HEWLETT hp PACKARD

9825A/S Desktop Computer Specifications

TECHNICAL DATA* FEBRUARY 1979

The HP 9825A is a desktop computer that can be used as a stand-alone device or as a system controller for industrial and scientific applications.

The 9825S is a desktop computer system which consists of

- a 9825A desktop computer,
- 23 228 bytes of read/write memory (three times the standard 9825A),
- Read-Only Memories for string variables and interfacing.

Whichever model you choose, you get a 32-character LED display, 16-character thermal strip printer, a typewriter-like keyboard that lets you use both uppercase and lowercase alphanumerics, three I/O ports, four Read-Only Memory(ROM) slots and a two-track tape cartridge drive.

A unique feature of the tape cartridge system is the "record memory". This allows you to copy the entire contents of memory including all programs, data, flags, Special Function keys and internal system information so that the 9825 can be returned to the identical operating environment at a later time.

Another feature of the 9825 is the high-level programming language (HPL) that offers power and efficiency for handling equations and input/output operations, yet is easy to learn and use.

The live keyboard is another valuable characteristic the 9825 provides. This means you can perform calculations and execute subroutines as well as list the current program and examine or change program variables while a program is running.

The 9825 also has interrupt capability. When given a signal from a peripheral, the 9825 suspends operations to execute a priority program or input more information. The desktop computer then resumes operations at the point of interruption.

In addition to its inherent computing power, the 9825 also allows flexible interfacing with a variety of devices including plotters, digitizers, printers, and flexible disk drives. To complete your system's configuration, you can choose from a range of software packs for engineering, mathematics and statistics applications.

Features

- Alphanumeric keyboard
- 32-character LED display
- Built-in tape cartridge drive
- High-level programming language (HPL)
- Interrupt capability
- Plug-in read-only memories (ROMs)
- 12 Special Function keys (24, with shift)
- Expandable read/write memory
- 12 significant digits
- Live keyboard
- Direct memory access
- Trigonometric capability
- Boolean algebraic capability

Index

General Information

9825A Read/Write Memory

Standard ..... 6 844 bytes
Opt. 001 ..... 15 036 bytes
Opt. 002 ..... 23 228 bytes
Opt. 003 ..... 31 420 bytes

(The following ROMs will not operate with Opt. 003: — 98210A, 98213A, 98214A, and 98216A)

9825S Read/Write Memory

Standard ..... 23 228 bytes

Range

Dynamic range:
10^{99} to 10^{-99}, 0, -10^{-99} to -10^{99}
Internal calculation range:
10^{511} to 10^{-511}, 0, -10^{-511} to -10^{511}

Computer Museum

Tape Cartridge

Memory capacity	250 000 bytes
Read/write speed	559 mm/s (22 in./s)
Search speed (bidirectional)	2 286 mm/s (90 in./s)
Transfer rate	2 750 bytes/s
Typical rewind time	19 s (end-to-end)
Typical erase time	40 s (one track)
Tape length	42.67 m (140 ft)
Size	63.5 x 82.5 x 12.7 mm (2.5 x 3.25 x 0.5 in.)
Verification	automatic on recording

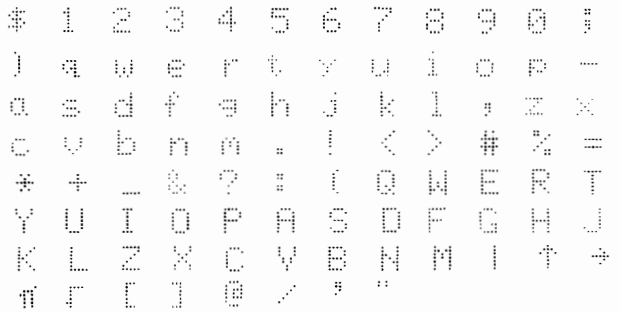
Tape cartridges are intended for nominal program or data storage; the typical life cycle is 50-100 hours, depending on the application. Environmental conditions of 25°C (77°F) and 20 to 50% relative humidity are most favorable for a long tape life. Tape life is decreased by a high-duty cycle (percent of time the tape is accessed during the total time the 9825 is in use), high turning resistance and continuous use for long periods of time (longer than one-half hour). It is suggested that tape transports be regularly cleaned and cartridges removed from drives after use.

For heavy usage of mass storage files, such as in consecutive file sorts or data base management applications, flexible disk drives are recommended for optimum performance and reliability.

Printer

Paper width	57.15 mm (2.25 in.)
Speed	180 lines/min
Font	5 x 7 dot matrix; prints all the following characters in upper and lower case; up to 16 characters/line

9825S Character Set



Built-in Functions

Mathematical and trigonometric functions and operations are included in the following with average execution times.

Absolute (abs)	0.19 ms
Fraction (frc)	0.37 ms
Integer (int)	0.47 ms
Maximum (max)	variable
Minimum (min)	variable
Modulus (mod)	3.1 ms
log	8.6 ms
ln	6.7 ms
e^x	5.5 ms
10^x	7.6 ms
Raise to power	15 ms
Random number (rnd)	1.8 ms
Sign (sgn)	0.20 ms
$\sqrt{}$	2.5 ms
Sine (sin)	18 ms
Cosine (cos)	18 ms
Tangent (tan)	13 ms
Arcsine (asn)	22 ms
Arccosine (acs)	22 ms
Arctangent (atn)	15 ms
+	0.32 ms
−	0.37 ms
*	0.88 ms
/	2.5 ms
Power of ten round (prnd)	0.74 ms
Digit round	0.53 ms

Logic operators
AND, NOT, OR, XOR (exclusive or)

Relational operators
= equal to
>= or => greater than or equal to
> greater than
<= or =< less than or equal to
< less than
or <> not equal to

ROMs — 9825S

The 9825S also includes the 98210A String—Advanced Programming ROM and a choice of the 9862A Plotter—General I/O—Extended I/O ROM or the 9872A Plotter—General I/O—Extended I/O ROM.

Environmental Range

Operating temperatures	5°C to 40°C ambient
Storage temperature	−40°C to 65°C
Ambient humidity	<80%

Size/Weight

Height	129.5 mm (5.1 in.)
Width	383.5 mm (15.1 in.)
Depth	495.3 mm (19.5 in.)
Weight:	
Net	11.8 kg (26 lb)
shipping	19.5 kg (42 lb)
Cube	0.12 m^3 (4 ft^3)

Power Requirements

Source	110 V +5%, −10% 120 V +5%, −10% 220 V +5%, −10% 240 V +5%, −10%

Note: Voltage is switch-selectable.

Line frequency	48 to 66 Hz
Consumption	1.7 A @ 100V 1.5 A @ 120V 0.8 A @ 220V 0.75A @ 240V

9825A/S Read-Only Memories (ROMs)

To extend language capabilities and control external devices, several ROMs are available for use with the 9825A/S. They include the following combinations, with part numbers in parentheses:

- String—Advanced Programming (98210A)† *
- Matrix (98211A)
- 9862 Plotter—General I/O (98212)
- General I/O—Extended I/O (98213A)†
- 9862 Plotter—General I/O—Extended I/O (98214A)† **
- 9872 Plotter—General I/O (98215A)
- 9872 Plotter—General I/O—Extended I/O (98216A)† **
- 9885M Flexible Disk Drive (98217A)
- Systems Programming (98224A)

†Will not operate with 31 420 total bytes of memory
*Part of standard 9825S
**Choice of ROMs with 9825S

Physical Specifications

All ROMs described herein conform to these physical specifications.

POWER

Provided by the 9825A/S

ENVIRONMENTAL RANGE

5°C to 40°C
< 80% ambient humidity

SIZE/WEIGHT

Width . . . . . 71.6 mm (2.82 in.)
Length . . . . . 115.8 mm (4.56 in.)
Depth . . . . . 15.5 mm (0.61 in.)

String Capabilities

The string portion of the 98210A allows the 9825A/S to accept and manipulate alphabetic and numeric information. It provides 26 single string variables or string array variables. Maximum length is 32 767 characters but in practice is limited by the memory size of the 9825.

This ROM allows comparison of strings or substrings. All the relational operations allowed in numerical comparisons apply to string computations. In addition to the standard characters, the 98210A permits these special characters to be displayed and printed on the internal printer:

STRING FUNCTIONS

ent - Enter statement for strings and substrings.
dim - Reserves storage space for strings or string arrays.
len - Obtains the length of a string or substring.
pos - Determines the position of a substring within a single string.
val - Allows the numerical value of a string of digits to be used in computations; fixed point and floating point notations are allowed.
num - Gives the decimal value of an ASCII or non-ASCII character.
str - Converts a numeric value into a string based on the current fxd/flt setting; the inverse of val.
char - Generates ASCII or non-ASCII characters; the inverse of num.
& - Joins strings without modifying any of the original strings (concatenation).
cap - Converts lower-case alphabetic characters to upper case without modifying the original string.

SPECIFICATIONS

Memory: uses 52 bytes of read/write memory

Advanced Programming Capabilities

The advanced programming portion of the 98210A provides parameter-passing functions and subroutines with local variables. It includes for...next statements and a cross-reference operator. Numbers can be packed with split or integer precision.

FUNCTIONS

'name' - Calls a function which is labeled by "name"; any number of parameters can be passed and local variables may be used within the function.
ret - Causes a single value to be returned to the statement which called the function.

SUBROUTINES

cll - Calls a subroutine; any number of parameters can be passed, and local variables may be used within the subroutine.
ret - Causes the program to return to the statement following the call.

LOOPING

for...next - Allows the controlled repetition of a group of statements within a program.

SPLIT AND INTEGER PRECISION STORAGE

The 98210A allows the storage of numbers in two compact formats:

fts - Split precision: six digits, mantissa sign and exponent (−63 to 63); packing density of 2:1 over floating point.
fti - Integer precision: numbers in the range of −32768 to +32767; a 4:1 density over floating point.
stf - Unpacks split precision to floating point.
itf - Unpacks integer precision to floating point.

CROSS REFERENCE

xref - Gives an alphabetical list of variables used in a program along with the line numbers in which they are referenced.

SPECIFICATIONS

Memory: uses 4 bytes of read/write memory.

Computer Museum

Matrix Capabilities

The HP 98211A Matrix ROM provides matrix and array operations to augment the multidimensional array capability of the 9825.

MATRIX OPERATIONS

inv - Matrix inversion and determinant.
mat - Matrix multiplication.
trn - Matrix transposition.
idn - Establishes an identity matrix.

The matrix inversion technique employs a modified Gauss-Jordan reduction using the maximum pivot strategy. This method is superior to the standard Gauss-Jordan elimination or the diagonal pivot strategy because it will successfully invert all but singular or near-singular matrices. Pivoting on the maximum elements maximizes the accuracy of the results.

ARRAY OPERATIONS

The number of dimensions can be anything specified by valid dimension (dim) statements.

ara - Performs addition, subtraction, multiplication, division, and copying; this statement performs the indicated operation on the corresponding elements from each array in succession.
smpy - Scalar multiplication; the scalar may be a simple variable or a number.
ina - Sets all elements of an array to a value; the value may be a simple variable or a number.
aprt - Prints the elements of arrays on the strip printer.
rdm - Redimensions arrays.

SPECIFICATIONS

Memory: uses no read/write memory, except during matrix inversion.
Speed: 20 × 20 matrix inversion in 10 seconds.

Will not operate with the Systems Programming ROM (98224A).

Plotter Capabilities

9862A

The HP 9862A Plotter portion of the 98212A and 98214A provides the statements necessary for the 9825A to control the 9862A. These commands are designed to simplify the task of producing graphic representation of data.

scl - Sets the range of X and Y in user units.
axe - Draws the X and Y axes with optional tick marks.
ofs - Temporarily shifts the origin to a new location.
pen - Raises the pen without moving to a new position.
plt - Moves the pen to the point X,Y; the pen may be raised or lowered before or after the pen movement.
iplt - Same as plot, except that the pen is moved relative to the current pen position instead of relative to the origin.
psc - Permits the plotter select code to be changed, permits a plotting program to run without a plotter, and permits using multiple plotters.
cplt - Allows plotted characters to be centered over a particular point by moving the pen in units of "character size".
lbl - Prints (on the plotter) using standard format.
ltr - Sets the starting point, size, and direction of lettering.
csiz - Specifies the character height, width, and direction.
ptyp - Permits characters to be printed on the plotter directly from the 9825's keyboard.

SPECIFICATIONS

Memory: uses 70 bytes of read/write memory.

9872A

Statements for the 9872A Plotter are contained in the 98215A and 98216A ROMs and are listed here. These mnemonics enable the 9825 to control the 9872A and, like the previous 9862A Plotter statements, simplify production of output.

psc - Allows several plotters to be addressed via one plotter ROM.
scl - Sets a range of X and Y in user units.
xax - Draws an X axis with optional tick marks and tick mark labels.
yax - Draws a Y axis with optional tick marks and tick mark labels.
ofs - Shifts scale origin to a new location.
pen - Raises pen without moving to a new location.
plt - Moves pen to point X, Y; pen may be raised or lowered before or after moving.
iplt - Same as plt except that movement is relative to current pen position instead of scale origin.
pen # - Allows programmed selection of pen to be used for plotting or lettering.
line - Selects one of eight line types to be used for plotting.
limit - Restricts programmed pen motion to specific rectangular area on the platen.
cplt - Allows incremental plotting in units of character spaces.
lbl - Prints characters, numbers, and symbols on plotter from a program.
ptyp - Sets a manual lettering mode from 9825 keyboard.
csiz - Specifies character height and width as well as direction of lettering.
dig - Enables digitizer mode between 9825 and plotter to return scaled coordinates from plotter to 9825.
pclr - Clears plotter of previously programmed plotting or lettering specifications and selects 9825 character set.
wrt - (General I/O write statement) Sends all HP-GL (Hewlett-Packard Graphics Language) commands to plotter, e.g., SM (symbol mode), SL (character slant) and VS (select velocity).

SPECIFICATIONS

Memory: uses 104 bytes of read/write memory.

General I/O Capabilities

The General I/O portion of the 98212A, 98213A or 98214A provides basic input/output capabilities including read/write with format control, binary read/write, status testing and code conversion. Any of these ROMs can list programs on a peripheral. The General I/O portion provides fundamental input/output operations with HP-IB (conforms to IEEE Specification 488-1975) peripherals. These special characters can be displayed and printed on the internal printer:

In addition to controlling external devices, this ROM can address the 9825's printer, display and keyboard.

GENERAL I/O COMMANDS

fmt - Establishes the format for the read and write statements; format specifications can include fixed point, fixed point with leading zeros, floating point, binary, strings, literals, spaces, carriage return/line feed, and CR/LF suppression with repeat functions for each specification.
red - Inputs data from a peripheral to the 9825.
wrt - Outputs data from the 9825 to the peripheral.
wtb - Outputs a single byte (8 bits) or word (16 bits).
rdb - Inputs a single byte (8 bits) or word (16 bits).
wtc - Outputs control bits to an interface.
rds - Inputs the status of an interface.
conv - Specifies the conversion of up to 10 ASCII characters to other ASCII characters during I/O operations.
list # - Extends listing capability to peripheral devices.

SPECIFICATIONS

Memory ..... uses 56 bytes of read/write memory
Speed ..... up to 16k bytes/s depending on the format, program and peripheral

Extended I/O Capabilities

The Extended I/O portion of the 98213A or 98214A has complete HP-IB control, plus vectored interrupt, buffered I/O, burst read/write, and Direct Memory Access (DMA). It provides bit manipulation and testing, code conversion, error trapping, time out, and AUTO START.

HP-IB FUNCTIONS

dev - Associates user-defined names with peripheral devices for use in select code specifications.
equ - Associates user-defined names with setup functions for HP-IB devices.
cmd - Statement used to address the HP-IB directly.
tfr - Transfers information between peripherals and internal buffers.
trg - Group execute trigger.
clr - Selective device clear, general device clear.
rem - Remote enable/disable.
loc - Go to local.
llo - Local lockout.
polc - Parallel poll configure.
polu - Parallel poll unconfigure.
pol - Used to conduct a parallel poll.
pct - Pass active control to a specified HP-IB device.
rqs - Used to set the service request line when the 9825 is acting as a peripheral on the bus.
rds - Extends rds function of the General I/O ROM to input multiple status bytes from HP-IB and to conduct a serial poll.

INTERRUPT FUNCTIONS

The Extended I/O allows for user-written, keyboard language interrupt service routines. When devices interrupt, program control is passed to a service routine at the end of the current program line. After service, your program executes a special return statement which polls for other interrupt requests. Control is then returned to the next line of the main program. Select codes 8 through 15 have priority over select codes 0 through 7 with provisions for abortive interruptions for emergencies.

oni - On interrupt; specifies the location of keyboard language service routine for a given select code.
eir - Enables a peripheral to interrupt.
iret - Interrupt return; terminates a service routine.

BUFFERED I/O, BURST READ/WRITE, DMA

In addition to the "fmt, red, and wrt" statements of the General I/O, the Extended I/O has mnemonics to handle data transfers of slow and/or random time devices and very fast devices.

buf - Allocates a segment of read/write memory to be used as an I/O buffer; can set the size of the buffer and the type (interrupt, burst, or DMA).

When you write to a device, data is placed in the buffer, and the device can interrupt when it is ready for more. If the peripheral is an input device, the buffer is filled under interrupt, and when completed, data is taken from the buffer.

For burst read/write, the ROM buffers data until a termination condition is met.

For DMA, the ROM requests the DMA channel and then does a DMA transfer.

DIRECT REGISTER ACCESS

You may directly access the interface card to alter the normal I/O sequence for special applications.

rdi - Allows you direct access to the registers used for communication with a peripheral interface.
wti - Writes one byte/word of data directly to a designated interface register.
iof - Provides direct testing of the I/O interface flag.
ios - Provides direct testing of the I/O status line.

BIT MANIPULATION AND TESTING

These functions permit you to operate on 16-bit binary values in order to form special bit patterns for input/output operations.

ior - Returns the inclusive OR of two values.
eor - Returns the exclusive OR of two values.
band - Returns the AND of two values.
cmp - Returns the one's-complement of a value.
rot - Performs a left/right rotate on a value by a specified number of bits.
shf - Performs a left/right shift on a value by a specified number of bits.
add - Performs octal addition when 9825 is in the octal mode.
bit - Tests the specified bit(s) of a value and returns a true/false indication.

Computer Museum

CODE CONVERSION

ctbl - Allows you to specify a string as a complete conversion table between ASCII code and a different code.

par - Specifies the parity bit of input/output data.

OCTAL MODE

moct - Sets a mode where all binary references are interpreted in octal instead of decimal.

mdec - Cancels the octal mode and returns to the decimal mode.

Functions for direct decimal/octal conversion are also provided.

ERROR TRAPPING

on err - When an error is made, the program goes to a labeled routine to allow the program to take alternative action; the error number and line are available.

TIME OUT

Lets you specify alternative actions when a peripheral does not respond in a specified time.

AUTO START

Automatically loads and runs file Ø when the 9825A's power comes on.

SPECIFICATIONS

Memory . . . . . uses 94 bytes of read/write memory.

Speeds† . . . . . burst read/write up to 90k transfers/s; DMA input rates of up to 400k transfers/s; output rates of up to 225k transfers/s; 16-bit word or one 8-bit byte.

† Speeds given are maximum rates. Actual rates depend on the program, I/O card, and peripheral used.

Flexible Disk Capabilities

The 9885M software system includes the 98217A ROM and "bootstraps" that are supplied on a data cartridge. These bootstraps are moved to the disk when it is initialized.

The system requires 1 140 bytes of the 9825's read/write memory for data buffer, bootstrap area, pointers and status words.

The 98217A ROM contains statements, listed in the following, that are programmable and are organized in a file-by-name directory that maintains user files and available space.

open - Creates a data file with a specified number of physical records and assigns it a name.

save - Stores an entire program or parts of it in a specified file.

save keys - Stores Special Function key definitions in a named file.

get - Loads a program from the disk to the 9825.

get keys - Loads Special Function key definitions from the disk to the 9825.

drive - Specifies the drive to be used.

on end - Sets a branching condition that changes the program flow to a new location when an end condition is encountered.

kill - Erases the named file from the disk and adds the file space to the availability table.

files - Declares which files are to be used.

assign - Allows the declared files to be changed and allows a string variable to declare a file to be used.

catalogue - Lists information about every user file on the disk.

chain - Loads a program from the disk to the 9825, retaining variable values.

copy - Duplicates the contents of one file into another file or drive.

DATA FILE STATEMENTS

serial print - Prints data into a file after the last item previously read or printed, or at the beginning of the file.

random print - Prints data into a file from the beginning of a specified record.

serial read - Reads data from a file starting after the last item printed or read.

random read - Reads data from a file starting at a specified record.

SUPPORTING COMMANDS

rename	file dump	file load	type
repack	resave	get binary	verify

Systems Programming Capabilities

The 98224A ROM enhances the I/O capability of the 9825 and is particularly useful for:

- asynchronous terminal emulation,
- progam input from ASCII-coded devices,
- control of the 98036A Serial I/O,
- remote keyboard operation of the 9825,
- dynamic program modification,
- keyboard redefinition,
- annotated HPL programs,
- efficient memory utilization,
- high-speed data logging.

In addition, this ROM provides three types of statements specified in the following.

TERMINAL EMULATOR AIDS

asc - Returns ASCII equivalent of a 9825 code.

bred - Buffer read; permits reading the contents of an active (transfer in progress), input, byte-oriented interrupt buffer.

eol - end of line; permits specifying up to seven characters which will be substituted for the nominal CR/LF output following each line sent by list #, wrt, cat and a "/" specification in a fmt statement. An optional delay parameter sets a delay between successive output lines.

key - Returns the keycode for oldest unprocessed key in the keyboard buffer set up by on key.

kret - Returns from a keyboard interrupt service routine.

on key - On keyboard interrupt; sets up a 16-character circular keyboard buffer and specifies the location of an HPL service routine to be accessed whenever a key is pressed.

98036A CONTROL INSTRUCTIONS

rkbd - Enables (or disables) remote keyboard operation of the 9825; permits choosing either a 9825 - type or ASCII keyboard.

rss - Reads serial status; reads the USART status word (R4D) on the 98036A.

wsc - Writes serial control word; sets the USART control word (R4D) on the 98036A to the specified value.

wsm - Writes serial mode word; sets mode word (R4C) on the 98036A to specified value; control word (R4D) can also be specified.

SYSTEM PROGRAMMING INSTRUCTIONS

avm - Available memory; returns the number of bytes of read/write memory not presently used.

cln - Current line number; returns the number of the program line currently executing in the 9825.

nal - Next available line; returns a number one greater than the last program line in memory.

% - Free text prefix; stores characters following % as text in 9825 memory.

store - Stores a literal or string variable as a program line at the line number specification.

SPECIFICATIONS

Memory . . . . . uses 160 bytes of read/write memory.

Will not operate with the Matrix ROM (98211A).

9825A/S Interfaces

There are four interface cards designed for use with the 9825A/S:

- 16-Bit Parallel I/O (98032A)
- BCD Input (98033A)
- HP-IB† (98034A)
- Real Time Clock (98035A)
- Serial I/O (98036A)

†Conforms to IEEE Specification 488-1975

Physical Specifications

These interfaces conform to the following specifications.

POWER

Provided by the 9825A/S.

SIZE/WEIGHT

Length . . . . . 163 mm (6.4 in.)
Width . . . . . 89 mm (3.5 in.)
Depth . . . . . 38 mm (1.5 in.)
Shipping weight . . . . . 2.3 kg (5 lb)

16-Bit Parallel I/O

This interface provides the 9825 with a latched 16-bit input data bus and a latched 16-bit output data bus for bidirectional transfer of information. Operation of the 98032A requires the General I/O ROM for typical read/write functions and the Extended I/O ROM for advanced capabilities such as vectored interrupt, buffered I/O and DMA.

Input/output transfers can be in a 16-bit word format or in two independent 8-bit bytes. DMA transfers are word oriented with rates up to 400k 16-bit words/s. Enabling/disabling and interrupt priority are controlled by select code settings and software commands.

Extended control and status lines are available for applications that require more than one signal from the 9825. These signals, combined with full-word or byte-data transfer modes, allow interfacing to a variety of equipment.

SPECIFICATIONS

Logic Configuration

Fifteen jumpers are provided within a removable cable boot to control the logic of I/O data, control signals, flag information and peripheral status information. Such operating modes as handshake operation, DMA, and word/byte data are also controlled by these jumpers.

Data Input/Output

Sixteen input lines with 3k Ω to 5 V and 6.2k Ω to ground terminations accept standard TTL signal levels.

Sixteen output lines have high voltage/current (30 V, 40 mA) open-collector transistor drivers.

Control Lines

PCTL Peripheral Control—indicates to the peripheral that data is ready for output or 9825 is ready for input; PCTL is reset by a ready-to-busy transition on PFLG.

PFLG Peripheral Flag—indicates to the 9825 completion of a data transfer; also used to request peripheral interrupt when enabled.

PSTS Peripheral Status (optional) — indicates to the 9825 the readiness of the I/O device (paper out, power off, etc.); PSTS is sampled by the 9825 whenever communication with the peripheral is requested.

STIØ,STI1 Extended Status (optional) — examined by reading the 98032A I/O status register.

CTLØ,CTL1 Extended Control — setting or clearing these signals can be accomplished by writing into the 98032A I/O control register.

I/O Direction — indicates to the peripheral the direction of the current data transfer; valid when PCTL is valid.

PRST Peripheral Reset — used to initialize a peripheral. PRST is pulsed low when the 9825 is turned on, when the RESET key is pressed, or when software requests a device to be reset.

EIR External Interrupt Request — used only during DMA when EIR can be used to abort the transfer prior to completion; normal interrupt requests use the PFLG line.

Select Code Settings

Choose any one of 14 select codes via an externally accessible rotary switch. Select codes 2-7 have low interrupt priority, whereas 8-15 have high interrupt priority. The Extended I/O ROM is required to operate the 98032A under interrupt control.

Accessories

The standard 98032A Interface is shipped with a 4.5 m (15 ft) open-ended cable but is also available with a 2 m (6.6 ft) cable terminated with a specific option for connection to various peripherals. A 98241-67932 Test Connector is available to verify hardware operation of the interface.

Computer Museum

BCD Input Interface

This interface connects the 9825 with bit-parallel, digit-parallel, binary coded decimal devices for data input. Up to 10 BCD digits, with overload and sign information, can be input using the General I/O ROM with transfer rates to 250 readings/s.

An input format is selectable that allows two instruments to be read from a single interface card. The speed of the slowest device dictates the overall transfer rate.

The Extended I/O ROM can extend transfer rates to 3125 readings/s and also provides buffered I/O with peripheral interrupt for communication with slow devices.

SPECIFICATIONS

Data Formats

Data is serialized into the 9825 in a 16-character sequence. Two data formats are switch selectable on the interface card:

8-digit signed mantissa with 1-digit signed exponent
1-digit function code and overload indication

or

4-digit signed mantissa
5-digit signed mantissa with positive exponent

Additional data formatting can be accomplished via formatted read statements in the software.

Codes

Data — 8421 binary coded decimal weighting with codes 0-9 representing digits 0-9 and other codes as follows:

1010 (L.F.) line feed
1011 (+) plus sign
1100 (,) comma
1101 (−) minus sign
1110 (E) character "E"
1111 (.) decimal point

Additional Input Information

Exponent, Functions } 8421 binary coded decimal weighting: codes 0-9 only

Mantissa sign, Exponent sign, Overload } 1 binary bit: logic sense is selectable

Logic Configuration

Switches are provided inside the interface to select the logic sense of the following signals: FLGA, FLGB, CTLA, CTLB, SGN1, SGN2, OVLD, and interface DATA. Selection of optional data format (2 devices) and pulsed operation of CTLA or CTLB (or both) is also accomplished via these switches.

Data Input

Forty-three data input lines (10 BCD digits, mantissa sign, exponent sign, and overload) have low-power Schottky TTL receivers with V max of 7 V. External device must sink 0.4 mA to produce a low-level input. Data is not latched and, therefore, must be held stable while the 9825 is reading.

Control Lines

CTLA, CTLB Peripheral Control A and B — CTLA and CTLB are open collector outputs with 2.2k Ω pull-up resistors. V max is 15 V and current sinking capability is 14 mA. CTLA (B) can be reset by either edge (ready-to-busy or busy-to-ready) of FLGA (B), with the ready-to-busy option providing the pulsed mode of operation.

FLGA, FLGB Peripheral Flag A and B — FLGA and FLGB receiver circuits are low-power Schottky TTL Schmitt triggers whose inputs have 2.2k Ω to +5 V, 0.01 μF capacitors to ground, and 47 Ω in series with the driver. Either FLG in a busy state will indicate busy to the 9825.

Select Codes

One of 14 select codes may be chosen via an externally accessible rotary switch. Select codes 2-7 have low interrupt priority, codes 8-15 have high priority. The Extended I/O ROM is required to operate the 98033A under interrupt control.

Accessories

A 98241-67933 Test Connector is available to verify hardware operation of the 98033A Interface. This interface has no options; it is shipped with a 4.5 m (15 ft) open-ended cable.

HP-IB Interface

This interface allows the HP 9825 to communicate via the HP-IB to as many as 14 compatible instruments per interface. The 98034A utilizes a controlling processor to provide efficient management of interface bus protocol.

The General I/O ROM and the Extended I/O ROM access all the capabilities of the 98034A. For example, with these ROMs, the 98034A provides such capabilities as peripheral interrupt for service requests and data transfer at rates up to 45k bytes/s.

SPECIFICATIONS

The following specifications conform to the IEEE Standard Digital Interface for Programmable Instrumentation (IEEE 488-1975).

Data Input/Output

Eight bidirectional data lines provide data input/output.

Control Lines

DAV, NRFD, NDAC } provide handshake

Interface Management

IFC, ATN, SRQ, REN, EOI } provide control of the interface system

Interface Functions

SH1 - source handshake
AH1 - acceptor handshake
T5 - talker
L3 - listener
SR1 - service request
RLØ - remote local
PP2 - parallel poll
DC1 - device clear
DTØ - device trigger
C1,2,3,4,5 - controller

Interrupt Capability

When used with the Extended I/O ROM, the 98034A is capable of responding to any or all of the following interrupt requests:

- take active controller status,
- take active talker status,
- take active listener status,
- respond to service request,
- input buffer full,
- output buffer empty.

Switch Configuration

Select Code Setting — switch is externally accessible and allows one of 14 possible select codes to be set for the interface cards; bus interface addresses then select the specified device.

Interface Bus Address — 5-bit talker/listener address pair.

System Controller — switch allows the 98034A to act as a system controller; if not selected, the 98034A assumes the function given to it by the system controller if that status exists in the previous table of interface functions.

Parallel Poll Bit — select any one of the 8 data bits for response purposes.

Parallel Poll Bit Sense — selected parallel poll bit logical sense controlled with this switch.

Accessories

The 98034A is shipped with a 4 m (13 ft) interface cable terminated with the standard HP-IB connector and metric fasteners. Additional lengths of interface cables available are:

Item	HP Part No.
1 m (3 ft)	10631A
2 m (6.6 ft)	10631B
4 m (13 ft)	10631C

A 59405-66503 Test Connector is available to verify hardware operation of the 98034A Interface.

Real Time Clock

The 98035A adds a real time reference and time-related control capabilities to the 9825. It provides:

- real time information in the form of month, day, hour, minute and second;
- real time in U.S. (month first) or European (day first) format, jumper selectable;
- internal battery to hold real time when 98035A is not in use;
- four independent timing units which can be used in interrupt or counting mode;
- direct I/O operations on external lines;
- status monitoring;
- synchronization of four independent timing units.

SPECIFICATIONS

Operation of the 98035A requires the General I/O ROM for typical read/write functions and the Extended I/O ROM for vectored interrupt on the basis of a real time match, a periodic time interval or a specific time delay. The String ROM is useful in reading the real time from the 98035A.

SETTING AND READING REAL TIME

The 98035A real time is set using the wrt command of the General I/O ROM to specify month, day, hour, minute and second. Execution of this command starts the processor which will update the time while the clock chip is set. The real time can then be read by using the red command in either U.S. or European format.

TIMING UNITS

Four timing units are available to be used in either interrupting or counting mode. Interrupt can occur (using these units) at a specified real time, after a specified time delay, at a specified periodic interval, or at any combination of these to request service from the 9825. These units can also be used as counters, incremented every millisecond, to determine time intervals for such things as the length of an event or the time elapsed between two events.

Synchronization

The four independent timing units can be started simultaneously. An output line is provided to synchronize the input lines with the internal timing. This line will output a pulse every millisecond indicating when the inputs are valid, i.e., synchronized.

Error Codes

An 8-bit word can be read from the 98035A to determine if any software or hardware errors have occurred. The 98035A is a multioperational card due to the four independent timing units. An error which stops program execution would affect all operations of the 98035A. The error word is used in lieu of the normal 9825 error codes to prevent all operations from stopping when only one operation may be in error.

Optional Cable

The optional cable would be used in situations where the normal 9825 end-of-the-line interrupt would not be fast enough, i.e., if your program consisted of long lines. The cable output lines could then be used to trigger the external device for interrupt at a particular time. With the optional cable, output pulses can be sent to an external device and input can be received from an external device. However, this input and output can only be in the form of a 4-bit word. Normally, one of the other four interface cards, 98032A, 98033A, 98034A or 98036A, will be used for transfer of data between the 9825 and a peripheral device.

Select Codes

One of 14 select codes may be chosen via an externally accessible rotary switch. Select codes 2-7 have low interrupt priority, codes 8-15 have high priority. The Extended I/O ROM is required to operate the 98035A under interrupt control.

Options

The 98035A Opt. 001 provides the time in U.S. format while the 98035A Opt. 002 provides the time in European format. If Opt. 100 is ordered, the 98035A is shipped with optional cable. Opt. 025 should be ordered for use of the 98035A with the 9825.

Serial I/O Interface

The 98036A Interface provides bit serial communication between the 9825 Desktop Computer and asynchronous EIA RS-232-C devices such as data terminals and modems. Data rates range from 75 to 9 600 bits/second (baud) and are set via an externally accessible rotary switch. Allowable data formats include 5, 6, 7 or 8 bits/character with 1, 1.5 or 2 stop bits.

Information can be sent and received in either EIA RS-232-C voltage specification or 20-mA current loop configuration. Receive-only capability in 60-mA current loop is also possible.

Normal input/output operations require the General I/O ROM. The Extended I/O ROM is required for interrupt, buffered input/output operations, and extended RS-232-C control/status capability.

SPECIFICATIONS

Two cables are available for use with the 98036A. The standard cable is suitable for connection to data terminal equipment; the optional cable is used for connection to data set equipment. The standard 98036A is shipped with a 2 m (6.6 ft) cable terminated with a standard female EIA 25-pin connector.

When Opt. 001 is ordered, the 98036A is shipped with a standard male EIA 25-pin connector.

Data

All signals present at the connector conform electrically to EIA RS-232-C and CCITT V.24 specifications. The interface operates in an asynchronous mode providing 5-, 6-, 7- or 8-bit data formatting with 1, 1.5 or 2 stop bits and odd, even, or no parity. Additionally, the interface will detect framing errors (invalid stop bit), parity errors, and overrun errors; these errors will be indicated in a status byte.

Data rates available are 75, 110, 150, 300, 600, 1 200, 1 800, 2 400, 4 800, and 9 600 baud. Data-rate selection is via an externally accessible rotary switch. Under programmable control of the 9825, the switch-selected data rate can be reduced to half its set value.

Additional Operating Information

The transmitter and receiver sections of the 98036A each have a separate one-character buffer. The status of these buffers can be interrogated by the 9825.

The interface can be programmed by the 9825 to interrupt when either the input buffer is full or the output buffer is empty. This interrupt capability allows the interface to operate in a full duplex fashion in that information can be input under interrupt control while information is being output by standard 9825 write commands.

The Extended I/O ROM is required to operate under interrupt control.

Select Code Setting

Any one of 14 possible select codes may be chosen via an externally accessible rotary switch. Select codes 2-7 have low interrupt priority, whereas select codes 8-15 have high priority. The Extended I/O ROM is required to operate under interrupt control.

Options

The standard 98036A is shipped with 2 m (6.6 ft) cable terminated with a standard EIA 25-pin female connector. If Opt. 001 is ordered, the cable is terminated with a similar male-type connector. A 98241-67936 Test Connector is supplied with each 98036A Interface.

Ordering Information

Read/Write Memory — 9825A

Item	HP Part No.
15 036 bytes	Opt. 001
23 228 bytes	Opt. 002
31 420 bytes	Opt. 003

(order only one)

ROMs

Item	HP Part No.
String—Advanced Programming†***	98210A
Matrix*	98211A
9862 Plotter—General I/O	98212A
General I/O—Extended I/O†	98213A
9862 Plotter—General I/O—Extended I/O****	98214A
9872 Plotter—General I/O	98215A
9872 Plotter—General I/O—Extended I/O†***	98216A
9885M Flexible Disk Drive	98217A
Systems Programming**	98224A

*Will not operate with Systems Programming ROM (98224A)
**Will not operate with Matrix ROM (98211A)
***Part of standard 9825S
****Opt. 001 of 9825S (in place of 98216A)

Interfaces

Item	HP Part No.
16-Bit Parallel I/O	98032A
BCD Input	98033A
HP-IB	98034A
Real Time Clock	98035A
RS-232-C Serial I/O	98036A

Accessories Supplied

Item	HP Part No.
Operating and Programming Manual	09825-90000
Quick Reference Guide (2)	09825-90010
Blank data cartridge	9162-0061
Utility pack	09825-10000
Error booklet	09825-90015
Dust cover	9222-0495
Tape head cleaner	8500-1251
Special Function key overlays — blank (5)	7120-4802
Test cartridge	09825-90036
Test Cartridge Manual	09825-90037
Spare fuses	
1.5A	2110-0043
3.0A	2110-0003
I/O slot covers (3)	5040-7723
Power cord	depends on origin of sale

Accessories Available

Item	HP Part No.
Vinyl carrying case	98025A
Thermal printer paper (6 rolls)	9270-0479
Blank data cartridge	9162-0061
Software binder	9282-0563

Purchase Plans

Contact one of the Hewlett-Packard worldwide sales and service offices for specific prices and plans in your area.

Maintenance Agreements

Maintenance agreements are available for all desktop computer products. Current U.S. rates are found in the Maintenance Service and Prices Microfiche, No. 5952-2432D. These agreements represent HP's best level of support. Major advantages to the customer include:

- fixed annual cost,
- priority service response,
- on-site service,
- regular maintenance,
- individualized contracts.

9825A/S Peripherals

Description	To purchase the peripheral, order peripheral number:	If peripheral is owned, order card number:	Required ROMs
Plotter	9862A, Opt. 025	98032A, Opt. 062	9862A Plotter
Digitizer	9864A, Opt. 025	98032A, Opt. 064	General I/O
Thermal Line Printer	9866B, Opt. 025	98032A, Opt. 066	General I/O
Hopper Card Reader	9869A, Opt. 025	98032A, Opt. 069	General I/O
Serial Impact Printer	9871A, Opt. 025	98032A, Opt. 71	General I/O
HP-IB Serial Impact Printer	9871A, Opt. 001 (also requires 98034A Interface)	98034A	General I/O
Plotter	9872A, Opt. 025 (also requires 98034A Interface)	98034A	9872A Plotter
Digitizer	9874A, Opt. 025	98034A	General I/O
Cartridge Tape Unit	9875A, Opt. 025	98034A	General I/O
Thermal Graphics Printer	9876A, Opt. 025	98034A	General I/O
External Tape Memory	9877A, Opt. 025	not applicable	none
I/O Expander	9878A, Opt. 025	not applicable	none
Paper Tape Reader	9883A, Opt. 025	98032A, Opt. 083	General I/O
Tape Punch	9884A, Opt. 025	98032A, Opt. 084	General I/O
Flexible Disk Drive (Master)	9885M, Opt. 025	98032A, Opt. 085	Supplied with Opt. 085
Flexible Disk Drive (Slave)	9885S, Opt. 025	not applicable	none
Dot Matrix Serial Impact Printer	2631A, Opt. 825	98034A	General I/O
Plotter	7225A with 17600A, Opt. 025	98034A, Opt. 062	9862A Plotter
HP-IB Plotter	7225A with 17601A, Opt. 025	98034A	9872A Plotter
Plotter/Printer	7245A, Opt. 025	98034A	9872A Plotter

*Data subject to change.

3404 E. Harmony Road, Fort Collins, Colorado 80525

Printed in U.S.A.
(2/79)15M

Revised from November 1977
5953-1013