Series 9800 Desktop Computers

HP 9825
Desktop Computer
Quick Reference

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NOTICE

HP 9825 Desktop Computer
Quick Reference

Manual Part No. 09825-90012
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Printing History

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Operators

The available operators are summarized here. For more details see page 3-19 in your Operating and Programming Reference.

Arithmetic

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

Logical

and	
ior	inclusive OR
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

2

Math Hierarchy

highest priority functions, flag references, r-variables
↑ (exponentiation)
implied multiply
− (unary minus)
*, /, mod
+, −
all relational operators (=,>,<,<=, >=,#,→)
not
and
lowest priority or, xor
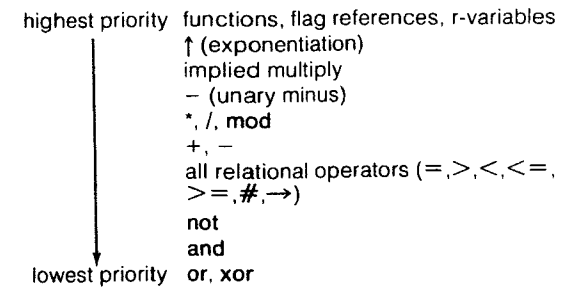
Operators of the same level in an expression are executed from left to right. Any operations within parentheses, however, are performed first. For more details, see page 3-18 in your Operating and Programming Reference.

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Syntax Conventions

These terms and conventions are used in the following listing:

bold type — all key words and characters appearing in bold type must appear exactly as shown. These items are shown in dot matrix in the referenced manuals.

[ ] — 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 1 through 999 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 list — 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 disk file.

file name — a string indicating the disk 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.
    1 Tape drive.
    16 Printer.

device address — a two-digit number appended to the select code, indicating a device's HP-IB address. Device address range is from 01 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 1 through 15 indicating a programmable flag.

A

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

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.

aprt array variable [, array variable [, ...]]
Prints the specified array's elements on the internal printer. M, 8.

ara array variable₁ [$\left\{\begin{matrix} + \\ - \\ * \\ / \end{matrix}\right\}$ array variable₂] → array variable₃

Performs the arithmetic operation, element by element, on arrays 1 and 2. The result is stored in array 3. (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 AB→C). M, 11.

asc expression
Returns the ASCII equivalent of the specified 9825 keycode. O&P, 7-25.

asgn file name, file number [, drive number
[, return variable]]
Assigns a number (1 through 10) to an existing disk file name and indicates optional drive number and a return variable (values below). D,3-5.

0   File available and assigned.
1   File doesn't exist.
2   Program file.
3   Special function key file.

(cont'd)

6

4   File not defined by 9825.
5   Memory file.
6   Binary program file.
7   File type not defined.
8   File number out of range.
9   Data file, but logical records not 256 bytes long (98228A ROM only).

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

expression → variable name₁ [→ variable name₂ [→ ...]]
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. 9862 Plotter ROM 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.

7

bit (expression₁ , expression₂)
> Returns the binary value of the bit position in expression 2 indicated by expression 1. I/O, 3-15.

boot
> Loads 98217A Disk ROM bootstraps from a disc tape to an initialized disk. D, 4-4.

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	—

C

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

cat [select code or buffer name]
> Prints a catalog of files on the specified disk or default drive. File types listed below. D, 1-16.
>
> B   Binary program file.
> D   Data file.
> K   Special function keys file.
> M   Memory file.
> O   Other file (not created via 9825).
> P   Program file.

cfg [flag no. [, ...]]
> Clears either all 15 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 disk file. Same optional line numbers as get. D, 2-7.
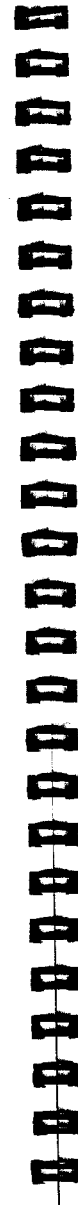
char (expression)
> Returns the ASCII equivalent character. O&P, 6-20.

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

cll 'name' [[(variable₁ [, variable₂ [, ...])]]
> Calls the subroutine having the specified label, passing the value of any optional variables 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 15 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 [expression₁ , expression₁
> [, expression₂ , expression₂] ...]
> Sets up a conversion table (up to 10 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.

HPL Syntax

copy source file [, drive number [, select code]]
        destination file [, drive number [, select code]]
        Copies a file to another location. D, 4-7.

copy [source drive number [, select code],]
        "to" [, destination drive number [, select code]]
        Duplicates the contents of the source disk onto the
        destination disk. D, 4-7.

copy source file number , record number ,
        destination file number , record number , records
        Copies only the specified number of records, begin-
        ning 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.

csiz [height [, aspect ratio [, paper ratio
                        [, angle of rotation]]]]
        Specifies the size, shape and lettering direction for lbl
        statements. Defaults are: height = 1.5% of paper
        height; aspect ratio = 1; paper ratio = 1; angle = 0
        (left to right lettering). I/O, 7-38.

csv
        Clears simple variables A through 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.

D

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

del line number [, 2nd line number [,*]]
        This command deletes either the specified program
        line or all lines through the optional 2nd line number
        specified. Including the * changes all remaining re-
        ferences 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.

dig X , Y [, return variable]
        Reads, computes and stores the current pen position
        in user units. Return variables: 0 = pen up; 1 = pen
        down. 9872 Plotter ROM only. I/O, 7-48.

dim variable name [, variable name [, ...]]
        Reserves memory for specified variables. Use sub-
        scripts to indicate size of each variable. O&P, 3-37.

dirc
        Copies the spare disk directory (default drive) to the
        main directory. 98217A ROM only. D, 4-16.

drive unit no. [, select code]
        Sets the default unit and, optionally, the select code
        for disk operations. Default is 0,8 for 9885 and 0,707
        for 9895. D, 1-14.

drnd (expression , expression)
        Returns the value of the first expression, rounded to
        the number of digits indicated by the second expres-
        sion. O&P, 3-22.

dsp item list
        Displays the items listed. To display quotes use dou-
        ble quotes within the string
        (e.g., 1: dsp "Display""test""in quotes."). O&P, 3-12.

dto (expression)
        Returns the octal equivalent of the decimal value ex-
        pressed. I/O, 3-12.

dtrk [tape file number]
        Dumps a bad track during the 98217A error recovery
        routine. 98217A ROM only. D, 4-15.

dtype
  Returns a code indicating the type of drive, disk and data format at the default disk address. 98228A ROM only. See page 1-15. Return values are:

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

dump [file name , tape file name] [, expression]
  Transfers the contents of the default disk to a tape cartridge. The optional file names indicate to only dump a specified file. The expression can be 1 or 10, indicating the number of disk records to put in each tape file. A positive expression automatically marks the tape. A negative expression suppresses marking the tape. D. 4-12.

E

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

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

enp ["prompt",] string variable
  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 in milliseconds]
  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.
  v   Erase all variables and flags.
  fn   Erase specified key definitions.

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

exp (expression)
  Returns e (2.71828...) raised 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.

files file name$_1$ [: unit no.] [, file name$_2$ [: unit no.] [, ...]
  Assigns names up to 10 disk files. Substituting an • for a file name allows an asgn statement to assign a file name via a string variable. D, 3-3.

flg (flag no.)
  Returns flag status: 1 = set; 0 = clear. O&P, 3-30.

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

HPL Syntax

fmt [format no. ,] [spec₁ [, spec₂ ...]]

    Sets up a list of format specs for red and wrt operations. Format number can be from 0 through 9. Format specs are listed below. Omitting specs cancels specified format. Omitting format no. sets format 0. A repeat factor can precede each spec. 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 zeros.
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.

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

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

    Loads the program from the specified disk file. D, 2-4.

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getb file name

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

getk file name

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

getm file name

    Loads the specified disk memory file. D, 2-10.

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 − no. of lines

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

gto line number or line label

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

gto + or − no. 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 [, array name [, ...]]

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

if expression₁ = expression₂

    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.

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HPL Syntax

ina array variable [: value] [, array variable [: 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
Runs the disk initialization routine and loads bootstraps. 98217A ROM only. D, 4-2.

init drive number , select code[, interleave factor]
Initializes disks in either 9885 or 9895 drive. 98228A ROM only. The interleave can be an integer from 1 thru 29. See page 4-3.

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

inv array variable₁ → array variable₂ [, 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 [, expression]
Moves the pen the number of X and Y units from its current position. The expression is for pen control; see plt. I/O, 7-29.

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.

16

J

jmp expression
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 disk file. D, 1-18.

killall
Purges all disk user files. 98217A ROM only. D, 1-18.

killall drive number , select code
Purges all user files from the specified disk. 98228A ROM only. See page 1-18.

kret
Returns execution to the main program after the key buffer is emptied. O&P, 7-9.

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 [, line number₁ [, line number₂]]]
Loads the specified tape file into the appropriate area of memory. The optional line numbers indicate where to start loading (line number 1) and continuing (line number 2) a program. Omitting the file number loads file 0. O&P, 5-18.

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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.

ldp [file number [, line number₁ [, line number₂]]
Loads a program from either file 0 (file number omitted) or the specified file. The optional line numbers indicate where to start loading (line number 1) and were to start running (line number 2). 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. 9872 Plotter ROM only. 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%, 9872 Plotter ROM only. I/O, 7-32.

```
1 — .................................................
2 — — — — — — — — — — — — — — — — — — —
3 — —  —  —  —  —  —  —  —  —  —  —  —
4 — — · — — · — — · — — · — — · — — · — .
5 — — — — — — — — — — — — —
6 — — — — — — — — — — — — —
omit
number — ————————————————————————
```

list [# select code] [, line number [, line number]]
Lists the entire program on the internal printer (no parameters) or lists the program to the specified select code. The line numbers indicate starting and ending lines for the listing. O&P, 3-39 and I/O, 1-23.

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

18

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 (logₑ) of the expression. O&P, 3-24.

load [disk file name , tape file number]
Loads files previously dumped to a tape back onto the disk. Omitting all parameters loads the entire dump back onto the disk. Including parameters loads only selected data files back onto the disk. D, 4-13.

log (expression)
Returns the common log (log₁₀) 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 through 9. D is lettering direction and can be from 1 through 4. 9862 Plotter ROM only. I/O, 7-47.

ltrk
Returns corrected data to a reinitialized track during disk error-recovery routine. 98217A ROM only. D, 4-15.

M

mat array variable₁* array variable₂ → array variable₃
Array multiplication (arrays must have correct dimensions). M, 19.

max (expression [, expression [, ...]])
Returns the largest value in the list. O&P, 3-22.

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

19

min (expression [, expression [, ...]])
Returns the smallest value in the list. O&P, 3-22.

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

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.

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. 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 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. 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.

oni select code , "label"
References an interrupt service routine associated with the peripheral's select code. I/O, 5-5.

open file name , number of records
Creates a disk data file of the specified size. D, 3-2.

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

P

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

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

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# [expression]
Selects the plotter pen (1 through 4). 9872 Plotter ROM only. I/O, 7-22.

% 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.

plt X coordinate , Y coordinate [, expression]
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 (string₁ , string₂)
Returns the character position of the second string within the first. O&P, 6-16.

prnd (expression , expression)
Returns the first expression rounded to the power of ten indicated by the second expression. O&P, 3-22.

prt expression or string [, expression or string [, ...]]
Prints the list of items on the internal printer. To print quotes
(e.g., 3: prt "print""text""in quotes."). O&P, 3-12

psc select code
Sets the select code for all plotter ROM operations. psc 0 causes either the program to ignore all plotter operations (9872 ROM) or the computer to suppress output to plotter (9862 ROM). I/O, 7-5.

ptyp
Sets a plotter lettering mode. Press STOP key 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.

rcf [file number [, line number
                   [, line number]] [, "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. 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 [, array variable [, ...]]
Redimensions the array(s) to the specified dimensions. M, 16.

rds (select code)
Returns the current status word from the specified interface. I/O, 3-5.

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 disk file. D, 28.

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

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

resave file name [, 1st line number [, 2nd line number]]
Stores a program (or only the specified lines) in an existing disk 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 [, expression]
Enables a remote keyboard to control the computer. The expression indicates the keycode interpretation: 0 = ASCII (default) or 1 = 9825 keycodes. O&P, 7-24.

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

rot (expression₁ , expression₂)
Returns the result of binary rotation of the 16-bit equivalent of expression 1, rotated the number of bits indicated by expression 2. I/O, 3-13.

rprt file number , record number [, data list]
[,"**end**" or "**ens**"]
Prints the list of data items on the disk 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, 3-12.

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 disk file, starting at the specified record. D, 3-15.

rss (select code)
Returns the 98036 interface status register byte. O&P, 7-16.

run [line number or "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]]
Stores either the entire program on the disk file or only the specified block of lines. D, 2-2.

savek file name
Stores all special function key definitions on the disk file. D, 2-9.

HPL Syntax

savem file name
Stores the entire read/write memory on the disk file. 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 15 program flags to 1 or only the specified flags. O&P, 3-28.

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

shf (expression₁ , expression₂)
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 number or simple variable
[*] array variable₁ → array variable₂
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 internal printer. O&P, 3-16.

sprt file number , data list [, "end" or "ens"]
Prints the list of data items on the disk file. Including "end" prints an EOF mark after the data. Including "ens" suppresses the automatic EOR mark printed after data. D, 3-7.

sread file number , variable list
Reads data from the disk file. D, 3-10.

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

store string name or "string" [, line number]
Stores program lines from an executing program. O&P, 7-21.

stp [line number₁ [, line number₂]]
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)
Returns the ASCII character equivalent to the expression. O&P, 6-19.

T

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

tfr source name , destination name
[, expression [, last character]]
Transfers data between an I/O buffer and a peripheral device. Optional 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 (expression)
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. 98217A ROM only. D, 4-15.

27

tlist

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

0   Null file.
1   Binary program.
2   Numeric data file.
3   String or string /data.
4   Memory file.
5   Special function key file.
6   Program file.

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 expression

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 disk 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.

(continued)
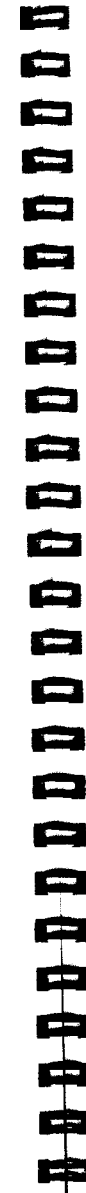
Indicates string overlapping record boundaries:

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

U

units

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

V

val (string)

Returns the numeric value of the string. 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 disk bootstraps. 98217A ROM only. D, 4-15.

voff

Disables disk data verification. D, 4-6.

von

Enables disk data verification (default). D, 4-6.

W

wait expression

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

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

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

HPL Syntax

wsc select code , expression

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

wsm select code , expression [, expression]

Outputs a mode word and, optionally a control word (second expression) to the specified 98036 Interface. O&P, 7-15.

wtb select code , expression [, expression [, ...]]

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

wtc select code , expression

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

wti select code

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

wti expression₁, expression₂

Outputs a control byte (expression 2) to a specified interface register (expression 1). 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. 9872 Plotter ROM only. 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. 9872 Plotter ROM only. 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 disk may be down.
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.
14	Program structure destroyed.

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

Error Codes

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
      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.

Error Codes

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 * $\pi/2$ 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 ($0\uparrow0$).

74 Storage range overflow.

75 Storage range underflow.

76 Calculation range overflow.

Error Codes

77	Calculation range underflow.
A0	Relational operator in for statement not alloweo. 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 B0 thru B8 may result during the binary disk initialization and disk error recovery routines.

B0	Wrong syntax, argument out of range or variable not properly dimensioned.
B1	More than six defective tracks on the disk.
B2	Verify error. Boots on the disk 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.
C9	Missing 98036A Interface card.
D0	Improper argument in disk 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.

Error Codes

D8   Insufficient storage space on disk.

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

DISK IS DOWN (98217A ROM)
UNABLE TO ACCESS DISK CONTROLLER (98228A ROM)
    Computer cannot access the disk controller.

d0   Firmware/driver out of synchronization.
More than six defective tracks in a row (Press (RESET)) or too many defective tracks with 98228A init.

d1   All drives in system not powered on.

d2   Door opened while disk being accessed.

d3   Disk not in drive or drive not present.

d4   Write not allowed to protected disk.

d5   Record header error (error recovery routine.)

d6   Track not found (use error recovery routine.)

d7   Data checkword error. (use error recovery routine.)

d8   Hardware failure (Press (RESET)).

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.

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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.

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. (98217A ROM only).

F8   Disk is down and (STOP) pressed.

F9   System error (save files individually and reinitialize).

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.

---

1 Press the (RECALL) key to position the cursor at the location of the error

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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 Error Codes

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.

9872A Plotter ROM (HP-GL) 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 incountered; 9822 ROM cannot execute them.

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

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.

Error Codes

Errors generated by write (wrt) and read (red) statements 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 disk directory (backup track) automatically replaces the main directory.

Option ROM Syntax and Errors

The following syntax and error messages require the appropriate option ROM be plugged into your Desktop Computer. See the alphabetical listing for syntax and error descriptions.

Advanced Programming ROM
Syntax: cll, for, fti, fts, itf, next, stf, xref
Errors: A0 through A9

98217A Disk ROM
Syntax: asgn, boot, cat, chain, copy, dirc, drive, dtrk, dump, files, get, getb, getk, getm, init, kill, killall, load, ltrk, on end, open, renm, repk, resave, rprt, rread, save, savek,savem, sprt, sread, tinit, type, vfyb, voff, von
Errors: B0 through B8, D0 through D9, F0 through F9, d0 through d9

98228A Disk ROM:
Syntax asgn, cat, chain, copy, drive, dtype dump, files, get, getb, getk, getm, init, kill, killall, load, on end, open, renm, repk, resave, rprt, rread, save, savek, savem, sprt, sread, type, von, voff.
Errors: D0 thru D9, d0 thru d9, F0 thru F9.

Extended I/O ROM
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 ROM
Syntax: conv, fmt, list#, rdb, rds, red, wrt, wtb, wtc
Errors: G1 through G9

Matrix ROM
Syntax: aprt, ara, dim, idn, ina, inv, ldf, mat, rcf, rdm, smpy, trn
Errors: M1 through M5

Option ROM

9862A Plotter ROM

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

Errors: P1 through P8

9872A Plotter ROM

Syntax: cplt, csiz, dig, iplt, lbl, lim, line, ofs, pclr, pen, pen#, plt, psc, ptyp, scl, xax, yax

Error: P1 through P8, p0 through p6

String Programming ROM

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

Errors: S0 through S9

Systems Programming ROM

Syntax: asc, bred, eol, key, kret, nal, on key, rkbd, rss, store, wsc, wsm

Errors: C0 through C9

Interface Card Registers

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

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.

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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.

98033A Register Map

	IN	OUT
R4	DATA IN	(not used)
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.

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

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98033A Registers

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.

98034A Register Map

	ON	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	OTHER	SEE NOTE

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

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.

98034A Read Status Sequence

1. R5-IN: Initiate status read sequence. In the byte received, bits 4 and 5 are ones, indicating an HP-IB interface type. No other bits are meaningful.

2. R6-IN: Get status byte 1.

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

98034A Read Status

3. R6-IN: Get status byte 2.

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

4. R6-IN: Get status byte 3.

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

5. R6-IN: Get status byte 4.

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

98036A Register Map

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

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		Bit Rate Factor 00=not used 01=1 X bit rate clock 10=1/16 X bit rate clock 11=1/64 X bit rate clock	

R4D USART Control Word

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Always 0	USART Reset	Clear To Send Pin 5 (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

R4E USART Status Word

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Always 0	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	Signal Quality Detect Pin 21	Secondary Line Signal Detect Pin 12	Line Signal 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	Data Signal Rate Select Pin 23	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	Special Purpose Pin 25	Data Signal Rate Select (U.K.) Pin 11	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 Line Signal Detect Pin 12	Ring Indicator Pin 22	Line Signal Detect Pin 8

ASCII TABLE

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

ASCII Char.	Binary	Oct	Hex	Dec
space	00100000	040	20	32
!	00100001	041	21	33
"	00100010	042	22	34
#	00100011	043	23	35
$	00100100	044	24	36
%	00100101	045	25	37
&	00100110	046	26	38
'	00100111	047	27	39
(	00101000	050	28	40
)	00101001	051	29	41
*	00101010	052	2A	42
+	00101011	053	2B	43
,	00101100	054	2C	44
–	00101101	055	2D	45
.	00101110	056	2E	46
/	00101111	057	2F	47
0	00110000	060	30	48
1	00110001	061	31	49
2	00110010	062	32	50
3	00110011	063	33	51
4	00110100	064	34	52
5	00110101	065	35	53
6	00110110	066	36	54
7	00110111	067	37	55
8	00111000	070	38	56
9	00111001	071	39	57
:	00111010	072	3A	58
;	00111011	073	3B	59
<	00111100	074	3C	60
=	00111101	075	3D	61
>	00111110	076	3E	62
?	00111111	077	3F	63

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

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