HP 9000 Series 200 Computers

HPL Condensed Reference

HEWLETT PACKARD

HPL Condensed Reference

for the HP 9000 Series 200
Model 216/226/236 Computers

Manual Part No. 98614-90020

Printing History

This reference replaces the *HP 9826 HPL Pocket Reference*, 09826-90045. All versions of Series 200 HPL are covered in this reference.

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Table of Contents

Introduction

This reference lists all Series 200 HPL syntax. Except where noted, all keywords are available beginning with HPL 1.0. More information on each HPL operation can be found by referring to the indicated manual and page. The manual titles are abbreviated:

D	*Disc Programming*, 09825-90220
I/O	*I/O Control Reference*, 09825-90210
M	*Matrix Programming*, 09825-90022
O&P	*Operating & Programming Reference*, 09825-90200

More details on the HPL 1.0, 2.0 and 2.1 keywords can be found by referring to the:

OP	*HPL Operating Manual*, 98614-90010

The HPL programming language utilizes four basic types of syntax constructions: **statements**, **functions**, **operators** and **commands**. Operators, such as `+` and `mod`, are used with numbers and variable names to construct **expressions** (like `A+5`). Expressions can be included in many statements and executed from the keyboard. Each statement can also be preceded by a line number and stored as a program line (like `10: prt A`). Most functions can include expressions and can be executed from the keyboard. Functions can also be treated as expressions when constructing a statement (like `prt sin A`). Commands are operator aids that can only be executed from the keyboard; they're not programmable.

Operators

The HPL operators are summarized here. For more details see O&P, page 3-19.

Arithmetic

+	Add
−	Subtract, unary −
*	Multiply
/	Divide
^	Exponentiate
mod	Modulus

Logical

and	inclusive OR
ior	
xor	exclusive OR
not	

Relational

=	Equal to
→	Assign
>	Greater than
<	Less than
>= or =>	Greater than or equal to
<= or =<	Less than or equal to
# or <> or ><	Not equal to

String

&	Concatenation

Math Hierarchy

highest priority:	functions, flag references, r-variables
	^ (exponentiation)
	implied multiply
	− (unary minus)
	*, /, mod
	+, −
	all relational operators:
	(=,>,<,<,=, >=,#,→)
	not
	and
lowest priority:	or, xor

Operators of the same level in an expression are executed from left to right. Any operations within parentheses, however, are performed first. For more details, see O&P, page 3-18.

MSUS Table

The syntax of a mass storage unit specifier (msus) is:

:[device format [controller select code]] [, unit code]

The msus specification can be added to the "file name" parameter of any disc programming statement except the files statement.

Disc Drive	Code	Format
Internal	I	LIF
8290x	M	LIF
9133V microdisc	M	LIF
9133V Winchester	H	9825 compatible
9133V Winchester	J	LIF
9885	F	9825 compatible
9885	G	LIF
9895	H	9825 compatible
9895	J	LIF

Syntax Conventions

These terms and conventions are used in the following listing:

computer type — all key words and characters appearing in `dot matrix` must appear exactly as shown.

[ ] — elements enclosed in brackets (not key characters or parentheses) are optional.

... — an ellipsis indicates that the preceding parameter or sequence in the syntax can be repeated.

variable name — a numeric or string variable name (like `A` or `r5` or `A$`). Subscripts are allowed (like `A [7]`).

array name — an array variable name, with or without subscripts.

string variable — a string variable name (like `A$` or `B$ [1,4]`).

string — either a string variable or text within quotes (`"text"`).

line number — an expression from 0 thru 32767 referring to a program line.

line label — a unique name assigned to a program line. It's enclosed in quotes, follows the line number, and is followed by a colon. For example: `5: "print": ...`

expression — a logical combination of numeric variable names, constants, operators and functions (including user-defined functions) grouped within parentheses as needed. The evaluated expression yields a numeric result.

constant — a fixed number within the computer's range, like 2.23467.

character — a letter, number or symbol.

item — a series of constants, expressions and/or strings separated by commas, for example:
`prt 5,A,"was",A+7`

subscripts — numbers within brackets which are attached to variable names to designate a particular variable element or boundary. For example:
`A[10,5] or B$[1,10]`

file number — an expression indicating the tape or disc file.

file name — a string indicating the disc file name.

select code — an expression indicating the device's interface select code setting (an integer from 0 through 16). For example: `wrt 6`

These select codes are assigned to internal devices:

0	Keyboard/Display Line
7	Internal HP-IB
16	Printer/CRT

device address — a two-digit number appended to the select code, indicating a device's HP-IB address. Device address range is from 00 through 31. For example: `wrt 711` outputs to device 11 via the HP-IB interface set to select code 7.

format no. — a number from .1 through .9 appended to the select code to reference a corresponding fmt statement. For example: `wrt 7,3` references `fmt 3`

return variable — a simple numeric variable name (A or R4) where information is stored after the operation.

flag no. — an expression from 0 thru 31 indicating a programmable flag.

A

abs expression

Returns the absolute value of the expression. O&P, 3-22.

aclr [number of pages]

Added at HPL 1.0. Clears screen, allocates specified number of scrolling pages. OP, 34.

acs expression

Returns the principal value of the arccosine of the expression in the current angular units. O&P, 3-25.

add (expression , expression)

Returns the sum of the expressions, added in the current numeric mode, decimal (mdec) or octal (moct). I/O, 3-15.

adump [select code [, number of lines]]

Added at HPL 1.0. Dumps alpha screen to printer. Number of lines parameter added at HPL 2.0. OP, 35.

aoff

Added at HPL 1.0. Turns the alpha display off. OP, 35.

aon

Added at HPL 1.0. Turns the alpha display on. OP, 35.

aprt array variable [, array variable [, ...]]

Prints the specified array's elements on the system printer. M, 8.

ara array variable[1] [{+ − * /} array variable[2]] → destination array

Performs the arithmetic operation, element by element, on arrays 1 and 2. The result is stored in the destination array. (Example: **ara** A+B→C). Arithmetic operations can be performed on arrays in place (**ara** A+B→A), arrays can be copied (**ara** A→B) and implied multiplication is allowed (**ara** A→C). M, 11.

asc expression

Returns the ASCII equivalent of the specified keycode. O&P, 7-25.

assn file name , file no.[, drive no. [, return variable]]

Assigns a number (1 thru 10) to an existing disc file name and indicates optional drive number and a return variable (values below). D, 3-5.

0	Typed data file available and assigned.
1	File doesn't exist.
2	Program file.
3	Special function key file.
4	String/mixed BDATA file available and assigned.
5	Memory file.
6	Binary program file.
7	Numeric BDATA file available and assigned.
8	File number out of range.
9	Data file, but logical records not 256 bytes long.
10	ASCII file available and assigned.
11	Other mainframe file.

asn expression

Returns the principal value of the arcsine of the expression in the current angular units. O&P, 3-26.

expression → variable name[1] [→ variable name[2] [→ ...]]

Assigns the value of the expression to the variable(s). O&P, 3-19.

atn expression

Returns the principal value of the arctangent of the expression in the current angular units. O&P, 3-26.

avd

Disables automatic tape verification. O&P, 5-24.

ave

Enables automatic tape verification (default setting). O&P, 5-25.

avm

Returns the size (bytes) of unused read/write memory. O&P, 4-27.

axe X coordinate ,Y coordinate [, X tic [, Y tic]]

Draws axes through the X,Y point, drawing optional tic marks at X tic and Y tic intervals. (9825 only.) I/O, 7-18.

B

band (expression , expression)

Returns the 16-bit result of ANDing the expressions. I/O, 3-12.

beep

Sounds the computer's beeper. O&P, 3-16.

bit (expression , bit position)

Returns the binary value of the bit position in the expression. I/O, 3-15.

boot

Loads 98217A Disk ROM bootstraps from a disc tape to an initialized disc. D, 4-4. (9825 only.)

bplt string , no. of bytes per line [, function]

Added at HPL 1.0. Plots binary data in the string to the graphics screen. The function can be:

0	OR
1	AND
2	EOR
3	STORE

bplt red string [, green string , blue string]

Added at HPL 2.0 to support the color output interface. Omitting the optional strings outputs black & white. OP, 73.

bred (buffer name)

Returns the contents of the specified, active, interrupt buffer. O&P, 7-10.

buf "name" [, buffer size or string variable , buffer type]

Sets up and names a data buffer of either type read/write (no type specified) or the specified type (see below). I/O, 6-6.

Buffer Type	Word	Byte
interrupt	0	1
fast read/write	2	3
DMA	4	5

C

`cap ( string )`
Returns an equivalent string of uppercase characters. O&P, 6-24.

`cat [ select code or buffer name ]`
Prints a catalog of the files on the default disc to the specified printer/buffer or to the system printer. Single letter file type mnemonics (9825 compatible discs) and multiple letter mnemonics (LIF discs) are shown below.

9825	LIF	Description
Z	NULL	null file
D	TDATA	typed data file
P	PROGRM	program file
K	KEYS	special function keys file
S	SBDATA	string/mixed binary data file
M	MEMORY	memory file
B	BINARY	binary program file
N	NBDATA	numeric binary data file
O	OTHER	other mainframe file
-	ASCII	ASCII data file (LIF only)
-	SYSTEM	Series 200 system file (LIF only)

`cfg [ flag no. ] , ... ] ]`
Clears either all program flags or only the specified flags. O&P, 3-29.

`chain file name [ , 1st line number [ , 2nd line number ] ]`
Loads a program from the specified disc file. Same optional line numbers as get. D, 2-7.

`char ( expression[1] [ , expression[2] , ... ] )`
Returns the ASCII equivalent character(s). O&P, 6-20.

`cli select code`
Sends the abort message to all devices on the HP-IB, I/O, 2-27.

`cll 'name' [ (expression[1] [ , expression2 ] , ... ] ) ] ]`
Calls the subroutine having the specified label, passing the value of any optional expressions as pass-parameters. O&P, 4-10.

`cln`
Returns the current program line number. O&P, 7-28.

`clr select code`
Sends the clear message, either the all devices or to only a selected device by including the device address in the select code. I/O, 2-17.

`cmd select code , "address parameters" [ , "string" ]`
`cmd "device name(s)" or select code [ , "string" ]`
Sends the string of data characters to the specified HP-IB device. I/O, 2-31.

`cmf [ flag no. [ , ... ] ]`
Complements either all program flags or only the specified flags. O&P, 3-29.

`cmp ( expression )`
Returns the 16-bit binary one's complement of the expression. I/O, 3-13.

`cont [ line number or line label ]`
This command continues program execution, either from the current point or from the specified point. O&P, 2-24.

`conv [ expression[1] , expression[1] [ , expression[2] , expression[2]] ...]`
Sets up a conversion table (up to ten sets of expressions) referenced by red and wrt statements. Each expression represents an ASCII character. conv (no parameters) cancels any existing table. I/O, 1-23.

`COPY` source file [, drive no. [, select code]] ,
destination file [, drive no. [, select code]]
Copies a file to another location. D, 4-7.

`COPY` [source drive no. [, select code] ,] " to"
[, destination drive no. [, select code]]

`COPY` complete source msus , "to" , destination msus
Duplicates the contents of the source disc onto the destination disc. D, 4-7. To copy a disc from the Model 236 right-hand drive to the left-hand drive. For example:

```
COPY ":I,0","to",":I,1"
```

`COPY` source file no. , record no. ,
destination file no. , record no. , records
Copies only the specified number of records, beginning at the specified record numbers. D, 4-10.

`COS` (expression)
Returns the cosine of the expression. O&P, 3-25.

`CPLT` [character-space widths , character-space heights]
Moves the pen the specified distance away from the current point. I/O, 7-41.

`CRET`
Added at HPL 1.0. Returns to the program from an on-cycle routine. OP, 66.

`CSIZ` [height [,aspect ratio [,paper ratio [,angle of rotation]]]]
Specifies the size, shape and lettering direction for lbl statements. I/O, 7-38. Defaults are:

height	1.5% of paper height
aspect ratio	1
paper ratio	1
angle	0 (left to right lettering)

`CRT` value
Added at HPL 2.0. Sets display enhancements bits. OP, 34.

bit 0	inverse video
bit 1	blinking
bit 2	underline
bit 4	halfbright

`CSV`
Clears simple variables A thru Z. O&P, 3-39.

`CTBL` [string variable]
Sets up a conversion table; the value of each string character represents ASCII; the character position represents the foreign code + 1. ctbl with no parameters cancels the table. I/O, 4-6.

`CYCLE`
Added at HPL 1.0. Returns the number of on cycle interrupts that have occurred since the previous cycle function call. OP, 66.

D

`DATA` numeric or string constant
[, numeric or string constant] ...
Added at HPL 1.0. Provides constants for read statement variables. OP, 32.

`DEG`
Sets degrees units for angular calculations. O&P, 3-25.

`DEL` line number [, ending line number [,*]]
This command deletes either the specified program line or all lines through the optional ending line number. Including the * changes all remaining references to the deleted lines to the next remaining program line, preventing error 36. O&P, 2-25.

`dev "name" , select code`

Assigns a name for use in place of the select code in I/O operations. I/O 2-9.

`dis X , Y [ , return variable ]`

Reads, computes and stores the current pen position in user units. External plotter only. I/O, 7-48. Return variables:

0	pen up
1	pen down

`dim` variable name[1] [, variable name[2] [, ...]]

Reserves memory for specified variables. Use subscripts to indicate size of each variable. O&P, 3-37.

`dirc`

Copies the spare disc directory (default drive) to the main directory. (9825 only.) D, 4-16.

`dret`

Added at HPL 1.0. Returns to the program from an on-delay routine. OP, 67.

`drive` unit no. [, select code]

Sets the default unit and, optionally, the select code for disc operations. D, 1-14.

`drnd ( expression , no. of digits )`

Returns the value of the first expression, rounded to the indicated number of digits. O&P, 3-22.

`dsp` item list

Displays the items listed. To display quotes use double quotes within the string. O&P, 3-12.

```
1: dsp "Display""test""in quotes."
```

`dto ( expression )`

Returns the octal equivalent of the decimal value expressed. I/O, 3-12.

`dtrk [ tape file number ]`

Dumps a bad track during the 98217A error recovery routine. (9825 only.) D, 4-15.

`dtype`

Returns a code indicating the type of drive, disc and data format at the default disc address. D, 1-15. Return values are:

0	Unable to access default disc controller.
1	Drive door is open or drive not present.
2	Drive door closed, but door was opened since last disc operation. File pointers are cleared.
3	9895 drive, single-sided disc, HP format
4	9895 drive, double-sided disc, HP format.
5	9895 drive, single-sided disc, unknown format.
6	9895 drive, double-sided disc, unknown format.
7	9895 drive, single-sided disc, IBM 3740 format.
8	9885 drive, single-sided disc.
9	9826 internal drive or 8290X drive.

`dump [ file name , tape file name ] [ , no. of records ]`

Transfers the contents of the default disc to a tape cartridge. The optional file names indicate to only dump a specified file. The number of records expression can be 1 or 10, indicating the number of disc records to put in each tape file. A positive expression automatically marks the tape. A negative expression suppresses marking the tape. (9825 only; will syntax but not execute with Series 200 HPL.) D, 4-12.

E

`edit` [line number or key]

Added at HPL 1.0. Selects edit mode, edit screen format at selected line number, or SFK definition. OP, 13.

`eir` select code [, byte]

Enables an interrupt from the specified select code. Specifying byte = 0 disables the interrupt. I/O, 5-6.

`emsg ("NN")`
`emsg (ern,rom)`
`ermg (ern,rom [,erl]`

Added at HPL 2.0. Either of the first statements returns the string "error NN message". Including `erl` returns the string "error NN in LLLL message". OP, C-5.

`end`

Halts program execution and sets the program counter to 0. O&P, 3-17.

`enp` ["prompt" ,] variable name

Enters and prints data entered from the keyboard. O&P, 3-15.

`ent` ["prompt" ,] variable name

Enters data from the keyboard. O&P, 3-13.

`eol` code [, [,...]] [, – delay]

Specifies up to seven optional ASCII characters for an end-of-line sequence for wrt operations (replaces CR/LFs). The optional delay occurs after the last eol character in the sequence. O&P, 7-12.

`eor` (expression , expression)

Returns the 16-bit binary result of the exclusive ORing of the expressions. I/O, 3-13.

`equ` "name[1]" , "string[1]" [, "name[2]" , "string[2]"] , ...]]

Equates the ASCII character string with the name, for use with cmd. I/O, 2-33.

`erase` [letter or key]

Erases either all programs and variables or the specified areas listed below. O&P, 2-26.

a	Erase entire memory.
k	Erase all special function keys and sets to defaults.
v	Erase all variables and flags.
f	Erase specified key definitions.

`erl`

Added at HPL 1.0. Returns the line number in which the error occurred. OP, C-5.

`ern`

Added at HPL 1.0. Returns the error number for an on err routine. OP, C-5.

`ert` file number

Erases the current tape track, beginning with the specified file. O&P, 5-15.

`exp` (expression)

Returns e (2.71828...) raised to the expressed power. O&P, 3-24.

F

`fdf` file number

Positions the tape at the specified file on the current track. O&P, 5-9.

`fetch` [line number or key]

Displays the specified program line or special function key definition. O&P, 2-27. (9825 only.)

`files` file name[1] [:unit no.] [,file name[2] [:unit no.] [,...]

Added at HPL 1.0. Assigns names up to 10 disc files. Substituting an * for a file name allows deferring the assignment for that particular file number.

`find` string expression [,beginning line no.
[,ending line no.]]

Added at HPL 2.0. Lists all lines containing the specified string. OP, 37.

`flg` (flag no.)

Returns flag status: 1 = set; 0 = clear. O&P, 3-30.

`flt` [places]

Sets floating point notation; from 0 thru 11 places allowed. O&P, 3-10.

`fmt` [format no. ,] [spec[1] [, spec[2] ...]]

Sets up a list of format specs for red and wrt operations. Format number can be from 0 through 9. Omitting specs cancels specified format. Omitting format no. sets format 0. A repeat factor can precede each spec. Format specs are listed on the next page. I/O, 1-8.

b	Single-character binary output.
cw	String character data.
ew.d	Exponential format.
fw.d	Fixed-point.
fzw.d	Fixed point with leading zeroes.
x	Blank space.
z	Suppresses auto CR/LF.
/	Outputs CR/LF.
"text"	Outputs text.

w = field width.
d = number of digits to right of decimal point.

`for` simple variable = initial value `to` value [`by` step value]

Defines start of a for-next loop. O&P, 4-3.

`frc` (expression)

Returns the fractional part of the expression. O&P, 3-22.

`fret`

Added at HPL 2.0. Returns execution from the power-fail (on pfail) routine. OP, 78.

`fti` (expression)

Rounds and changes the expression to integer precision. The result can be stored in a two-character field. O&P, 4-26.

`fts` (expression)

Changes the expression to split precision for storage in a four-character field. O&P, 4-20.

`fxd` [expression]

Sets the fixed-point format; from 0 through 11 places are allowed. O&P, 3-9.

G

gclr

Added at HPL 1.0. Clears the graphics screen. Beginning with HPL 2.0, gclr acts on the current psc device. OP, 71.

gdump [select code [, number of lines]]

Added at HPL 1.0. Dumps the graphics screen to a raster-scan standard printer. OP, 72.

get file name [, 1st line no. [, 2nd line no.]]

Loads the program from the specified disc file at the 1st line number, and begins execution at the 2nd line number. D, 2-4.

getb file name

Loads the specified disc binary program file. D, 2-11.

getk file name

Loads the special function keys disc file. D, 2-9.

getm file name

Loads the specified disc memory file. (9825 only; will syntax but not execute with Series 200 HPL.) D, 2-10.

gload string

Added at HPL 1.0. Loads the graphics screen from the specified string. OP, 74.

gload red string [, green string , blue string]

Added at HPL 2.0. Omitting the last strings gives black & white. OP, 74.

goff

Added at HPL 1.0. Turns the graphics display off. OP, 71.

gon

Added at HPL 1.0. Turns the graphics display on. OP, 71.

gptr xcoord , ycoord [, type]

Added at HPL 1.0. Draws a graphics cursor at the specified location. OP, 72. The types are:

0	off
#0	on

grad

Sets the grads units for angular calculations. O&P, 3-25.

gsb line number or line label

Branches program execution to the specified subroutine. O&P, 3-34.

gsb + or − number of lines

Branches to the subroutine beginning the number of lines relative to the current line. O&P, 3-34.

gstore string variable

Added at HPL 1.0. Store graphics screen to the specified string. OP, 74.

gstore red string [, green string , blue string]

Added at HPL 2.0. Supports the color output interface. Omitting the lst strings outputs black & white. OP, C-2.

gto line number or line label

Sends program execution to the specified line. O&P, 3-31.

gto + or − number of lines

Sends execution to specified line relative to the current line. O&P, 3-31.

I

idf file number [, file type [, current size [, absolute size [, track]]]]

Returns info on the current tape file. See tlist for file types. O&P, 5-7.

idn array name[1] [, array name[2] [, ...]]

Creates identity (square) matrices. All elements are 0 except major diagonal elements which are 1. M, 22.

if expression[1] = expression[2]

If the equation is true, the rest of the line is executed. If false, execution immediately branches to the next line. Any relational operator can be used (<, #, >=, etc.). When both expressions are strings, the characters are compared using ASCII values. O&P, 3-36.

ina array variable[1] [:value] [,array variable[2] [:value]...]

Initializes each element of the array to the specified value (number or variable). Omitting the value initializes each element to 0. M, 8.

init select code [, interleave factor]

Initializes discs in a 9885 or 9895 drive at indicated select code. The interleave can be an integer from 1 thru 29. D, 4-3.

init complete msus [, interleave factor [, no. of directory records]]

Added at HPL 1.0. Initializes the specified disc with the specified (or default) interleave factor and the specified or default number of directory records. OP, 49.

int (expression)

Returns the integer value of the expression. O&P, 3-22.

inv array variable[1] → array variable[2] [, simple variable]

Stores the inverse matrix of array 1 in array 2. If the simple variable is specified, the determinant of array 1 is returned. M, 24.

iof select code

Returns interface flag state: 0 if peripheral busy; 1 if ready. I/O, 4-12.

ior (expression , expression)

Returns the 16-bit result of the inclusive OR operation on the expression. I/O, 3-13.

ios select code

Returns interface status: 0 if in error condition; 1 if operational. I/O, 4-12.

iplt X increment , Y increment [, pen control]

Moves the pen the number of X and Y units from its current position. I/O, 7-29.

The pen control expressions are:

odd, positive integer	lift pen before moving
odd, negative integer	lift pen after moving
even, positive integer	lower pen before moving
even, negative integer	lower pen after moving
0	no change
omit parameter	move to specified point and lower pen.

iret

Ends an interrupt service routine and returns to main program. I/O, 5-7.

itf (string variable)

Returns a full-precision number from the packed, integer-precision number (a two-character string). O&P, 7-26.

J

`JMP` number of lines

Jumps program execution the relative number of lines forward (+ expression) or back (− expression). jmp 0 returns execution to the beginning of the current line. O&P, 3-33.

K

`Key`

Returns the earliest, unprocessed keycode in the keyboard buffer. 0 indicates no keycodes in the buffer. O&P, 7-8.

`kill` file name

Purges the specified disc file. D, 1-18.

`killall` drive number , select code

Purges all user files from the specified disc. D, 1-18.

`killall` complete msus

Added at HPL 1.0. Purges all user files on the specified disc. OP, 53.

`kloff`

Added at HPL 1.0. Turns special function key labels off. OP, 35.

`klon`

Added at HPL 1.0. Turns special function key labels on. OP, 35.

`knob`

Added at HPL 1.0. Returns the accumulated knob count. CCR rotation is negative valued, CR rotation is positive valued. OP, 41.

`Kret`

Added at HPL 1.0. Returns execution to the main program after the key buffer is emptied or after knob count is zeroed. O&P, 7-9. OP, 41.

`Kstat`

Added at HPL 1.0. Returns knob status. Bit 5 = Control, 4 = Shift. OP, 42.

L

`lbl` expression or "string" [, expression or "string" [, ...]]

Prints characters on the plotter. I/O, 7-36.

`lcl` select code

Sends the local message to all HP-IB devices or, if the select code includes a device address, sends a clear lockout/local message. I/O, 2-20.

`ldb` file number

Loads a binary program from the specified tape file. O&P, 5-23.

`ldf` [file number [, 1st line no. [, continue line no.]]]

Loads either file 0 (omitting the file number) or the specified tape file into the appropriate area of memory. The optional line numbers indicate where to start loading (1st line number) and continuing a program. O&P, 5-18.

`ldf` [file number [, data list]]

Loads data from the specified tape file into the listed variables. O&P, 5-21.

`ldk` [file number]

Loads the special function key file into memory. Omitting the file number loads tape file 0. O&P, 5-22.

`ldm [ file number ]`

Loads the entire computer memory from the specified tape file (9825 only.) O&P 5-23.

`ldp [ file number [ , 1st line no. [ , run line no. ] ] ]`

Loads a program from either file 0 (file number omitted) or the specified file. The optional line numbers indicate where to start loading (1st line no.) and were to start running. O&P, 5-18.

`len ( string variable )`

Returns the character length of the string. O&P, 6-14.

`lim [ X lower left , X upper right , Y lower left , Y upper right ]`

Restricts plotter pen movement to the stated bounds in user units. If bounds are omitted, movement is limited to the mechanical limits. I/O, 7-34.

`line [ pattern number [ , pattern length ] ]`

Specifies the type of line plotted with plt, iplt, xax and yax. 9872 patterns are listed below. Pattern length is percentage of the total line length; default is 4%. External Plotter only. I/O, 7-32.

1: .....
2: — — — — — — — — — — — — — —
3: — — — — — — — — — — — — — —
4: — · — · — · — · — · — · — · — ·
5: — — — — — — — — — — — — — —
6: — — — — — — — — — — — — — —

omit pattern number: ————————————————————

`list [ # select code] [ ,starting line no. [ ,ending line no.]]`

Lists the entire program on the internal printer (no parameters) or lists the program to the specified select code. O&P, 3-39 and I/O, 1-23.

`list (k) or listk`

Lists the special function key definition or all definitions (listk). O&P, 3-39.

`lkd`

Disables live keyboard mode. O&P, 2-32.

`lke`

Enables live keyboard mode. O&P, 2-32.

`llo select code`

Sends the local lockout message to all HP-IB devices. I/O, 2-19.

`ln ( expression )`

Returns the natural log ($\log_e$) of the expression. O&P, 3-24.

`load [ disc file name , tape file number ]`

Loads files previously dumped to a tape back onto the disc. Omitting all parameters loads the entire dump back onto the disc. Including parameters loads only selected data files back onto the disc. D, 4-13. (9825 only; will syntax but not execute with Series 200 HPL.)

`log ( expression )`

Returns the common log ($\log_{10}$) of the expression. O&P, 3-24.

`ltr X coordinate , Y coordinate [ , HWD ]`

Moves the 9862 plotter pen to the specified point and specifies dimensions for lettering. H and W can be from 1 thru 9. D is lettering direction and can be from 1 thru 4. (9825 only.) I/O, 7-47.

`ltrk`

Returns corrected data to a reinitialized track during disc error-recovery routine. (9825 only.) D, 4-15.

M

`machine`

Added at HPL 2.0. Returns details of the computer configuration. OP, 33.

```
bit (0,machine)  - 0 = 80-column alpha;
                   1 = 50-column alpha
bit (1,machine)  - 0 = 400x300 pixel graphics;
                   1 = 512x390 pixel graphics
bit (2,machine)  - 0 = no CRT highlights;
                   1 = CRT has highlights
bit (3,machine)  - 0 = machine has keyboard;
                   1 = no keyboard
```

`mat` array variable[1] * array variable[2] → array variable[3]

Array multiplication (arrays must have correct dimensions). M, 19.

`max` (expression[1] [, expression[2] [, ...]])

Returns the largest value in the list. O&P, 3-22.

`mdec`

Sets the decimal mode (default) for binary operations. I/O, 3-11.

`min` (expression[1] [, expression[2] [, ...]])

Returns the smallest value in the list. O&P, 3-22.

`moct`

Sets the octal mode for binary operations. I/O, 3-11.

`mret`

Added at HPL 1.0. Returns to the program from an on-match routine. OP, 67.

`mrk` number of files , file size [, return variable]

Marks the number of files, beginning at the tape's current position. The last file number marked is returned in the optional return variable. O&P, 5-10.

`msi` [":device format [, controller select code [, unit number]] "]

Added at HPL 1.0. Sets the current system disc drive and format. OP, 48.

Drive formats:

I	internal disc
M	8290x flexible disc and 9133V micro disc
F	9885(9825)
G	9885(LIF)
H	9895(9825) and 9133V Winchester
J	9895(LIF) and 9133V Winchester

N

`nal`

Returns the last program line number plus one; used with store to store strings. O&P, 7-24.

`next` simple variable

Terminates for-next loop and tests for loop completion. O&P, 4-3.

`nor` [line number [, line number]]

Clears the master program flag, either while executing all lines (omit all parameters) or only for the specified line numbers. Clears debug flags of the specified program lines. O&P, 3-44.

`num` ("character" or substring)

Returns the ASCII-decimal value of the character. O&P, 6-21.

O

`ofs` X coordinate , Y coordinate
Offsets the origin (0,0) to point X,Y. I/O, 7-27.

`on end` file number , line number or label
Enables a branch to the specified line or label when a disc EOF or EOR mark is encountered during read and write operations. D, 3-19.

`on cycle` time [, line label]
Added at HPL 1.0. Sets up clock periodic interrupt service routine. on cycle with no label specified cancels clock-cycle interrupt service. Time is in seconds. OP, 66.

`on delay` time [, line label]
Added at HPL 1.0. Sets up clock delay interrupt service routine. On delay with no label specified cancels clock-delay interrupt service. Time is in seconds. OP, 67.

`on err` [line label]
Enables an error-trapping routine. The program branches to the label and the erl, ern and rom functions are assigned values when an error occurs. Executing on err with no line label cancels on-error trapping. I/O, 4-4.

`on key` [line label [, flag no.]]
Enables a keyboard interrupt routine. The program branches to the label and optionally sets the flag when the keyboard buffer overflows. Omitting all parameters disables the keyboard interrupt. O&P, 7-6.

`on key` [line label [, flag no. [, repeat rate [, delay]]]]
Added at HPL 2.0. The repeat rate ranges from 0 thru 2.55 seconds; default is 0.08 sec. The delay before repeat can range from 0.1 thru 2.56 seconds; default is 0.7 sec. OP, 41.

`on knob` [line label]
Added at HPL 1.0. Sets up Knob interrupt service routine. on knob with no label cancels Knob interrupt service. OP, 41.

`on knob` [line label [, delay rate]]
Added at HPL 2.0. The delay rate can range from 0.01 thru 2.56 seconds; default is 0.01 sec. OP, 41.

`on match` time [, line label]
Added at HPL 1.0. Sets up clock match interrupt service routine. on match with no label cancels clock-match interrupt service. Time is in seconds. OP, 67.

`oni` select code [, line label]
References an interrupt service routine associated with the peripheral's select code. Executing oni with no label cancels interrupt service. I/O, 5-5.

`on pfail` [line label [, protection time [, glitch length]]]
Added at HPL 2.0. Enables a powerfail cycle on computers equipped with powerfail. OP, 78.

`open` file name , number of records [, file type]
Creates a disc data file of the specified size. D, 3-2. Optional file types are `"ASCII"`,`"NULL"`, or `"TDATA"`. OP 53.

`otd` (expression)
Returns the decimal equivalent of the octal value expressed. I/O, 3-12.

P

par (parity type)

Sets the parity type (listed below) used for I/O checking. I/O, 4-9.

0 Parity disabled
1 Parity = 1
2 Even parity
3 Odd parity

pbeep [frequency [, duration]]

Added at HPL 1.0. Programmable beep with frequency (0 thru 5167 Hz) and duration (0 thru 2.56 seconds). OP, 33.

pclr

Sets default plotter values except scale units, select code, P1, P2, pen location and pen#. 9872 Plotter ROM only. I/O, 7-10.

pct select code

Passes active control to the specified HP-IB device. I/O, 2-26.

pen

Raises the plotter pen. I/O, 7-22.

pen# [graphics pen]

Selects the plotter pen (external plotters). I/O, 7-22. Graphics pens are:

> 0 Normal
= 0 Off
−1 Erase
−2 EOR

Beginning with HPL 2.0, the pen number can be from −15 thru 15:

color	store	erase	OR	XOR
no-pen	0	0	8	−8
white	1	−1	9	−9
red	2	−2	10	−10
yellow	3	−3	11	−11
green	4	−4	12	−12
cyan	5	−5	13	−13
blue	6	−6	14	−14
magenta	7	−7	15	−15

% string [;]

The % free-text prefix allows storing text without syntax checking. Free text is terminated with a semicolon or end of line. O&P, 7-25.

pi

Returns value of pi.

pkbd [string]

Added at HPL 1.0. Executes ASCII string, as if it were pushing keys. OP, 43.

plt X coordinate , Y coordinate [, pen control]

Move plotter pen to specified X,Y point. Optional expression controls pen (see below). I/O, 7-22.

even	lowers pen.
odd	raise pen.
positive	action before plotting.
negative	action after plotting.

pol select code

Conducts a parallel poll on the HP-IB. I/O, 2-25.

`polc` select code , byte

Sets parallel poll bits on the specified HP-IB device. I/O, 2-26.

`polu` select code

Clears parallel poll bits on the specified device. I/O, 2-26.

`pos` (string[1] , string[2])

Returns the character position of the second string within the first. O&P, 6-16.

`power`

Added at HPL 2.0. OP, 78. Returns the powerfail state:

1	powerfail installed and operating
0	power failed
−1	power on but no powerfail hardware

`prnd` (expression , power of ten)

Returns the expression rounded to the power of ten indicated. O&P, 3-22.

`prt` expression or string [, expression or string [, ...]]

Prints the list of items on the system printer. To print quotes, use double quotes within the string. O&P, 3-12.

```
3: prt "print""text""in quotes."
```

`prtsc` select code [, width]

Added at HPL 1.0. Sets system printer select code (and width). OP, 36.

`psc` select code [, tv]

Sets the select code for all plotter ROM operations. psc 0 causes the program to ignore all plotter operations. psc 16 selects CRT graphics. I/O, 7-5; OP, 70. The tv parameter was added at HPL 2.0 to configure the color output interface for:

1	US STD, 512 x 390 pixels (default)
2	EURO STD, 512 x 390 pixels
3	US TV, 512 x 474 pixels
4	EURO TV, 512 x 512 pixels
5	HI RES, 512 x 512 pixels
6	JVC monitors

`pshutdown`

Added at HPL 2.0. Switches the computer off and on again to re-boot. OP, 79.

`time` (expression)

Added at HPL 2.0. Returns the amount of powerfail battery time used. OP, 79.

`dsp ptime (0)` - displays battery time used.
`dsp ptime (1)` - displays length of current powerfail.

`typ`

Sets a plotter lettering mode. Press **STOP** to terminate mode. I/O, 7-45.

R

rad

Sets radians units for angular calculations. O&P, 3-25.

√(expression **)**

Returns the square root of the expression. O&P, 3-22.

rcb file number

Added at HPL 1.0. Records the binary program in memory on the specified file. OP, 40.

rcf [file number [, beginning line no. [, ending line no.]] [, "SE" or "DB"]]

Records either all program lines onto the specified tape file (no line numbers) or only the specified block of lines. Including SE prevents the program from being listed or displayed when reloaded. Including DB records all trace and stop flags with the program for debugging. O&P, 5-16.

rcf file number , variable list

Records the listed variables onto the tape file. O&P, 5-16.

rck file number

Records the special function key definitions on the tape file. O&P, 5-22.

rcm file number

Records the entire computer memory on the specified tape file. (9825 only) O&P, 5-22.

rdb (select code)

Returns one 16-bit binary character code from the specified device. I/O, 3-4.

rdi (register number)

Returns a status byte from the interface specified by wti 0. I/O, 4-12.

rdm array variable[1] [, array variable[2] [, ...]]

Redimensions the array(s) to the specified dimensions. M, 16.

rds ("name"[, type [, empty [, fill [, dim]]]])→status

Added at HPL 1.0. Extended buffer-status function. OP, 68.

rds (select code)

Returns the current status word from the specified interface. I/O, 3-5.

rds (select code [, A [, B [, C]]]) → D

Returns HP-IB extended read status. I/O, 2-34.

read variable name[1] [, variable name[2]] [,...]

Added at HPL 1.0. Reads data statement constants into variables. OP, 32.

red select code [, format no.] , variable list

Reads and stores data from the specified device. I/O, 1-5.

rem select code

Sends the remote message to either all HP-IB devices or only one device when its address is included in the select code. I/O, 2-18.

renm old file name , new file name

Renames a disc file. D, 28.

repk

Repacks user files on the default disc. D, 4-5.

res

Returns the result of the last keyboard operation not stored in a variable. O&P, 2-20.

resave "name [,beginning line no. [,ending line no.]]
[,"SE" or "ND"]

Stores a program (or only the specified lines) in an existing disc file. D, 2-9.

ret

Ends a subroutine and returns program execution to the main program (line after gsb). O&P, 3-34.

rew

Rewinds the tape. O&P, 5-6.

rkbd *select code* [, *type*]

Enables a remote keyboard to control the computer. O&P, 7-24. The type indicates the keycode interpretation:

0	ASCII (default)
1	hardware keycodes

rnd (*seed*)

Returns a pseudo-random number from 0 to (less than) 1. A negative expression is used as a new seed. O&P, 3-22.

rom

Returns the ROM in which the error occurred. 0 = mainframe error. Other ASCII-decimal numbers indicate letter of plug-in ROM.

rot (*expression* , *no. of bits*)

Returns the result of binary rotation of the 16-bit equivalent of the expression, rotated the number of bits indicated. I/O, 3-13.

rprt file number , record number [, data list]
[,"end" or "ens"]

Prints the list of data items on the disc file, starting at the specified record. Including "end" prints an EOF mark after the data. Including "ens" suppresses the automatic EOR mark printed after data. D, 43.

rqs select code , byte

Requests service from the HP-IB system controller and sends the serial status byte upon response to a serial poll. I/O, 2-21.

rread file number , record number [, variable list]

Reads data from the disc file, starting at the specified record. D, 3-15.

rss (select code)

Returns the 98036 Interface status register byte. O&P, 7-16.

rstr [line label]

Added at HPL 1.0. Resets data pointer either to line 0, or to "label" if specified. OP, 32.

rtime

Added at HPL 1.0. Returns internal clock value in elapsed seconds. OP, 65.

run [line number or line label]

Begins program execution, either at line 0 or at the specified line. O&P, 2-9.

S

save file name [, 1st line number [, 2nd line number]]
[,"SE" or "ND"]

Stores either the entire program on the disc file or only the specified block of lines. D, 2-2.

saveb file name

Added at HPL 1.0. Saves the binary program in memory to the specified file. OP, 56.

savek file name

Stores all special function key definitions on the disc file. D, 2-9.

savem file name

Stores the entire read/write memory on the disc file. (9825 only; will syntax but not execute with Series 200 HPL.) D, 2-10.

scl Xp1 , Xp2 , Yp1 , Yp2

Locates the origin and specifies user units for plotting operations. I/O, 7-7.

sfg [, flag no. [, flag no. [, ...]]]

Sets either all program flags to 1 or only the specified flags. O&P, 3-28.

sfk [key number [, definition string [, label string]]

Added at HPL 1.0. Defines SFK (0 to 31) and optional soft label. No parameters sets all to defaults. Key number only erases sfk. OP, 44.

sgn (expression)

Returns sign of expression: 0 = zero; 1 = positive; −1 = negative. O&P, 3-22.

shf (expression[1] , expression[2])

Returns the result of right-shifting the 16-bit binary equivalent of expression[1], the number of places indicated by expression[2]. A negative expression 2 shifts the byte to the left. I/O, 3-14.

sin (expression)

Returns the sine of the expression. O&P, 3-2.

smpy scalar number or simple variable [*] array variable[1]
→ array variable[2]

Multiplies each element of array 1 by the scalar number. The * can be omitted. M, 13.

spc [expression]

Outputs the expressed number of line feeds on the system printer. O&P, 3-16.

sprt file number , data list [, "end" or "ens"]

Prints the list of data items on the disc file. Including "end" prints an EOF mark after the data. Including "ens" suppresses the automatic EOR mark printed after data. D, 38.

sqr expression

Added at HPL 1.0. Returns the square root of the expression variable. OP, 37.

sread file number , variable list

Reads data from the disc file. D, 3-10.

stf (string)

Unpacks and returns a split-precision number from its four-character string. O&P, 4-20.

`stime` seconds

Added at HPL 1.0. Sets the internal clock to the specified number of seconds. OP, 65.

`store` string [, line number]

Stores program lines from an executing program. O&P, 7-21.

`stp` [line number[1] [, line number[2]]]

Stops program execution either immediately or, optionally, at the specified line (line 1). Specifying both line numbers indicates a block of lines to stop at. O&P, 3-17.

`str` (expression [, base])

Returns the ASCII character equivalent to the expression. If the optional base parameter is specified, the numeric expression is converted to ASCII characters of the specified base (2-31). O&P, 6-19; OP, 40.

`sysboot` [system name]

Added at HPL 1.0. Boots language system specified from disc or ROM. OP, 45.

T

`tabxy` x col , y row

Added at HPL 1.0. Moves print position to column x (0 thru 49), row y (0 thru 17). OP, 35.

`tan` (expression)

Returns the tangent of the expression. O&P, 3-25.

`tfr` source name ,destination name[,bytes[,last character]]

Transfers data between an I/O buffer and a peripheral device. Optional bytes expression indicates the total number of bytes to transfer. Optional last character expression is the decimal value of the character to terminate the transfer. I/O, 6-8.

`time` (delay)

Causes an I/O operation to wait for a device to become ready for the specified number of milliseconds. I/O, 4-4.

`tinit`

Reinitializes a bad track during 9885 error recovery. (9825 only.) D, 4-15.

`tlist`

Catalogs tape files on the internal printer (file types listed below). O&P, 5-9.

−1	Non-tape file type (OTHER)
0	Null file. (NULL)
1	Binary program. (BINARY)
2	Numeric data file. (NBDATA)
3	String or string/data. (SBDATA)
4	Memory file. (MEMORY, 9825 only)
5	Special function key file. (KEYS)
6	Program file. (PROGRM)
7	Track dump error recovery (9825 only)
8	Single file dump (9825 only)
9	Entire disc dump (9825 only)

`tn^ ( expression )`
Returns 10 raised to the specified power. O&P, 3-24.

`trc [ 1st line number [ , last line number ] ]`
Sets the master flag and, optionally, trace flags for specified program lines. O&P, 3-44.

`trg` select code
Sends the trigger message to the specified HP-IB device. I/O, 2-17.

`trk` track no.
Specifies the tape track (0 or 1) for successive operations. O&P, 5-6.

`trn` array name → array name
Transposes rows and columns between arrays. M, 23.

`type ( [ – ] expression )`
Returns the next item-type (types listed below) in a disc data file. A negative expression indicates a search for an EOR mark. D, 3-20.

0	Unidentified type
1	Full-precision number
2	String (within record)
3	EOF mark or physical end of file
4	EOR mark

Indicates string overlapping record boundaries:

2.1	Start of string
2.2	Middle of string
2.3	End of string

U

`units`
Displays the currently-set angular units. O&P, 3-25.

V

`val ( string [ , base ] )`
Returns the numeric value of the ltring. If the base parameter is specified, the string is converted from the specified base (2-31). O&P, 6-17.

`vfy [ return variable ]`
Verifies the contents of a tape file with the original in memory. Return variable: 0 = no error: 1 = error. O&P, 5-25.

`vfyb`
Verifies disc bootstraps. (9825 only.) D, 4-15.

`voff`
Disables disc data verification. D, 4-6.

`von`
Enables disc data verification (default). D, 4-6.

W

`wait` delay

The program waits for the specified time in milliseconds (from 1 thru 32767). O&P, 3-16.

`wrt` select code [, format no.] [, item list]

Outputs the items to the specified device. I/O, 1-3.

`wsc` select code , control word

Outputs a control word (expression) to the specified interface. O&P, 7-14.

`wsm` select code , mode word [, control word]

Outputs a mode word and, optionally a control word (second expression) to the specified 98626A Interface. O&P, 7-15.

`wtb` select code , byte[1] [, byte[2] [, ...]]

Outputs the byte representing each number or character to the specified device. I/O, 3-3.

`wtc` buffer name [, type [, empty [, fill]]]

Added at HPL 1.0. Writes buffer pointers to specified buffer name. OP, 68.

`wtc` HP-IB select code , value

Added at HPL 1.0. Resets HP-IB interface. If value is <31, new bus address = value. If value = 31, no further action. If value > 31, value configures Parallel Poll response. OP, 68.

`wtc` select code , control byte

Outputs a control byte to the specified interface. I/O, 3-9.

`wti 0` , select code

Specifies an interface for successive wti or rdi operations. I/O, 4-11.

`wti` register , control byte

Outputs a control byte to a specified interface register. I/O, 4-11.

X

`xax` Yoffset [,tic interval [,start [,end [,no. of tics/label]]]]

Draws an X axis with optional tic marks and labels. I/O, 7-11.

`xref`

Prints a cross reference of program variables and line numbers, using the current program in memory. O&P 4-32.

Y

`yax` Xoffset [,tic interval [,start [,end [,no. of tics/label]]]]

Draws a Y axis with optional tic marks and labels. I/O, 7-11.

Error Codes

An error in a program sets the program line counter to line 0. Press the continue key to continue the program from line 0. Execute the continue command with a line number to continue at any desired line (such as: cont 50).

00 System error.

01 Unexpected peripheral interrupt.

02[1] Unterminated text.

03[1] Mnemonic is unknown.
Mnemonic not found because disc may be down. (9825 only)

04 System is secured.

05 Operation not allowed; line cannot be stored or executed with line number.

06[1] Syntax error in number.

07[1] Syntax error in input line.

08 Internal representation of the line is too long (gives cursor sometimes).

09 gto, gsb, or end statement not allowed in present context.
Attempt to execute a next statement either from keyboard while for/next loop using same variable is executed in program or from program while for/next loop using same variable is executed from keyboard. Attempt to call function or subroutine from keyboard.

10[1] gto or gsb statement requires an integer.

11 Integer out of range or integer required; must be from −32768 thru +32767.

12[1] Line cannot be stored; can only be executed.

13 ent statement not allowed in present context.

[1] Press the **RECALL** key to position the cursor at the location of the error.

14 Program structure destroyed.

15 Printer out of paper or printer failure.

16 String Variables ROM not present for the string comparison. Argument in relational comparison not allowed.

17 Parameter out of range.

18 Incorrect parameter.

19 Bad line number.

20 Missing ROM or binary program. The second number indicates the missing ROM. In the program mode, the line number is given instead of the ROM number. Displayed number and missing item:

1 Binary Program
4 Systems Programming ROM
5 Series 200 HPL Extension
6 Strings ROM
8 Extended I/O ROM
9 Advanced Programming ROM
10 Matrix ROM
11 Plotter ROM
12 General I/O ROM
17 Disk ROM

21 Line is too long to store.

22 Improper dimension specification.

23 Simple variable already allocated.

24 Array already dimensioned.

25 Dimensions of array disagree with number of subscripts.

26 Subscript of array element out of bounds.
P-number reference is negative.

27 Undefined array.

28 ret statement has no matching gsb statement

29 Cannot execute line because a ROM or binary program is missing.

30 Special function key not defined.

31 Non-existent program line.

32 Improper data type.
Non-numeric value in for statement or in fts or fti function.

33 Data types do not match in an assignment statement.

34 Display overflow due to pressing a special function key.

35 Improper flag reference (no such flag).

36 Attempt to delete destination of a gto or gsb statement.

37 Display buffer overflow caused by dsp statement.

38 Insufficient memory for subroutine return pointer.
Memory overflow during function or subroutine call.

39 Insufficient memory for variable allocation or binary program.

40 Insufficient memory for operation.
Memory overflow while using for statement or while allocating local p-numbers.

41 No cartridge in tape transport.

42 Tape cartridge is write protected. (Slide record tab to other position for recording.)

43 Unexpected Beginning-Of-Tape (BOT) or End-Of-Tape (EOT) marker encountered.
Tape transport failure.

44 Verify has failed.

45 Attempted execution of idf statement without parameters or mrk statement when tape position is unknown.

46 Read error in file body.

47 Read error in file head.

48 End-Of-Tape (EOT) encountered before specified number of files were marked.

49 File too small.

50 ldf statement for a program file must be last statement in the line. get or chain statement should be the last statement in a line.

51 or 52 Memory configuration error for attempted ldm statement. For example, a ROM present when memory was recorded is now not present (see error 20), or attempting to load a memory file recorded on a 9825A into a 9825B.

Memory files are not compatible between the 9825A and 9825B. Only the program portion can be recovered by loading the memory file into the original machine and doing a rcf. This program file can then be loaded into any 9825 with the ldf statement.

53 Negative parameter in cartridge statement.

54 Binary program to be loaded is larger than present binary program and variables have been allocated.

55 Illegal or missing parameter in a cartridge statement.

56 Data list is contiguous in memory for a cartridge statement.

57 Improper file type.

58 Invalid parameter in rcf statement; **"SE"** or **"DB"** expected.

59 Attempt to record a program or special function keys which do not exist.

60 Attempt to load an empty file or the null file (type = 0).

61 The line referenced in an ldf or ldp statement does not exist. If the line containing the ldf or ldp statement has been overlaid by the load operation, the line number in the display may be incorrect.

62 Specified memory space is smaller than cartridge file size.

63 Cartridge load operation would overlay subroutine return address in program; load not executed.

Disk load operation would overlay gsb return address; load not executed.

64 Attempt to execute ldk, ldf (program file), or ldp during live keyboard statement.

get, chain or getk not allowed from live keyboard mode or during an ent statement.

65 File not found.
File specified in the previous fdf statement does not exist.

Default values associated with errors 66 thru 77 when flag 14 is set are explained in the programming chapter of the operating and programming manual.

66 Division by zero.
A mod B, with B equal to zero.

67 Square root of negative number.

68 Tan (n * π/2 radians).
Tan (n * 90 degrees).
Tan (n * 100 grads).
where n is an odd integer.

69 Ln or log of a negative number.

70 Ln or log of zero.

71 Asn or acs of number less than − 1 or greater than + 1.

72 Negative base to non-integer power.

73 Zero to the zero power (0 ↑ 0).

74 Storage range overflow.

75 Storage range underflow.

76 Calculation range overflow.

77 Calculation range underflow.

A0 Relational operator in for statement not allowed.
No closing apostrophe.

A1 A for statement has no matching next statement.

A2 A next statement encountered without a previous for statement.

A3 Non-numeric parameter passed as a p-number.

A4 No return parameter for a function call.

A5 No functions or subroutines running.
Improper p-number.

A6 Attempt to allocate local p-numbers from the keyboard.

A7 Wrong number of parameters in fts, stf, fti, or itf function. stf or itf parameter must be a string (not a numeric). stf or itf parameter contains too few characters.

A8 Overflow or underflow in fts function.
Overflow in fti function.

A9 String Variables ROM missing for stf or itf functions.

Errors E thru B8 may result during the binary disc initialization and disc error recovery routines. (9825 only)

B0 Wrong syntax, argument out of range or variable not properly dimensioned.

B1 Are than six defective tracks on the disc.

B2 Verify error. Boots on the disc not identical to boots on the cartridge.

B3 dtrk or tinit not allowed because error information lost or error not d5, d6, d7 or d9.

B4 Attempt to access record for error correction which isn't part of data file.

B5 Improper string length (inconsistent with length given in header).

B6 Not enough space in computer buffer for data item. Item can't be placed in this part of buffer.

B7 Missing Disk or String ROM.

B8 Track still bad after tinit.

C0 Missing General I/O or Extended I/O ROM.

C1 Incorrect number of parameters.

C2 Improper parameter specified.

C3 Wrong parameter type.

C4 Illegal buffer type for bred statement.

C5 Key buffer overflow.

C6 Too large or wrong sign of parameter.

C7 Improper execution of store statement.

C8 Illegal use of kret, mret, cret, or dret.

C9 Missing 98626A Interface card.

D0 Improper argument in disc statement.

D1 Disk argument out of range.

D2 Improper file size (must be from 1 thru 32767). No lines to store for save or savek.

D3 Invalid file name.

D4 File not found.

D5 Duplicate file name. Attempting to copy a non-data file to an existing file.

D6 Wrong file type.

D7 Directory overflow.

D8 Insufficient storage space on disc.

D9 Verify error due to cable, computer or drive problem. Bad data (reprint data).

DISK IS DOWN (9825 only)

UNABLE TO ACCESS DISK CONTROLLER (9825 only)
Computer cannot access the disc controller.

d0 Firmware/driver out of synchronization.
Too many defective tracks with init.

d1 All drives in system not powered on.

d2 Door opened while disc being accessed.

d3 Disk not in drive or drive not present.

d4 Write not allowed to protected disc.

d5 Record header error
d6 Track not found.
d7 Data checkword error.
} can use error recovery on 9825/98217 only

d8 Hardware failure (Press the RESET key).

d9 Verify error. Data not readable under reduced margins (reprint data).

E0	General I/O ROM missing. HP-IB error under interrupt.
E1	Wrong number of parameters.
E2	Improper buffer device or equate table usage. Multiple-listeners error. Buffer busy.
E3	Wrong parameter type.
E4	Timeout error.
E5	Buffer underflow or overflow.
E6	Parameter value out of range.
E7	Parity failure.
E8	Improper use of iret statement. Attempt to DMA with HP-IB. Buffer or select code is busy.
E9	Illegal HP-IB operation.
F0	File overflow when read or print executed.
F1	98217A bootstraps not found (reload bootstraps). Wrong memory configuration for 98228A ROM. (9825 only).
F2	String read but wrong data type encountered.
F3	Attempt to read data item but type doesn't match.
F4	Availability table overflow (repack).
F5	Attempt on end branch from other than running program.
F6	Unassigned data file pointer.
F7	Disk is down; line cannot be reconstructed. (9825 only).
F8	Disk is down and **STOP** pressed. (9825 only).
F9	System error (save files individually and reinitialize).
f0	Unable to access disc controller. This error has the same cause as the error which issued the "DISK IS DOWN" and "UNABLE TO ACCESS DISK CONTROLLER" messages, except the error is now trappable by on err.
f1	No DMA card present for 9885 disc controller.
f2	Invalid msus syntax. Probable illegal device/format specifier.
f3	Directory entry field overflow. Attempted file copy not possible.
f4	Illegal structure on LIF format disc. The disc cannot be repacked.
f5	Disc copy attempted to a significantly larger disc. Use file copy to back up contents of disc.
f6	Disc copy attempted from 9825-compatible disc to LIF disc, or vice-versa. Only file copy is allowed across media formats.
f7	System record is not valid for LIF disc.
f8	System record is not valid for 9825-compatible disc.
f9	Statement not implemented on Series 200.
G1	Incorrect format numbers.
G2	Referenced format statement has an error.
G3	Incorrect I/O parameters.
G4	Incorrect select code.
G5	Incorrect read parameter.
G6	Improper conv statement parameters.
G7	Unacceptable input data.
G8	Peripheral device down.
G9	Interface hardware problem.

M1[1] Syntax error.

M2 Improper dimensions. Array dimensions incompatible with each other or incompatible with the stated operation.

M3 Improper redimension specification. New number of dimensions must equal original number; new size cannot exceed original size.

M4[1] Operation not allowed. An array which appears to the left of → cannot also appear on the right.

M5 Matrix cannot be inverted. Computed determinant = 0.

9862A Plotter ROM Errors (9825 only)

P1 Wrong state.
Statements executed out of order.

P2 Wrong number of parameters.

P3 Wrong type of parameters. Parameters for a label statement must be expressions, text, or string variables.

P4 Scale out of range. Maximum value is less than or equal to the minimum value.

P5 Integer out of range. Pen control parameter is out of the range −32768 thru −32767 or the select code is not 0 or in the range 2 thru 15.

P6 Character size out of range. Width or height in letter statement is zero or there is an integer overflow in csize calculations or results.

P7 Not used.

P8 Axes origin off-scale. X, Y specified for axis statement doesn't fall on plotter surface.

PLT DOWN Check interface connection and select code setting; be sure LINE and CHART HOLD are on.

1 Press the **RECALL** key to position the cursor at the location of the error.

Graphics/Plotter Error Codes

P1 Attempt to store into constant. Occurs when one or more parameters in a dig statement are constants rather than variables.

P2 Wrong number of parameters. Occurs on instructions with numeric-only parameter lists (scl, ofs, plt, iptl, cplt, xax, yax, lim, dig, csiz, line, pen#, and psc). In certain unusual cases where a parameter list contains user-level function calls, an instruction having an incorrect number of parameters may be executed.

P3 Wrong type of parameter or illegal parameter value.

P4 No HP-IB device number specified. Occurs when psc parameter is from 0 thru 14 and an HP-IB card is at the corresponding select code.

P5 Pen control value not from −32768 thru 32767. Hardware transmission error occurs between plotter and computer.

P6 No HP-IB card at specified select code.

P7 axe or ltr statement encountered; these are 9862 Plotter commands only.

P8 Computer **STOP** key cancelled operation. Occurs when the plotter fails to respond for three seconds after the **STOP** key has been pressed.

P9 No graphics hardware present. If you have a 9826A, you should not experience this error. Consult your HP field sales and service office for advice.

p0 Transmission error. The calculator has received an illegal ASCII input from the plotter.

p1 Instruction not recognized. The plotter has received an illegal character sequence.

p2 Wrong number of parameters. Too many or too few parameters have been sent with an instruction.

p3 Bad parameter. The parameters sent to the plotter with an instruction are out of range for that instruction.

p4 Illegal character. The character specified as a parameter is not in the allowable set for that instruction.

p5 Unknown character set. A character set out of the range 0 thru 4 has been designated as either the standard or alternate character set.

p6 Position overflow. An attempt to draw a character or perform a cplot that is located outside of the plotters numeric limit of −32768 thru +32767.

Errors generated by write (wrt) and read (red) statements to an external plotter will typically be displayed in the next executed plotter ROM statement. This can be avoided by using an output error command (wrt select code, "OE";) followed by a read statement (red select code, variable) to check for errors after read or write statements that address the plotter.

S0 Invalid set of strings in data list of ldf statement.

S1 Improper argument for string function or string variable.

S2 More parameters than expected for string function or string variable.

S3 Accessing or assigning to non-contiguous string, num function of null string.

S4 Trying to find the value of non-numeric string or null string.
Exponent too large.
Exponent format invalid (e.g., 1e+ +).

S5 Invalid destination type for string assignment.

S6 Parameter is zero, or negative, exceeded dimensioned size.
Invalid sequence of parameters for string variable.

S7 String not yet allocated.

S8 String previously allocated.

S9 Maximum string length exceeded; additional string length must be specified in dim statement.

SPARE DIR. Printed when the spare disc directory (backup track) automatically replaces the main directory.

Series 200 HPL Extended Errors

X0 No memory or I/O card present at specified address. This error should not be encountered when programming from HPL. Consult your HP field sales and service office for advice concerning this error should you receive it.

X1 A read statement was executed with no data remaining. Either a data statement must be added or a rstr statement must be added to reset the data pointer to the desired data statement in the program.

Opti .1 ROM Syntax and Errors

The following syntax and error messages require the appropriate option ROM be plugged into your 9825. See the alphabetical listing for syntax and error descriptions. Extensions to HPL are printed in bold type.

HPL Extensions

Syntax: aclr, aoff, aon, data, get, kloff, klon, pbeep, pi, read, rstr, sqr

Errors: X0 thru X2

Advanced Programming

Syntax: cll, for, fti, fts, itf, next, stf, xref

Errors: A0 through A9

Disk Programming

Syntax: asgn, cat, chain, copy, drive, dtype dump, files, get, getb, getk, getm, init, kill, killall, load, **msi**, on end, open, **rcb**, renm, repk, resave, rprt, rread, save, **saveb**, savek, savem, sprt, sread, type, von, voff.

Errors: D0 thru D9, d0 thru d9, F0 thru F9, f0 thru f9.

Extended I/O Programming

Syntax: add, band, bit, buf, cli, clr, cmd, cmp, ctbl, dev, dto, eir, eor, equ, iof, ior, ios, iret, lcl, llo, mdec, moct, on err, oni, otd, par, pct, pol, polc, polu, rdi, rds, rem, rot, rqs, shf, tfr, time trg, wti

Errors: E0 through E9

General I/O Programming

Syntax: conv, fmt, list#, **prtsc**, rdb, rds, red, **rtime**, **stime**, wrt, wtb, wtc

Errors: G1 through G9

Matrix Programming

Syntax: aprt, ara, dim, idn, ina, inv, ldf, mat, rcf, rdm, smpy, trn

Errors: M1 through M5

Plotter Programming

Syntax: **bplt**, cplt, csiz, dig, **gclr**, **gdump**, **gload**, **goff**, **gon**, **gptr**, **gstore**, iplt, lbl, lim, line, ofs, pclr, pen, pen#, plt, psc, ptyp, scl, xax, yax

Error: P1 through P9, p0 through p6

String Programming

Syntax: cap, char, dim, dsp, enp, ent, if, ldf, len, num, pos, prt, rcf, str, val

Errors: S0 through S9

Systems Programming

Syntax: asc, bred, **cret**, **cycle**, **dret**, eol, key, **knob**, **kstat**, kret, **mret**, nal, **on cycle**, **on delay**, on key, **on knob**, **on match**, **pkbd**, rkbd, rss, **sfk**, store, **sysboot**, wsc, wsm

Errors: C0 through C9

9862A Plotter ROM (9825 only)

Syntax: axe, cplt, csiz, iplt, lbl, ltr, ofs, pen, plt, psc, ptyp, scl

Errors: P1 through P8

Interface Card Registers

This section describes the register bit maps for the various interface cards that are available for the 9825/Series 200. See the associated Installation and Service Manual for a complete description of a specific interface.

98622A/98032A Register Map

	IN	OUT
R4	DATA IN	DATA OUT
R5	STATUS	CONTROL
R6	HIGH BYTE DATA	HIGH BYTE DATA
R7	(not used)	TRIGGER

R4-IN: Read 16 bits (lower 8 bits if jumper B is not installed) of data from the input data latches. Sets I/O line to input.

R4-OUT: Write 16 bits (lower 8 bits if jumper F is not installed) of data to the output data latches. Sets I/O line to output.

R5-IN: Read 98032A interface status byte.

R5 Status (R5-IN)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
INT	DMA	1	0	IID	IOD	STI1	STI0

R5-OUT: Write 98032A interface control byte.

R5 Control (R5-OUT)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
INT	DMA	RESET	AH	—	—	CTL1	CTL0

R6-IN: Read 16 bits (upper 8 bits if jumper B is not installed) of data from the input data latches. Does not affect I/O line.

R6-OUT: Write 16 bits (upper 8 bits if jumper F is not installed) of data to the output data latches. Does not affect I/O line.

R7-OUT: Sets PCTL to initiate an input/output handshake, depending on the state of the I/O line from the last R4 access.

98623A/98033A Register Map

	IN	OUT
R4	DATA IN	DATA OUT
R5	STATUS	CONTROL
R6	(not used)	(not used)
R7	(not used)	TRIGGER

R4-IN: Read one 8-bit ASCII character from the 98033A BCD-to-ASCII translator.

R4-OUT: Latch one byte of data to the 8-bit output port. (98623 only.)

R5-IN: Read 98033A interface status byte.

R5 Status (R5-IN)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
INT	0	1	0	0	0	0	0

R5-OUT: Write 98033A interface control byte.

R5 Control (R5-OUT)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
INT	—	RESET	—	—	—	—	—

R7-OUT: An output to R7 (actual value output is a "don't care") causes the 98033A to place the next ASCII character in the sequence representing the reading into the R4-IN register. After 16 characters have been so placed, the next R7-OUT causes a new reading to be taken (i.e., the card sets CTLA and CTLB to start a data handshake with the BCD device) and places the first character of that reading in the R4-IN register.

98624A/98034A Register Map

	IN	OUT
R4	DATA IN	DATA OUT
R5	STATUS	CONTROL
R6	STATUS/DATA	COMMANDS
R7	PARALLEL POLL	DIRECT BUS CONTROL

R4-IN: Initiates a data byte input sequence.

R4-OUT: Transfers one byte of data to the bus.

R5-IN: Initiates a status read sequence.

R5-OUT: Outputs a control byte to enable the 98034A for various interrupt conditions.

R5 Control (R5-OUT)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
SRQ	ACT	TLK	LST	IRF	ORE	SEE NOTE 2	SEE NOTE 1

Note 1: Bit 0, when set, causes the STS line to be cleared when EOI is received.

Note 2: 9825: DCL, SDC, Error
9826 HPL: DCL, SDC, IFC, GET

R6-IN: Completes a data byte input sequence.
Clears ATN.
Delivers 98034A status bytes.
Completes a parallel poll input sequence.

R6-OUT: Sets the ATN line true and outputs a byte of command or addressing information.

R7-IN: Initiates a parallel poll byte request.

R7-OUT: Direct[1] bus control.

R7 Out, Bit 7 Set

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	0	0	EOI	IFC	ATN	REN	SRQ

R7 Out, Bit 7 Clear

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	SRQ	X	X	X	X	X	X

R7-OUT: Service Request control and serial-poll response byte.

X = user definable.

98624A/98034A Read Status Sequence

rds(7, A, B, C,D) →E

Status Byte 1 (A)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	REM/ LOC	LLO	GET	DCL	IFC	ERROR

1 After executing this R7-OUT instruction, the 98034A will clear the STS line if an illegal operation (e.g., specifying ATN if the 98034A is not active controller) is indicated.

Status Byte 2 (B)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	1	0	A_5	A_4	A_3	A_2	A_1

Status Byte 3 (C)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
EOI	REN	SRQ	ATN	IFC	NDAC	NRFD	DAV

Status Byte 4 (D)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
SRQ	ACT	TLK	LST	SAC	1	0	EOR

98626A/98036A Register Map

	IN	OUT
R3	(not used)	CONFIGURATION
R4	DATA IN, R4E	DATA OUT, R4C, R4D
R5	STATUS	CONTROL
R6	LINE STATUS	LINE CONTROL
R7	(not used)	TRIGGER

R3 OUT

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
X	X	X	X	X	X	HANDSHAKE 1 = DISABLE 0 = ENABLE	CABLE 1 = DCE 0 = DTE

Registers are on the following pages.

R4C Mode Word

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Number of Stop Bits 00=not valid 01=1 bit 10=1.5 bits 11=2 bits		Parity Type 0=Odd 1=Even	Parity Enable 0=Disable 1=Enable	Character Length 00=5 bits 01=6 bits 10=7 bits 11=8 bits		98036A Bit Rate Factor Not Used for 9826A	

R4D USART Control Word

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Always 0	USART Reset	No Connect[1] (Standard) Request To Send Pin 4 (Option 001)	Reset Status Bits of USART Status Word	Send Break Character	Enable Data Receiver	Data Set Ready Pin 6 (Standard) Data Terminal Ready Pin 20 (Option 001)	Data Enable Transmitter

[1]The CTS line is controlled by (DTE) RTS line, not by R4D, bit 5.

R4E USART Status Word

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Request to Send Pin 4 (Standard) Data Set Ready Pin 6 (Option 001)	Break Indicator	Framing Error	Overrun Error	Parity Error	Transmitter Empty	Receiver Ready	Transmitter Ready

R5 OUT Register

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Interface Interrupt Enable		Programmed Interface Reset			Interrupt Control 2 Receiver Control	Interrupt Control 2 Transmitted Control	R4 Control 0=Data IN/ OUT 1=Control/ Status

R5 IN Register

Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Peripheral Status 1 Mode	Interface Interrupt Enable Status	0	Interface I.D. 0	Interface I.D. 1	0	0	Control Status 2 Receiver	Control Status 1 Transmitter Mode

R6 OUT Register (standard cable)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
			Half/Full Speed Control (Interface)	Ring Indicator Pin 22	No Connect	Secondary Carrier Detect Pin 12	Data Carrier Detect Pin 8

R6 IN Register (standard cable)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Always 1	Always 1	Always 1	Always 1	Always 1	Always 0	No Connect	Secondary Request To Send Pin 19

R6 OUT Register (option 001 cable)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
			Half/Full Speed Control	No Connect	No Connect	Data Signal Rate Select Pin 23	Secondary Request To Send Pin 19

R6 IN Register (option 001 cable)

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Always 1	Always 1	Always 1	Always 1	Always 1	Secondary Carrier Detect Pin 12	Ring Indicator Pin 22	Data Carrier Detect Pin 8

ASCII Table

ASCII Char.	EQUIVALENT FORMS				HP-IB
	Dec	Binary	Oct	Hex	
NUL	0	00000000	000	00	
SOH	1	00000001	001	01	GTL
STX	2	00000010	002	02	
ETX	3	00000011	003	03	
EOT	4	00000100	004	04	SDC
ENQ	5	00000101	005	05	PPC
ACK	6	00000110	006	06	
BEL	7	00000111	007	07	
BS	8	00001000	010	08	GET
HT	9	00001001	011	09	TCT
LF	10	00001010	012	0A	
VT	11	00001011	013	0B	
FF	12	00001100	014	0C	
CR	13	00001101	015	0D	
SO	14	00001110	016	0E	
SI	15	00001111	017	0F	
DLE	16	00010000	020	10	
DC1	17	00010001	021	11	LLO
DC2	18	00010010	022	12	
DC3	19	00010011	023	13	
DC4	20	00010100	024	14	DCL
NAK	21	00010101	025	15	PPU
SYNC	22	00010110	026	16	
ETB	23	00010111	027	17	
CAN	24	00011000	030	18	SPE
EM	25	00011001	031	19	SPD
SUB	26	00011010	032	1A	
ESC	27	00011011	033	1B	
FS	28	00011100	034	1C	
GS	29	00011101	035	1D	
RS	30	00011110	036	1E	
US	31	00011111	037	1F	

ASCII Char.	EQUIVALENT FORMS				HP-IB
	Dec	Binary	Oct	Hex	
space	32	00100000	040	20	LA0
!	33	00100001	041	21	LA1
"	34	00100010	042	22	LA2
#	35	00100011	043	23	LA3
$	36	00100100	044	24	LA4
%	37	00100101	045	25	LA5
&	38	00100110	046	26	LA6
'	39	00100111	047	27	LA7
(	40	00101000	050	28	LA8
)	41	00101001	051	29	LA9
*	42	00101010	052	2A	LA10
+	43	00101011	053	2B	LA11
,	44	00101100	054	2C	LA12
-	45	00101101	055	2D	LA13
.	46	00101110	056	2E	LA14
/	47	00101111	057	2F	LA15
0	48	00110000	060	30	LA16
1	49	00110001	061	31	LA17
2	50	00110010	062	32	LA18
3	51	00110011	063	33	LA19
4	52	00110100	064	34	LA20
5	53	00110101	065	35	LA21
6	54	00110110	066	36	LA22
7	55	00110111	067	37	LA23
8	56	00111000	070	38	LA24
9	57	00111001	071	39	LA25
:	58	00111010	072	3A	LA26
;	59	00111011	073	3B	LA27
<	60	00111100	074	3C	LA28
=	61	00111101	075	3D	LA29
>	62	00111110	076	3E	LA30
?	63	00111111	077	3F	UNL

ASCII Char.	EQUIVALENT FORMS				HP-IB
	Dec	Binary	Oct	Hex	
@	64	01000000	100	40	TA0
A	65	01000001	101	41	TA1
B	66	01000010	102	42	TA2
C	67	01000011	103	43	TA3
D	68	01000100	104	44	TA4
E	69	01000101	105	45	TA5
F	70	01000110	106	46	TA6
G	71	01000111	107	47	TA7
H	72	01001000	110	48	TA8
I	73	01001001	111	49	TA9
J	74	01001010	112	4A	TA10
K	75	01001011	113	4B	TA11
L	76	01001100	114	4C	TA12
M	77	01001101	115	4D	TA13
N	78	01001110	116	4E	TA14
O	79	01001111	117	4F	TA15
P	80	01010000	120	50	TA16
Q	81	01010001	121	51	TA17
R	82	01010010	122	52	TA18
S	83	01010011	123	53	TA19
T	84	01010100	124	54	TA20
U	85	01010101	125	55	TA21
V	86	01010110	126	56	TA22
W	87	01010111	127	57	TA23
X	88	01011000	130	58	TA24
Y	89	01011001	131	59	TA25
Z	90	01011010	132	5A	TA26
[	91	01011011	133	5B	TA27
\	92	01011100	134	5C	TA28
]	93	01011101	135	5D	TA29
^	94	01011110	136	5E	TA30
_	95	01011111	137	5F	UNT

ASCII Char.	EQUIVALENT FORMS				HP-IB
	Dec	Binary	Oct	Hex	
`	96	01100000	140	60	SC0
a	97	01100001	141	61	SC1
b	98	01100010	142	62	SC2
c	99	01100011	143	63	SC3
d	100	01100100	144	64	SC4
e	101	01100101	145	65	SC5
f	102	01100110	146	66	SC6
g	103	01100111	147	67	SC7
h	104	01101000	150	68	SC8
i	105	01101001	151	69	SC9
j	106	01101010	152	6A	SC10
k	107	01101011	153	6B	SC11
l	108	01101100	154	6C	SC12
m	109	01101101	155	6D	SC13
n	110	01101110	156	6E	SC14
o	111	01101111	157	6F	SC15
p	112	01110000	160	70	SC16
q	113	01110001	161	71	SC17
r	114	01110010	162	72	SC18
s	115	01110011	163	73	SC19
t	116	01110100	164	74	SC20
u	117	01110101	165	75	SC21
v	118	01110110	166	76	SC22
w	119	01110111	167	77	SC23
x	120	01111000	170	78	SC24
y	121	01111001	171	79	SC25
z	122	01111010	172	7A	SC26
{	123	01111011	173	7B	SC27
|	124	01111100	174	7C	SC28
}	125	01111101	175	7D	SC29
~	126	01111110	176	7E	SC30
DEL	127	01111111	177	7F	SC31

ASCII Control Codes

CTRL of	ASCII Value	ASCII Character	9826A Key Pressed (1)	Displayed Character (3)
@	0	NUL	reserved	$^{N}_{U}$
A	1	SOH	PAUSE	$^{S}_{H}$
B	2	STX	REWIND	$^{S}_{X}$
C	3	ETX	HOME LEFT	$^{E}_{X}$
D	4	EOT	HOME RIGHT	$^{E}_{T}$
E	5	ENQ	TO TOP	$^{E}_{Q}$
F	6	ACK	TO BOTTOM	$^{A}_{K}$
G	7	BEL	RESULT	$^{}_{}$
H	8	BS	INSERT LINE	$^{B}_{S}$
I	9	HT	DELETE LINE	$^{H}_{T}$
J	10	LF	EXECUTE	$^{L}_{F}$
K	11	VT	RECALL	$^{V}_{T}$
L	12	FF	RUN	$^{F}_{F}$
M	13	CR	ENTER	$^{C}_{R}$
N	14	SO	CLR TO END	$^{S}_{O}$
O	15	SI	CLR SCREEN	$^{S}_{I}$
P	16	DLE	DOWN ARROW	$^{D}_{L}$
Q	17	DC1	UP ARROW	$^{D}_{1}$
R	18	DC2	CLEAR LINE	$^{D}_{2}$
S	19	DC3	PRINT ALL	$^{D}_{3}$
T	20	DC4	LEFT ARROW	$^{D}_{4}$
U	21	NAK	RIGHT ARROW	$^{N}_{K}$
V	22	SYN	INSERT CHAR	$^{S}_{Y}$
W	23	ETB	DELETE CHAR	$^{E}_{B}$
X	24	CAN	STEP	$^{C}_{N}$
Y	25	EM	CONTINUE	$^{E}_{M}$
Z	26	SUB	DUMP GRAPHICS	$^{S}_{B}$
[	27	ESC	DISPLAY FUNCTIONS	$^{E}_{C}$
\(2)	28	FS	EDIT	$^{F}_{S}$
]	29	GS	CAPS LOCK	$^{G}_{S}$
^	30	RS	ALPHA	$^{R}_{S}$
_	31	US	GRAPHICS	$^{U}_{S}$

(1) This is the 9826A pkbd keypress and the key pressed from a remote ASCII keyboard.
(2) This is the shift ")" key on the Numeric Keypad.
(3) This is the displayed character if "DISPLAY FUNCTIONS IS ON".

HEWLETT PACKARD

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