

CAT—Gives a catalog of file information.

CAT$—Returns a string containing catalog information.

CHAIN—Purges current file, copies specified file into RAM, and executes it.

COPY—Copies a file from one location to another.

CREATE—Creates a data file.

INITIALIZE—Initializes a mass storage medium.

PACK—Packs directory and storage space on a medium.

PACKDIR—Packs only directory space on a medium.

PRIVATE—Permanently prevents a file from being changed or inspected.

PURGE—Deletes a file.

RENAME—Changes the name of a file.

RUN—Copies specified file into RAM and executes it.

SECURE—Prevents a file from being altered or purged.

TRANSFORM—Creates new TEXT file from BASIC file, or new BASIC file from TEXT file.

UNSECURE—Cancels security for a file.

(Continued)

GENERAL I/O OPERATIONS – DATA TRANSFER

ENTER—Reads data from HP-IL into numerical and string variables.

OUTPUT—Sends data from numeric and string expressions to HP-IL.

GENERAL I/O OPERATIONS – HP-IL INTERACTION

CLEAR—Clears an individual HP-IL device or all HP-IL devices.

DEVADDR—Returns the address of a device.

DEVAID—Returns the accessory ID of a device.

DEVID$—Returns a string containing the device ID of a device.

ENABLE INTR—Specifies the events that can cause an HP-IL interrupt.

LOCAL—Sets an individual HP-IL device or all HP-IL devices to Local mode.

LOCAL LOCKOUT—Sets all HP-IL devices to Local Lockout condition.

OFF INTR—Cancels HP-IL interrupt branching.

ON INTR—Defines how a program branches when an enabled HP-IL interrupt event occurs.

READDDC—Returns the number of the last HP-IL device-dependent command message received.

READINTR—Returns the value of the interrupt-cause byte.

REMOTE—Enables all HP-IL devices to change to Remote mode and can also set an individual HP-IL device to Remote mode.

REQUEST—Defines the HP-71 status byte that is sent when serially polled by an HP-IL controller.

SEND—Sends individual HP-IL messages on the loop.

SPOLL—Returns a value that represents one or more status bytes from an HP-IL device.

STANDBY—Sets the HP-IL timeout period and verify interval.

STATUS—Returns the HP-IL interface status.

TRIGGER—Triggers an event at an HP-IL device.

GENERAL I/O OPERATIONS – PASSING CONTROL

CONTROL OFF/ON—Sets the controller status of the HP-71.

PASS CONTROL—Gives control of the HP-IL system to another device.

BINARY FUNCTIONS

BINAND—Returns the value of the binary AND operation.

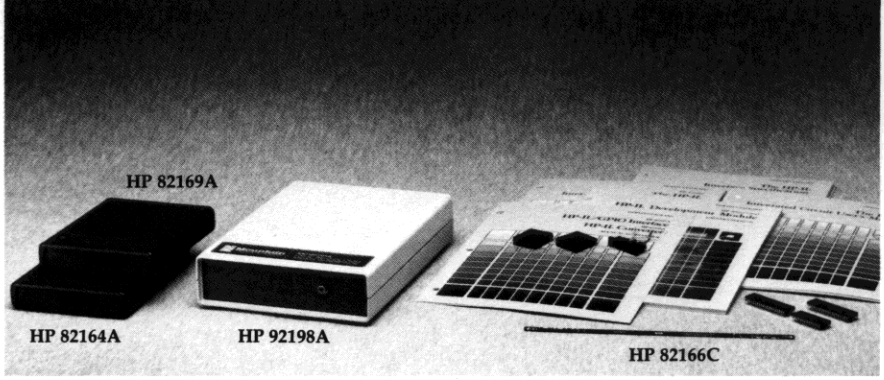
BINCMP—Returns the value of the binary complement.

BINEOR—Returns the value of the binary Exclusive-OR operation.

BINIOR—Returns the value of the binary Inclusive-OR operation.

BIT—Returns the value of one bit of an integer.

Hewlett-Packard Interface Loop Convertors and Interfaces



HP 82164A HP-IL/RS-232C Interface

The HP 82164A RS-232C Interface translates HP-IL signals into RS-232C signals and vice versa. It is designed to allow the interconnection of HP-IL systems with RS-232C devices. The interface operates in an asynchronous mode providing 5-, 6-, 7-, or 8-bit data formats with one or two stop bits and odd, even, zero, one, and no parity modes. A configuration control block allows the user to change the signals at the connector from a terminal (DTE) configuration to a modem (DCE) configuration so a host computer can be emulated.

HP 82169A HP-IL/HP-IB Interface

The HP 82169A expands HP-71 control and communication capabilities by linking low-cost HP-IL systems with high-performance HP-IB (IEEE 488) computers and lab equipment. It puts a variety of peripherals, instruments, and computers at your disposal, including more than 120 HP-IB-compatible devices made by HP and many more offered by other manufacturers.

With the HP-IB interface, you can operate HP-IB versions of the HP 82905B printer and the HP 7470A plotter; operate and control power supplies and instruments such as the HP 1980 oscilloscope; and talk directly with HP-IB computers such as HP Series 80, 100, 200, even the HP 1000 and 3000.

HP 82938A HP-IL/Series 80 Interface

With the HP 82938A, a Series 80 computer can act as a system controller or device in an HP-71 HP-IL system. You can take advantage of Series 80 graphics capabilities to display information from an HP-71 in easy-to-understand graphs and charts. Or, with Series 80 data communications products, you can pass information to larger computers.

HP 82165A HP-IL/GPIO Interface

Use your HP-IL system to control equipment operating with parallel bus structures. The GPIO interface contains the port buffering and a built-in power supply that operates from an HP standard AC adapter which is supplied with the interface. The interface links the HP-71 to computers for data collection, to specialized devices in production or lab environments, and to other devices.

HP 92198A Mountain Computer HP-IL 80-Column Video Interface

You can use this interface to display data and listings from an HP-71 HP-IL system on a standard video monitor. Add an RF modulator and use it with a conventional TV set. View your applications in 24 row by 80 column format, or choose 20 rows by 40 columns. Characters can also be displayed in inverse video (dark characters on a light background).

HP 82166C HP-IL Interface Kit*

The HP-IL Interface Kit provides the special components necessary for building HP-IL into your product. Three components are key to implementing the HP-IL interface standard: the HP-IL integrated circuits, the HP-IL transformer set, and the HP-IL panel receptacle. Included are complete component-level documentation and four complete sets of parts for prototype evaluation. Diagnostic and educational tools are also provided. Most of these tools are built-in features of the HP-71. Components may be purchased individually when design is completed.

National Semiconductor also supplies a pin-compatible HP-IL IC (part number NSC 851). Contact your local National Semiconductor supplier for details.

*Not available at retail outlets. To order an HP 82166C HP-IL Interface Kit, contact your local HP sales office.

Hewlett-Packard Interface Loop Instruments*

HP 3468A Digital Multimeter

HP's first HP-IL instrument is a low-cost, autoranging digital multimeter for your portable and bench applications. It electronically calibrates itself, measures AC and DC voltages and currents and makes four-wire and two-wire resistance measurements.

The device has 5½ to 3½ digits, five functions, and a 1-μV sensitivity.

HP 3421A Data Acquisition/Control Unit

The Data Acquisition/Control Unit provides low-cost automated measurement and control for your portable and bench test needs. Scan and measure up to 30 different channels or 56 single-ended channels of DC and AC voltage, resistance, temperature, and frequency; or read and write digital information and actuate control signals. It stores up to 30 analog readings in an internal buffer for later use by the computer.

HP 5384A/HP 5385A (Option 003) Frequency Counters

Two electronic frequency counters provide low-cost measurement performance for your bench, field and system applications. Measurement resolution of 9 digits/second and a liquid-crystal display assure you of highly readable results. High input sensitivity across a broad range of frequencies lets you solve a variety of frequency measurement problems using just one counter. And, extensive signal conditioning provides reliable measurements.

HP 1630A/D/G Logic Analyzer

Use HP 1630A/D/G Logic Analyzers for:

- Timing analysis at 100 MHz to check hardware and status signals.
- Stating analysis at 25 MHz to trace program and software flow.
- Performance analysis to optimize code.
- Interactive state/timing analysis to integrate circuits and code.

When used with the HP-71, you can run the HP 1630A/D/G remotely, automate production line tests, or even add it to a larger test and measurement system.

HP 5006A (Option 030) Signature Analyzer

The HP 5006A Signature Analyzer can be used with the HP-71 for inexpensive and fast troubleshooting.

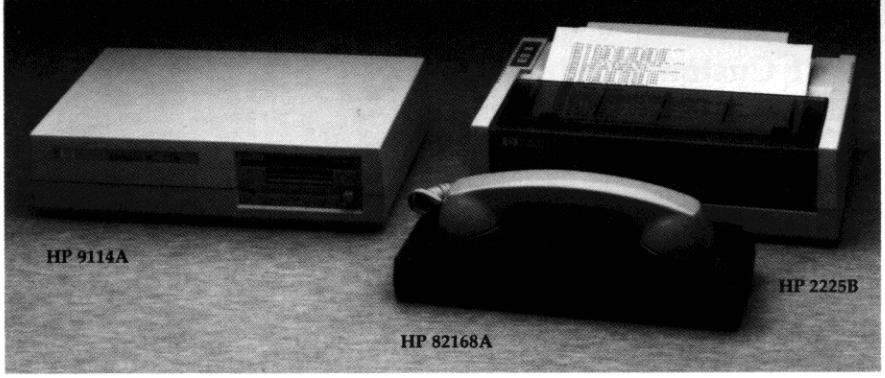
Compress bit streams into signatures of 16 bits, then instead of comparing entire bit streams you need only to compare signatures to detect bit errors in the unit under test. Signatures are stored in the HP 5006A memory after the probe switch is pushed. The memory stores the last 32 signatures probed. Individual signatures can now be compared in groups instead of after each probe by reviewing the memory in the RECALL mode.

HP 4945A Transmission Impairment Measuring Set

For portable data collection, use the HP 4945A Transmission Impairment Measuring Set (TIMS), controlled by the HP-71. TIMS provides the complete set of measurements needed to isolate faults quickly and qualify circuits for voice, data, or broadcast transmission up to 110 kHz. All measurements are compatible with current Bell standards including the ability to test local distribution loops for Dataphone Digital Service (DDS) to 56 kbps.

*Not available for purchase at retail outlets. For detailed specifications, contact your local HP sales office.

Hewlett-Packard HP-71 Peripherals



HP 2225B ThinkJet Printer

The battery-powered ThinkJet Personal Printer prints bidirectionally at 150 characters per second to produce 80-column pages quickly in the office or in the field. With sound pressure under 50 decibels, printer noise need never interrupt your train of thought again.

An inexpensive, disposable cartridge holds the print head and ink reservoir, and is capable of printing approximately 500 full pages before replacement. Ink is delivered to the paper on demand, and dries immediately, permanently.

The 11 x 12 dot-matrix format text mode has a logic-seeking feature to find the fastest print route. Add a bold mode that won't slow printing speed to handle most of your letter-quality needs. A ROMAN8 character set provides 216 printable characters to meet your multilingual printing needs. Print on single sheets or fanfold paper.

HP 82162A Thermal Printer/Plotter

The HP 82162A provides fast printouts with 24-character lines. It's battery-powered, so you can produce hard copy in the field.

This HP-IL compatible printer/plotter automatically centers and justifies text to the left or right. It has numeric upper- and lowercase alpha, double-wide characters, and intensity control for optimum contrast and readability. Additionally, it supports STANDBY mode that lets any HP-IL controller on the loop manage its power consumption.

*In Europe, order the following part number: HP 92205K – Belgium; HP 92205L – UK; HP 92205M – Germany; HP 92205P – France; HP 92205N – others.

HP 2671A/G Alphanumeric/Graphics Thermal Printers

The HP 2671A Alphanumeric Printer is both quiet and fast — 120 characters per second with a smart, bidirectional print path. The 9 x 15 dot matrix provides excellent character definition. Highlight with an underlining feature, print standard English or use Roman Extension for multilingual text.

In addition to all this, the HP 2671G offers high-resolution graphics capabilities for charts, tables, illustrations, and graphs.

HP 82168A Acoustic Coupler (Modem)*

Use the portable coupler to talk to computers over voice-quality telephone lines from remote locations. The 300-baud device meets the Bell 113 standard and can be used anywhere a conventional (G-type) telephone receiver is available.

The battery-powered device is compatible with HP-IL (Hewlett-Packard Interface Loop). It can be turned on or off by a controller, or it automatically turns itself off after 10 minutes of inactivity. Mode changes are under software control, making communication easier.

For additional data communications information, see the HP 82164A RS-232C Interface.

HP 82161A Digital Cassette Drive

The Digital Cassette Drive uses a digital-quality mini-cassette, capable of storing up to 128K bytes of information. Files can be located easily by name on the cassette drive. Rewind time is under 30 seconds and it can access over 250 bytes of information per second. All tape movement is under microprocessor control, unlike the more common audio cassette drives that must be operated manually.

The HP 82161A can locate files when under program control. It also features STANDBY mode, enabling an HP-IL controller to turn the Drive on or off remotely. This unique feature helps extend system battery life and allows for system operation in remote applications.

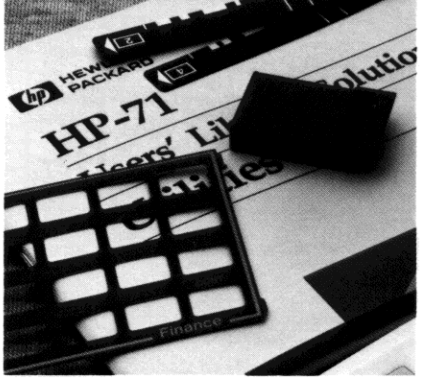
HP 9114A Portable Disc Drive

This compact, battery-operated, portable disc drive provides 630K bytes of information storage. It reads and writes double-sided, double-density format on 3½" flexible discs, and rotates at 600 RPM. Average access time of the HP 9114A is 497 msec (on) or 1479 msec (off). The maximum sustained transfer rate is 5K bytes per second.

The HP 9114A weighs about 5½ pounds, and provides 8 to 12 hours of battery operation on a single charge.

For additional information on HP peripherals, contact your local HP sales representative.

HP-71 Custom Products, Software and Users' Library



HP-71 Custom Products

HP's successful Custom Products Program combines customer-generated software, the Independent Custom Consultant (ICC) program, and the powerful HP-71 Handheld Computer.*

The availability of Custom Products enables original equipment manufacturers and other multi-user customers to take advantage of the HP-71 as an easy to use, powerful computer to optimize productivity.

HP provides several Custom Products and all are designed to tailor a problem-solving system to your professional demands.

ROM Modules

Custom ROM Modules change the HP-71 from a general purpose handheld computer to a specialized equipment controller. When you use a custom ROM, it executes the program, leaving the HP-71 memory free for greater computing power. Use up to four Custom ROM Modules at a time.

Magnetic Cards

Use Custom Magnetic Cards to store programs, text files, data files, and keyboard redefinitions. Store up to 1.3K bytes per card.

Keyboard Overlays

Custom Keyboard Overlays personalize your keyboard to match the Custom ROM or Magnetic Card you're using. Each key that has a specific function will be easy to locate, making the HP-71 simple to use.

The right custom option puts power and portability to work for you, swiftly transforming questions into answers and problems into productivity.

*Custom Product Programs also exist for the HP-41 and HP-75.

For more information on Custom Products contact your local HP sales office or write to:

Custom Products Department
1000 N.E. Circle Blvd.
Corvallis, OR 97330

Independent Custom Consultants (ICCs)

ICCs are independent software houses that contract with Hewlett-Packard. ICCs work together with you to develop your own Custom Products. The program is designed to make it easy for you; attention is focused directly on your needs.

ICCs meet your needs by:

- Designing HP-IL into your products
- Writing applications software
- Procuring finished Custom Products
- Providing consultation services on hardware, software, and applications
- Testing customer-generated software

For more information on ICCs, see the ICC Capabilities Guide.

HP-71 Software

Application Pacs

Hewlett-Packard offers HP-71 Application Pacs that include plug-in ROM modules and complete documentation to enhance the computational versatility of your HP-71 Handheld Computer.

These Application Pacs incude:

- FORTH/Assembler (HP 82441A)
- AC Steady State Circuit Analysis (HP 82481A)
- Curve Fitting (HP 82484A)
- Finance (HP 82482A)
- Math (HP 82480A)
- Surveying (HP 82483A)
- Text Editor (HP 82485A)
- Data Communications (HP 82488A)
- HP-71 Statistics by American Micro Products, Inc. (HP 82489A)

Solutions Books

HP-71 Solutions Books provide complete step-by-step keystroke listings to help equip you with answers to your general or specialized programs. Solutions Books are available on magnetic cards and mini data cassettes.

- Software Development Utility (HP 82440A)
- Software Developers' Handbook (00071-90097)
- General Utilities (basic subprograms) (00071-90066)
- Math (00071-90064)
- Games (00071-90065)

Users' Library

The Users' Library is a growing source of software solutions for HP-71 owners. Users' Library members enthusiastically contribute programs spanning many applications.

Each program has been reviewed by the Users' Library's technical staff and comes with complete documentation to give you ready-to-go solutions. You can expect detailed program descriptions, warnings, or limits; sample problems and examples as appropriate; instructions on running the program; and step-by-step listings of program keystrokes.

Program documentation includes individual program listings. You can also purchase Users' Library programs pre-recorded on magnetic pull cards, mini data cassettes or 3½" discs.

In addition, the Corvallis Software Distribution Center distributes software developed by Independent Software Vendors.

For more information about Library solutions and the Corvallis Software Distribution Center, contact:

Users' Library
1000 N.E. Circle Blvd.
Corvallis, OR 97330

HP-71 Development System

The HP-71 – An "Open" Machine

The HP-71 by itself is an extremely powerful machine. Add accessories, peripherals and instruments to further increase and enhance its problem-solving versatility. Hewlett-Packard also provides the tools with which you may choose language options and move between languages. Hardware and software developers are encouraged to dig deeper and develop hardware, software and interfaces that will make the HP-71 an indispensable tool for all kinds of applications.

Software Development Utility (82440A)

Develop your own HP-71 BASIC, FORTH, or Assembly language source files using a personal computer word processing program. Then transfer the files to the HP-71. Included in the Software Development Utility are the HP-71 transfer programs on mini data cassettes. Listings of typical programs on personal computers that work directly with the HP-71 program to effect the file transfer are also included. Choose your file-transfer option; either HP-IL, HP-IB, or RS-232C. (HP-IL/HP-IB or HP-IL/RS-232C interfaces are required.)

FORTH/Assembler (82441A)

The FORTH/Assembler ROM provides you with an extended software development environment for your HP-71. The FORTH operating system lets you write application programs in FORTH that execute faster than programs written in BASIC. HP-71 FORTH enhances the FORTH 1983 Standard word capability set with string manipulation words, floating point words and HP-IL words. The FORTH operating system is compatible with the HP-71 BASIC operating system so you can switch between FORTH and BASIC environments without program or data loss; reconfiguring the HP-71 is not necessary. Programs written in one language can execute routines written in the other language. FORTH also provides you with RPN calculator capability.

An assembler, written in FORTH, provides the same command set as the assembler used to develop the HP-71 operating system. Use it to create FORTH primitives, HP-71 binary files, or language extension (LEX) files to extend the BASIC language.

Use the text editor to create and edit text files for use as source files for BASIC, FORTH or Assembly language programs, as well as non-programming related purposes.

A BASIC keyword, <KEYBOARD IS>, lets you use any terminal device connected to your HP-71 through an interface as an external keyboard and display for the HP-71. The keyword <DISPLAY IS> is provided in the HP-IL Interface (HP 82401A).

Hewlett-Packard encourages software and hardware developers to delve deeper into the HP-71. To support these efforts, the internal specifications of the HP-71 have been documented and are available. The information includes details on the internal operation, entry points into the operating system, source code listings, an HP-IL interface description, and hardware bus specifications.

The Internal Design Specifications (IDS) Documents

Different aspects of HP-71 internal operation are covered in each specification document.

Volume I: Detailed Design Description (00071-90068)

- System Start-up and Memory Configuration
- Memory Structure
- System Control
- The BASIC Interpreter
- Language Extension and Binary Files
- BASIC File Considerations
- Statement Parse, Decompile, and Execution
- Utilities
- Message Handling
- File System
- Table Formats
- Internal Data Representation
- Numeric Computation Algorithms
- Clock System
- HP-71 Assembler Instruction Set
- HP-71 Code Examples
- HP-71 Resource Allocation

Volume II: Entry Point and Poll Interfaces (00071-90069)

- Documents entry and exit conditions of 25 categories of supported system entry points.
- Documents interfaces to operating system polls of LEX files.
- Index of entry point names and global symbol values.

Volume III: Operating System Source Listings (00071-90070)

- Full assembly listings of the 76 modules that comprise the 64K bytes of the HP-71 operating system.

HP-IL (82401-90023)

- Internal Design Notes
- Extended Command Syntax
- Examples of HP-IL Operation
- I/O Processor Firmware Specification
- HP-IL Poll Interfaces
- HP-IL ROM Utility Routines
- HP-IL LEX File Source Listings

Hardware Design Specification (00071-90071)

- Describes each bus line and its purpose; specifications and schematic diagrams are included.
- Describes the CPU (from a hardware perspective).

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