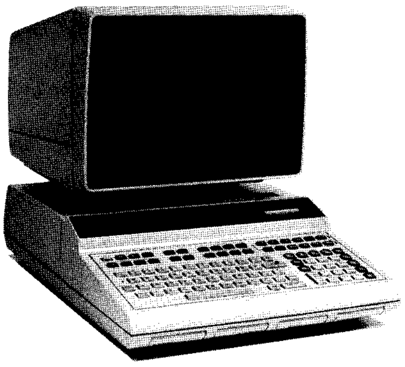
Basic Quick Reference



HP 9835A Desktop Computer

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Introduction

This booklet serves as a handy quick reference to System 35 BASIC. Its purpose is to remind you of the syntax and purpose of all the language features while writing programs. It contains general syntax guidelines, statements, functions, commands and error messages. ROM statements are listed after mainframe statements.

This booklet does not provide detailed reference information; the Reference Guide contains more details and examples.

BASIC Syntax Guidelines

These terms and conventions are used in the syntax listing.

[ ] - items enclosed in brackets are optional unless the brackets are in dot matrix.

dot matrix - all items in dot matrix must appear as shown.

... - three dots indicate that the previous item can be duplicated.

| - a vertical line between parameters means "or"; only one of the two parameters may be included.

/ - a slash between two parameters means that either or both parameters may be included.

character - a letter, number symbol or ASCII control code (ASCII control codes can be obtained using the control key); any arbitrary 8-bit byte defined by the CHR$ function.

constant - a number within the System 45's range, such as 2E12, which can't be altered.

controller address - an integer from 0 through 7; 0 is default.

file number - the number in the range 1-10 assigned to a mass storage data file by an ASSIGN statement.

file name - a 1 to 6 ASCII character string with the exception of a quote mark, colon, ASCII NULL or CHR$(255).

file specifier - a string expression of the form: file name [mass storage unit specifier].

formal parameters - simple variables, array identifiers, or files specified by # file number.

HP-IB device address - an expression in the range 1-30.

label - a unique name given to a program line. It follows the line number and is followed by a colon.

line identifier - the line number or label, if any, of a program line.

line number - an integer from 1 through 9999.

mass storage unit specifier (msus) - a string expression of the form -

: device type [select code [, controller address | 9885 unit code [, unit code]]]

The letters specifying the various device types are

T - Tape Cartridge
F - 9885 Flexible Disk
Y - 7905 Removable Platter
Z - 7905 Fixed Platter
C - 7906A Removable Platter
D - 7906A Fixed Platter
P - 7920A Disc Pack

name - a capital letter followed by 0 through 14 lowercase letters, digits or the underscore character.

numeric expression - a logical combination of variables, constants, operators and functions (including user-defined functions) grouped within parentheses as necessary. However, multiple line user-defined functions can't be used in any I/O statement.

pass parameters - variables, array identifiers, expressions, or files specified by #file number.

priority - a numeric expression in the range 1-15.

protect code - a string expression except one with a length of 0. Only the first 6 characters are recognized as the protect code, however.

redim subscripts - numeric expressions separated by commas and enclosed in parentheses.

scalar - a numeric expression used as a constant in mathematical operations.

select code - an expression (rounded to an integer) in the range 0 through 16. The following select codes are reserved -

0 - Internal thermal printer
15 - Tape cartridge drive
16 - CRT (9835A); Internal printer (9835B)

string expression - the forms a string expression can have are text within quotes, string variable, substring, string concatenation operation - & - and string function (including user-defined).

subscripts - an integer used to specify the range of an array dimension. One subscript is used to specify the upper bound of a dimension; two subscripts separated by a colon are used to specify the upper and lower bounds of a dimension. A comma is used to separate the subscripts for each dimension.

text - a string of characters, quoted (literal) or unquoted as specified.

unit code - an integer from 0 through 7; 0 is default. The 9885 unit code is an integer from 0 through 3; 0 is default.

variable - a name which is assigned a value and specifies a location in memory.

Statements

ASSIGN file specifier TO # file number [, return variable [, protect code]]
ASSIGN # file number TO file specifier [, return variable [, protect code]]
ASSIGN * TO # file number
ASSIGN # file number TO *

Opens a data file by assigning a number to it or closes a data file by assigning * to the file number. The return variable can be any simple variable. The protect code is required if the file was protected.

BEEP

Outputs an audible beep.

BUFFER # file number

Attaches a 266 byte, semi-permanent buffer from user Read/Write Memory to the specified file to reduce mass storage device transfers.

CALL subprogram name [(pass parameter list)]

Transfers control to a subroutine subprogram.

CAT [selective catalog specifier/msus [, heading suppression]]
CAT # select code [, HP-IB device address] [; selective catalog specifier/msus [, heading suppression]]

Outputs information about files on a mass storage medium. The selective catalog specifier is a string expression of 1 through 6 characters; only those files whose names begin with that combination of characters are catalogued. The heading is suppressed if the value of the numeric expression rounds to 1. The second syntax directs the catalog output to the specified device.

CHECK READ [# file number]

Provides verification that the information being stored on a storage medium is identical to that in memory. This verification may be specified for a certain file only. It also forces the output of data if it is not buffered.

CHECK READ OFF [# file number]

Deactivates a previous corresponding CHECK READ statement, either general or for a specified file.

COM item [, item...]

Dimensions and reserves memory space for the specified simple and array variables – numeric and string – in a "common" memory area, allowing values to be passed to subprograms or to other programs. REAL, SHORT or INTEGER can precede one or more numeric variables to specify precision.

COPY source file specifier TO destination file specifier [, protect code]

Copies a file from one location to a previously undefined file. The protect code is used only if the source file is protected.

CREATE file specifier, number of defined records [, record length]

Establishes a data file of the specified size (in bytes) and places an EOF mark in the first word of every record.

DATA constant or text [, constant or text...]

Provides constants and quoted or unquoted text from which READ and MAT READ obtain values for numeric and string variables. It can't be executed from the keyboard.

DEFAULT OFF

Cancels any DEFAULT ON statement previously executed.

DEFAULT ON

Prevents the following math errors from halting program execution by providing default values for out-of-range results which occur in computations or assignments. The default values are -

Error (Number)	**Default Value**
Integer precision overflow (20)	32767 or −32768
Short precision overflow (21)	+ or −9.99999E63
Real precision overflow (22)	+ or −9.99999999999E99
Intermediate result overflow (23)	+ or −9.99999999999E511
TAN(N*P1/2), N:odd integer (24)	9.99999999999E511
Zero to negative power (26)	9.99999999999E511
LGT or LOG of zero (29)	−9.99999999999E511
Division by zero (31)	+ or −9.99999999999E511
XMOD Y,Y=0 (31)	0

DEF FN subprogram name [(formal parameter list)] = numeric expression

DEF FN subprogram name $ [(formal parameter list)] = string expression

DEF FN subprogram name [(formal parameter list]
DEF FN subprogram name $ [(formal parameter list)]

Defines a single-line function (first two syntaxes), or, with RETURN and FN END, a multiple-line function subprogram (second two syntaxes).

DEG

Sets degree mode for results and arguments of trigonometric functions.

DIM item [, item...]

Declares the number of dimensions and the maximum number of elements in each dimension for the specified real precision array variables and ititialize all elements to 0. It is also used to define the maximum length for the specified simple and array string variables, declare the number of dimensions and maximum number of elements in each dimension and initialize all strings to the null string.

DISABLE

Deactivates any ON KEY # interrupt declarative so that pressing that key has no effect on current program control, but the interrupt is recorded by the computer.

DISP [display list]

Causes the items specified in the display list to be displayed. The items can be variables, expressions, SPA, and TAB, separated by commas or semicolons. Multiple-line user-defined functions cannot be specified in the display list.

EDIT ["prompt " ,] string variable

Allows the stored value of a string variable of up to 160 characters in length to be altered. EDIT can't be executed from the keyboard.

ENABLE

Reactivates any ON KEY# interrupt declaratives that were previously deactivated by DISABLE. Any pending interrupts are executed.

END

Is the last (highest numbered) statement in a main program and terminates program execution.

FIXED number of digits

Sets fixed mode for output of numeric values and specifies from 0 through 12 digits to the right of the decimal point.

FLOAT number of digits

Sets floating point mode (scientific notation) for output of numeric values and specifies the number of digits to the right of the decimal point in the range 0 through 11.

FN END

Is the last line in a multiple-line function subprogram.

FOR loop counter = initial value TO final value [STEP increment value]

Defines how many times a FOR-NEXT loop is to be executed. The loop counter must be a simple variable. If no increment value is specified, it defaults to 1.

GET file specifier [, line identifier[, execution line identifier]]

Loads into memory a program saved with the SAVE statement, or any string data file consisting of valid BASIC statements. When the first line identifier is specified, the program is renumbered so that it begins with the line number of the specified line. The second line identifier specifies where execution is to begin.

GOSUB line identifer

Transfers program control to the subroutine beginning at the specified line in the current program segment.

GOTO line identifier

Transfers program control to the specified line in the current program segment.

GRAD

Sets grad mode for all results and arguments of trigonometric functions.

IF numeric expression THEN line identifier
IF numeric expression THEN executable statement

Provides conditional branching. If the numeric expression is evaluated as true, execution is transferred to the specified line or the statement is executed.

IMAGE image format string

Is used with PRINT USING and specifies output format: numeric and string field specifiers, blanks, and carriage control. The image format string is a list of field specifiers; it is not enclosed in quotes. Field specifiers must be separated by a comma, @ or slash.

Below are the image symbols and uses. (N) preceding a symbol means that it can be replicated.

Image Symbol	Purpose	Comments
(N) X	Blank	Can go anywhere
" "	Text	Can go anywhere
(N) D	Digit	Fill = blanks
(N) Z	Digit	Fill = zeroes
(N) *	Digit	Fill = asterisks
S	Sign	"+" or "−"
M	Sign	" " or "−"
E	Exponent	Format = ESDD
.	Radix	Output "."
C	Comma	Conditional number separator
R	Radix	Output ","
P	Decimal point	Conditional number separator
(N) A	Characters	Strings
(N) ( )	Replicate	For specifiers, not symbols
#	Carriage control	Suppress CR-LF
+	Carriage control	Suppress LF
−	Carriage control	Suppress CR
K	Compact	Strings or numerics
,	Delimiter	
(N) /	Delimiter	Output CR-LF
@	Delimiter	Output FF

INITIALIZE mass storage unit specifier [, interleave factor]

Enables an unused mass storage medium to be used by establishing physical records and main and spare directories. A used medium can also be re-initialized; in the process, it is cleared of all information it contains. The interleave factor, an integer from 1 through 10 defines number of revolutions per track on the HP 9885 Disk; 7 is the default value.

INPUT ["prompt" ,] variable name [, ["prompt" ,] variable name...]

Allows values to be assigned to variables from the keyboard during program execution. It can't be executed from the keyboard.

INTEGER numeric variable [(subscripts)] [, numeric variable [(subscripts)] , ...]

Dimensions and reserves storage space for integer precision variables – simple and array.

[LET] numeric variable [= numeric variable...] = numeric expression

[LET] string variable [= string variable...] = string expression

Assigns a value to a variable or variables.

LINK file specifier [, line identifier [, execution line identifier]]

Loads into memory a program saved with SAVE, or any string data file consisting of valid BASIC statements, without destroying the values of variables. If one line identifier is specified, the loaded program is renumbered so that it begins with the number of the specified line. The second line identifier specifies where execution is to continue.

LINPUT ["prompt" ,] string variable

Allows any combination of characters to be assigned to a string variable during program execution. It can't be executed from the keyboard.

LOAD file specifier [, execution line identifier]

Loads back into memory a program stored with STORE, destroying any lines in memory. The execution line identifier specifies where execution is to begin.

LOAD BIN file specifier

Loads the specified binary file into memory without altering any other binary routines already in memory.

LOAD KEY file specifier

Loads SFK definitions from a file stored with STORE KEY. Program lines in memory aren't affected.

MASS STORAGE IS mass storage unit specifier

Specifies the standard (default) mass storage device. Valid specifiers are listed in the Syntax Guidelines of this booklet.

MAT array variable = CON [(redim subscripts)]

Assigns the value 1 to every element in a numeric array. A new working size can be specified with the redim subscripts.

MAT result array = operand array

Copies the value of each element in a numeric array into a second numeric array.

MAT result vector = CSUM operand matrix

Finds the sums of the elements of the columns of a numeric matrix and stores them in a vector.

MAT result array = function operand array

Evaluates each element in the operand numeric array by the specified system function; the result becomes the value of the corresponding element in the result array. The, function can be any single-argument system function.

MAT matrix name = IDN [(redim subscripts)]

Establishes an identity matrix: all elements equal 0 except the main diagonal (upper left to lower right) which all equal 1. A new working size can be specified; it must have 2 dimensions.

MAT array variable = (numeric expression)

Assigns the value of the expression to every element in a numeric array.

MAT INPUT array variable [(redim subscripts)] [, array variable[(redim subscripts)], ...]

Allows values to be assigned from the keyboard to the elements of an array during program execution. A new working size can be specified for any array.

MAT result matrix = INV operand matrix

Establishes a square matrix as the inverse of the specified square matrix.

MAT result matrix = operand matrix 1 * operand matrix 2

Multiplies two numeric matrices together. The number of columns of the first operand must equal the number of rows of the second.

MAT result array = operand array operator operand array

Performs an arithmetic or relational operation on corresponding elements of two numeric arrays; the result becomes the value of the corresponding element in the result array. The following operators are allowed —

+, −, * (multiply), /, =, <, >, <=, >=, <> or #.

MAT PRINT array variable [, or ; [array variable...]]

Prints the specified arrays on the standard printer.

MAT PRINT# file number [, defined-record number] ; array variable[, array variable , ...] [, END]

Records all of the elements of the specified arrays onto a mass storage medium. END causes an EOF to be printed after the data.

MAT READ array variable [(redim subscripts)] [, array variable[(redim subscripts)], ...]

Specifies that values for all the elements in an array or arrays are to be read from a DATA statement or statements which specify the values. A new working size can be specified for any of the arrays.

MAT READ # file number [, defined record number] ; array variable [(redim subscripts)] [, array variable[(redim subscripts)], ...]

Reads values for the elements of the specified arrays from a mass storage medium. A new working size can be specified for any of the arrays.

MAT result vector = RSUM operand matrix

Finds the sums of the elements of the rows of a numeric matrix and stores the sums in a vector.

MAT result array = operand array operator (scalar)
MAT result array = (scalar) operator operand array

Performs an arithmetic or relational operation on each element of a numeric array using a constant scalar (numeric expression); the result becomes the value of the corresponding element of the result array. The following operators are allowed —
+, −, *, /, =, <, >, <=, >=, <> or #.

MAT result matrix = TRN operand matrix

Establishes a matrix as the transpose of a specified matrix (rows become columns, columns become rows). A matrix can't be transposed into itself.

MAT array variable = ZER [(redim subscripts)]

Sets all elements in a numeric array to 0. The array can be redimensioned.

NEXT loop counter

Is the last statement of a FOR-NEXT loop and causes the loop counter to be incremented and tested.

NORMAL

Cancels all tracing operations.

OFF END # file number

Deactivates a corresponding ON END# statement.

OFF ERROR

Cancels any ON ERROR condition currently active.

OFF KEY # key number

Deactivates a corresponding ON KEY # statement; pressing the key then has no effect on program control.

ON END# file number GOTO line identifier
ON END# file number GOSUB line identifier
ON END# file number CALL subprogram name

Declares a branching that is to occur when an EOR or EOF mark is encountered during a READ# or PRINT# operation to that file so that the condition can be serviced. It also forces serial mode I/O for that file. No parameters can be passed to the subprogram when CALL is used.

ON ERROR GOTO line identifier
ON ERROR GOSUB line identifier
ON ERROR CALL subprogram name

Prevents some recoverable program execution errors from halting execution by causing branching when an error occurs and suppressing the normal error process. No parameters can be passed to the subprogram when CALL is used.

ON numeric expression GOSUB line identifier list

Accesses any one of one or more subroutines in the current program segment based on the value of the numeric expression. A value of 1 corresponds to the first line identifier in the list, 2 to the second, etc.

ON numeric expression GOTO line identifier list

Transfers program control to one of one or more statements in the current program segment based on the value of the numeric expression. A value of 1 corresponds to the first line identifier in the list, 2 to the second, etc.

ON KEY# key number [, priority] GOTO line identifier
ON KEY# key number [, priority] GOSUB line identifier
ON KEY# key number [, priority] CALL subprogram name

Allows any SFK to be used for program control. When an SFK is pressed during a program and an ON KEY# statement has been declared for it, the specified branching occurs if the specified priority is higher than the current system priority.

OPTION BASE 1 or 0

Allows the default lower bound of arrays to be specified as 1 rather than 0. OPTION BASE 0 can be declared for documentation purposes since it is default at power on. The OPTION BASE statement must be before any DIM, COM, REAL, SHORT, and INTEGER statements.

OVERLAP

Sets the computer to the overlapped processing mode allowing computation and multiple I/O operations to occur simultaneously.

PAUSE

Suspends program execution. It can't be executed from the keyboard.

PRINT [print list]

Prints the items specified in the print list on the standard printer. The items can be variables, array identifiers, expressions (excluding multiple line user-defined functions), TAB, SPA, LIN, and PAGE, separated by commas or semicolons.

PRINT ALL IS select code [, HP-IB device address]

Defines the standard print all device used when print all mode is set.

PRINT# file number; data list [, END]
PRINT# file number; END
PRINT# file number, defined-record number [; data list [, END]]
PRINT# file number, defined-record number; END

Records values onto the specified file. In serial access mode, recording starts at the beginning of the file or after the last data item accessed. In random access mode, with the defined record number specified, recording starts at the beginning of a defined record. The data list can include variables, constants and literals, separated by commas. END causes an EOF to be printed after the data. When the data list is omitted in random mode (4th syntax) an EOR is printed in that record.

PRINT USING line identifier [; print using list]
PRINT USING image format string expression [; print using list]

Allows the exact form of printed output to be determined by the image format string. The print using list can contain variables, array identifiers and expressions, separated by commas or semicolons; each item must correspond to an appropriate field specifier in the image format string. The line identifier must refer to an IMAGE statement.

PRINTER IS select code [, HP-IB device address] [, WIDTH number of characters per line]

Defines the standard printer for the system. The range of the WIDTH is 16 through 260 characters; 80 is default unless the internal printer is specified in which case it is 16.

PROTECT file specifier, protect code

Guards a file against accidental erasure. The protect code is any valid string expression except one with a length of 0. Only the first 6 characters are recognized.

PURGE file specifier[, protect code]

Erases the specified file from the storage medium. The protect code is allowed only if the file was previously protected.

RAD

Sets radian mode for all results and arguments of trigonometric functions.

RANDOMIZE [numeric expression]

Re-evaluates the random number seed.

READ variable name [, variable name, ...]

Specifies variables for which values are to be assigned from a DATA statement. It can't be executed from the keyboard.

READ #file number; variable list

READ #file number, defined-record number [; variable list]

Retrieves values for variables from the specified file. In serial access mode, reading starts at the beginning of the file or after the last data item accessed. In random access mode, with the defined reord number specified, reading starts at the beginning of the defined record. READ # can also be used to reposition the data pointer by omitting the variable list in random mode. The variables in the variable list must be separated by commas.

REAL numeric variable [(subscripts)] [, numeric variable [(subscripts)], ...]

Dimensions and reserves storage space for non-subscripted and array variables and declares them as full precision.

REDIM array variable (subscripts) [, array variable (subscripts), ...]

Allows a new working size for an array to be defined. The total number of elements can't exceed that originally declared. The number of dimensions can't change.

REM [any combination of characters]

Allows insertion of non-executable remarks into the listing of a program to provide documentation and make the program easier to follow.

RENAME old file specifier TO new file name [, protect code]

Allows any file to be given a new name. The protect code is used only if the file was previously protected.

RE-SAVE file specifier [, protect code] [, beginning line identifier [, ending line identifier]]

Allows a program to be written into a file that had been created with SAVE without purging the file first. The protect code is used only if the file was previously protected. When no line identifiers are specified, the entire program is saved. When one line identifier is specified, the program is saved from that line to the end. When two line identifiers are specified, that block of lines is saved.

RE-STORE file specifier [, protect code]

Allows a program to be written into a file that had been created with STORE without purging the file first.

RESTORE [line identifier]

Repositions the DATA pointer to the beginning of the specified DATA statement, or at the lowest numbered DATA statement in the current program segment if one isn't specified.

RESUME INTERACTIVE

Re-enables live keyboard capability previously disabled with SUSPEND INTERACTIVE.

RETURN

RETURN numeric expression

RETURN string expression

RETURN with no expression is the last line executed in a subroutine and transfers control back to the line following the GOSUB statement. RETURN is also used with DEF FN to specify the value to be returned to the calling program and to transfer control back to the statement which referenced the subprogram.

REWIND [mass storage unit specifier]

Rewinds the tape to its beginning. It is ignored if the mass storage unit specifier does not specify a tape cartridge.

SAVE file specifier [, beginning line identifier [, ending line identifier]]

Lists and records all or some of program lines in memory into a data file. If one line identifier is specified, the program is saved from that line to the end. When two line identifiers are specified, that block of lines is saved.

SECURE [line identifier [, line identifier]]

Prevents selected lines or an entire program from being listed; an asterisk appears after the line number replacing the line in the listing. If one line identifier is specified only that line is secured. If two line identifiers are specified, that block of lines is secured.

SERIAL

Cancels the effect of any previous OVERLAP statement and sets the computer to the serial processing mode.

SHORT numeric variable [(subscripts)] [, numeric variable[(subscripts)], ...]

Dimensions and reserves storage space for simple and array variables and declare them as short precision.

STANDARD

Sets standard mode for output of numeric values.

STOP

Terminates program execution and sets the program pointer to the lowest-numbered line. It can't be executed from the keyboard.

STORE file specifier

Stores all program lines and binary routines in memory into a program file on the specified mass storage device.

STORE ALL file specifier

Stores into a special file the entire contents of user Read / Write Memory with the exception of the files table. It can't be executed from within a subprogram.

STORE BIN file specifier

Stores into a special file all user binary programs in memory.

STORE KEY file specifier

Stores all SFK typing aid definitions into a special key file.

SUB subprogram name [(formal parameter list)]

Is the first line of a subroutine subprogram.

SUB END

Is the last line in subroutine subprogram and transfers control back to the calling program.

SUB EXIT

Transfers control from a subroutine subprogram back to the calling program before SUB END is executed.

SUSPEND INTERACTIVE

Disables live, interactive keyboard operations while a program is running.

TRACE [beginning line identifier [, ending line identifier]]

Traces program logic flow in all or part of a program. When one line identifier is specified, tracing begins after that line is executed. An ending line identifier causes tracing to stop after that line is executed.

TRACE ALL

Traces all program logic flow and variable assignments. It is like executing both TRACE and TRACE ALL VARIABLES.

TRACE ALL VARIABLES [beginning line identifier [, ending line identifier]]

Monitors value changes of all variables in a specified program segment, or throughout the entire program. When one line identifier is specified, tracing begins after that line is executed. An ending line identifier causes tracing to stop after that line is executed.

TRACE PAUSE [line identifier[, numeric expression]]

Causes execution to halt before a specified line is executed a certain number of times. If no parameters are specified, execution stops after the TRACE PAUSE statement and the next line to be executed is displayed. If just the line identifier is specified, execution stops just before that line is executed. If the numeric expression is specified, it is rounded to an integer N. Execution stops at the line before it is executed the Nth time.

TRACE VARIABLES variable list

Monitors value changes of selected variables; the trace output indicates the new value of the variable and in what line the assignment occurred. The variable list can contain 1-5 variables and array identifiers separated by commas.

TRACE WAIT number of milliseconds

Causes the computer to wait the specified amount of time after each line which causes a trace printout. The range of the numeric expression is − 32 768 through 32 767; a negative number defaults to 0.

TYPEWRITER OFF

Disables a previous TYPEWRITER ON and returns the keyboard to normal mode.

TYPEWRITER ON

Sets the keyboard to typewriter mode.

WAIT number of milliseconds

Causes program execution to delay approximately the number of milliseconds specified before it continues. The range of the numeric expression is − 32 768 through 32 767; a negative number defaults to 0.

Mass Storage ROM

Most of the Mass Storage statements and commands are included in the mainframe. Additional statements that are enabled by the Mass Storage ROM are listed here.

FCREATE file specifier, number of records

Creates a binary data file of the specified length.

FPRINT file specifier [, protect code] integer array identifier

Stores the numeric or string array into the specified binary data file at DMA speed.

FREAD file specifier [, protect code] integer array identifier

Reads the specified array from a binary data file at DMA speeds.

Plotter ROM

AXES [Xtic spacing, Ytic spacing[, Xintersection, Yintersection[, Xmajor count, Ymajor count [, major-tic size]]]]

Draws a pair of axes with optional (linearly spaced) tic marks.

CLIP [Xmin, Xmax, Ymin, Ymax]

Defines the soft clip limits. Omitting the parameters allows any two diagonal corners to be digitized.

CSIZE height [, aspect ratio]

Specifies the size and aspect ratio of characters used in labels. The height defaults to 15/4.54. The aspect ratio (width/height) defaults to 9/15.

CURSOR Xvariable, Yvariable[, Z pen status string variable]

Returns values to the specified variables indicating the coordinate values of the cursor's location and the pen status. For the pen status, "0" indicates up, "1" indicates down.

DIGITIZE Xvariable, Yvariable[, pen status string variable]

Pauses program execution and allows you to reposition the cursor; execution is resumed by pressing the CONTINUE key, any SFK or the STEP key. The values of the cursor coordinates are assigned to the variables. Pen status is assigned to a string variable; "1" for down, "0" for up.

DRAW Xcoordinate, Ycoordinate

Drops the pen and moves it to the absolute X,Y coordinate position which is specified.

FRAME

Draws a box around the current clipping area.

GCLEAR [distance]

Clears the incremental plotter by advancing the paper. The distance value specifies how many millimetres of paper to eject on certain printers; it has no effect on the 9872A.

GRID [Xtic spacing, Ytic spacing[, Xintersection, Yintersection[, Xmajor count, Ymajor count[, tic size]]]]

Can be used as an alternative to the AXES statement and is used to draw a full screen grid.

IPLOT Xincrement, Yincrement[, pen control]

Allows incremental plotting from the last plotted point. The pen control is the same as for the PLOT statement.

LABEL list

Is used like the PRINT statement and draws labels on the plotter. The label is terminated on CHR$(3).

LABEL USING image specifier; list

Is used like the PRINT USING statement and draws formatted labels on the plotter.

LDIR angle

LDIR Xcomponent, Ycomponent

Specifies the angle at which subsequent labels will be drawn. The angle specifies counter-clockwise rotation of the label from the positive X-axis in current angular units. The angle specified by the second syntax is a vector plotted such that the Xcomponent equals the run and the Ycomponent equals the rise.

LETTER

Allows you to draw all keyboard alphanumerics and symbols by typing them in on the keyboard.

LIMIT [Xmin, Xmax, Ymin, Ymax]

Defines the hard clip limits. The units are expressed in millimetres with the origin at the lower left physical limit. When the parameters aren't included, the lower left and upper right corner points can be digitized.

LINETYPE id number [, length]

Selects one of several solid or dashed line types.

The range of the id number is 1 through 10; 4 is the default length.

LOCATE [Xmin, Xmax, Ymin, Ymax]
Sets the area that SHOW will fill or SCALE will map to. The units are expressed in GDU's. The lower left and upper right corner points can be digitized if the parameters are not included. LOCATE also invokes soft clipping at its boundary.

LORG origin position
Sets the label origin position which determines where any subsequent labels are drawn relative to the current pen location. The range of the origin position is 1 through 9.

MOVE Xcoordinate, Ycoordinate
Lifts the pen and moves it to the absolute X,Y coordinate position which is specified.

MSCALE X, Y
Sets millimetres as user units and defines the origin. The origin is offset from the lower left LOCATE point (Xmin,Ymin) by the specified X, Y amounts.

PDIR angle

PDIR Xcomponent, Ycomponent
Sets the angle of rotation for relative and incremental plotting. The first syntax specifies counter-clockwise rotation from the positive X-axis in current angular units. The second syntax indicates the angle by specifying a vector in which the Xcomponent equals the run and the Ycomponent equals the rise.

PEN pen number
Specifies the pen to be used. 0(zero) specifies return all pens to their holders on the 9872A.

PENUP
Lifts the pen.

PLOT Xcoordinate, Ycoordinate[, pen control]
Provides absolute data plotting and pen control. The pen control defaults to one and operates by the following conditions:

odd	—	drop pen
even	—	lift pen
positive	—	pen change after motion
negative	—	pen change before motion

PLOTTER IS [select code[, HP-IB device address],]plotter id string[, step size[, number of pens[, pen offset[, pen select id]]]]
Defines where all plotter operations will be directed. The allowable plotter id strings and their default select codes are —

"9872A" (7,5)
"INCREMENTAL" (5)

PLOTTER select code[, HP-IB device address] IS OFF
Sets the specified device to an inactive state.

PLOTTER select code[, HP-IB device address] IS ON
Declares the specified device to be the active plotter.

POINTER Xcoordinate value, Ycoordinate value[, cursor type]
Moves the cursor to the specified absolute position.

The cursor type is allowed for compatibility with graphics on the HP System 45.

RPLOT Xrelative coordinate , Yrelative coordinate [, pen control]

Allows relative plotting from the last absolute plotted point which is used as the origin. The pen control is the same as for the PLOT statement.

SCALE Xmin , Xmax , Ymin , Ymax

Sets user definable units which are mapped onto the LOCATE rectangle.

SETGU

Sets graphic display units (GDU's) as the current units.

SETUU

Sets user defined units (UDU's) as the current units.

SHOW Xmin , Xmax , Ymin , Ymax

Defines an area that is stretched or shrunk equally in X,Y directions to fit into the plotting area defined by the LOCATE statement or by the default (LIMIT).

UNCLIP

Sets the soft clip limits equal to the hard clip limits.

WHERE Xvariable , Yvariable[, $ pen status string variable]

Returns the coordinate values of the last plotted or moved-to point.

I/O ROM

The following list presents a concise, formal syntax definition for all of the I/O ROM statements and functions.

Conventions and Terms

DOT MATRIX: All items in dot matrix must appear exactly shown.

[ ] : Items within square brackets are optional unless the brackets are also in dot matrix.

| : A vertical line between two items reads as "or"; only one of the two items may be included.

... : Three dots indicate that successive parameters are allowed, when each is separated by a comma.

{ } : When more than one item appears in an item list with no separators, individual items are within braces.

source|dest: sc|string variable|numeric array

sc: isc|isc,da|hpa|−isc|−isc,da|−hpa

isc: interface select code

hpa: Three or four digit HP-IB device bus address sequence (for example 705,712,1014, etc.) See the description of da below for rules regarding the use of secondary commands.

da: One or two digit device address sequence (i.e.,5,12,03) separated by commas. Note that a secondary command sequence can follow any device address. The secondary command sequence is set off from the device address by a decimal point and terminated by a secondary command >31. The entire device address and secondary command expression is limited to twelve digits.

transfer:	[type] [USING {image}] | [type] NO FORMAT
Etype:	itfr|{htfr} N|tfr
N:	Byte or word transfer count
type:	itfr|htfr|tfr
itfr:	{B|W} INT (Byte or word interrupt handshake)
htfr:	{B|W} {FHS|DMA} (Byte or word fast handshake or direct-memory access)
tfr:	WHS (word handshake)

list:

variable names
array identifiers
numeric expressions
string expressions

Syntaxes

ABORT IO isc

This statement is used to reset the interface functions of all HP-IB devices on the bus and return control to the System 35 if it is system controller.

BINAND (exp 1, exp 2)

This function returns the binary AND of the values specified by exp 1 and exp 2.

BINCMP (exp)

This function returns the binary complement of the value specified by exp.

BINEOR (exp 1, exp 2)

This function returns the binary EXCLUSIVE OR of the values specified by exp 1 and exp 2.

BINIOR (exp 1, exp 2)

This function returns the binary INCLUSIVE OR of the values specified by exp 1 and exp 2.

BIT (exp 1, {exp 2}|{string exp})

This function returns a value of 1 or 0 as follows:

- When exp 2 is a numeric expression, a 1 is returned when the bit position of exp 1 that is specified by exp 2 is a 1.
- When a string expression is specified, it is used as a mask for testing the bit pattern of exp 1. A 1 is returned when the string mask matches the bit pattern of exp 1. Any character of the mask that is not a 1 or Ø character represents a don't-care state for that bit.

CARD ENABLE [−] isc

This statement enables the specified interface card to generate end-of-line program interrupts. The CONTROL MASK word is stored into the interface's R5 register by the CARD ENABLE statement. If the isc is negative, the CONTROL MASK word is not stored in the R5 register of the interface.

CLEAR sc

This statement has four effects depending on the manner in which the select code is specified:

- If the select code of a non-HP-IB type interface is specified, the Reset bit (bit 5) of the interface control register (R5) is set true (logical 1).
- If the select code specifies an HP-IB interface with no device addresses, a Device Clear (DCL) message is sent.
- If the select code specifies an HP-IB interface and one or more HP-IB device addresses, the specified devices are sent a Selected Device Clear (SDC) message.
- If the negative select code of a 98034A interface is specified (i.e. RESET-7), those devices addressed to listen from a prior bus configuration are sent a Selected Device Clear (SDC) message.

COLLECT

This statement forces buffer reclamation for simultaneous input and output operations.

CONFIGURE isc [TALK =da1] [LISTEN = da2[, da3...]]

This statement allows HP-IB data transfers not involving the System 35 to take place on the bus. If the TALK address parameter is excluded, the System 35 is assumed to be the talker; if the LISTEN address parameter(s) is excluded, the System 35 is assumed to be the listener. When the System 35 is not involved in the transfer, an end-of-line program branch is requested (if enabled by an ON INT statement) when the data transfer is complete.

CONTROL MASK isc; bit mask

This statement establishes an end-of-line branch mask word. The numeric or string expression specified for the bit mask is converted to a 16 bit integer: bits set in the integer enable the corresponding end-of-line branch conditions from the interface. The string expression form of the bit mask consists of 1 and 0 characters.

CONVERT dest; mode{, string [, parity] }|{[, string], parity}

CONVERT dest; mode, exp 1 TO exp 2 [, parity]

This statement establishes a conversion table and optionally generates and checks parity for I/O operations. The string specified indicates the conversion table to be used.

The mode parameter is a string expression, specified as follows:

- I – input only conversions
- O – output only conversions
- IO – the conversion table specified is used for input, and an inverse table is generated for output.
- OI – the conversion table specified is used for output, and an inverse table is generated for input.

The parity parameter is a numeric value specified as follows:

- 0 – Parity bit is always reset (0).
- 1 – Parity bit is always set (1).
- Even value (=0) – Even parity is generated and checked.
- Odd value (= 1) – Odd parity is generated and checked.

Single character conversions can be specified by the second syntax, CONVERT...TO... Successive statements can be executed, and their values are placed in the appropriate position of the conversion table generated by the first CONVERT...TO...statement for that select code.

CONVERT dest; mode

This statement turns off conversions previously specified for the dest parameter.

DECIMAL

This function returns the decimal equivalent of an octal number ranging from -177777_8 to $+177777_8$.

[S] ENTER {sc} {Etype} [NOFORMAT | USING image]; enter list
[S] ENTER source [BYTE] [USING image]; enter list

This statement is used to initiate a transfer of data into the specified list. If WHS is not specified, 8 bits are transferred at a time. Two basic syntaxes are available as shown above, with parameter meanings as follows:

BYTE – This optional keyword is used for internal transfers only. Specifying BYTE causes one byte per word to be transferred from the source string or array, whereas omitting BYTE causes two bytes per word to be transferred from the source string or array.

image – valid input IMAGE specifiers are:

F Numeric freefield input using a decimal point radix symbol. Leading spaces are ignored, non-numeric characters are delimiters.

H Numeric freefield input using a comma for the radix symbol. Otherwise identical to F.

{n}N Numeric input of {n} characters per data item with a decimal point radix symbol. Non-numeric characters are counted but not entered.

{n}G Numeric input of {n} characters per data item with a comma radix symbol. Otherwise identical to N.

B Binary input of 8 bits per numeric or numeric array variable.

Y Binary input of two 8 bit bytes per numeric or numeric array variable. The first byte received becomes the 8 most significant bits of the variable.

W Binary input of 16 bits per numeric or numeric array variable.

For the B, Y, and W specifiers, if the input variable is a full or short precision real variable, the incoming binary value is converted to the appropriate data type.

T String variable freefield input with a line-feed delimiter. Carriage-returns not immediately followed by a line-feed are entered into the string. Input to a variable terminates with a line-feed or when the dimensioned string length is exceeded.

{n}A String variable input of {n} characters.

{n}X Causes {n} input characters to be skipped.

{n}/ Causes all characters up to the next {n} line-feeds to be skipped.

+ Causes line-feed to be canceled as terminator, and must appear before any other image specification in the image list. Data entry terminates with the last item in the list or EOI.

# Cancels the HP-IB EOI as a terminator and must appear before any other image specification in the image list. Data entry terminates when the last item in the enter list is received.

% Cancels both EOI and line-feed as terminators, and must appear before any other items in the image list.

{n}( ) Items or groups of items enclosed in parentheses are replicated {n} times.

enter list - Allowable items in the enter list include:

- Full precision variables
- Short precision variables
- String variables
- String array variables
- Full or short precision numeric arrays
- Integers

The optional form SENTER specifies sequential execution of the ENTER statement with respect to other SENTER and SOUTPUT statements when the program is the OVERLAP mode of execution.

EOI sc; expression

This statement provides the capability of sending a data byte in HP-IB Systems with EOI asserted.

EOL isc [; {sequence[, delay] }|delay]

This statement replaces the default carriage-return line-feed that is sent for the L image specifier of the OUTPUT image reference with the specified sequence. The delay parameter specifies the milliseconds of delay before initiating another line of output. The EOL sequence can be specified by either a string variable or expression.

IOFLAG (isc)

This function returns a value of 1 when the specified interface is ready: a 0 indicates the interface is busy.

IOSTATUS (isc)

This function returns the state of the interface status line: a 1 indicates the peripheral is operational, a 0 indicates an error condition.

KBD$

This function returns the ASCII or non-ASCII value(s) of the key(s) pressed on the System 35 keyboard when the ON KBD function has been enabled.

LASTBIT

This function returns the state of the last bit shifted or rotated out of the word specified in the ROTATE or SHIFT binary functions.

LOCAL sc

This statement puts the specified HP-IB devices back into their local state. Local Lockout is not cancelled.

LOCAL isc

This statement puts all devices on the bus back into their local state and cancels an existing Local Lockout state.

LOCAL LOCKOUT isc

This statement sends the Local Lockout message, which prevents an operator from returning a device to local control from its front panel. The System 35 must be the active controller to execute the LOCAL LOCKOUT statement.

OCTAL

This function returns the octal representation of a decimal number ranging from -65535_{10} to $+65535_{10}$.

OFF INT #isc

This statement cancels the ON INT condition for the specified interface.

OFF KBD

This statement deactivates the character buffer and the peripheral keyboard mode. The live keyboard mode is re-activated.

ON INT #isc [, priority] CALL {label}

This statement enables end-of-line program branches for the specified interface. The priority parameter sets the priority level for the end-of-line branch, and the system priority level is set to the level of the end-of-line branch for the duration of the subprogram. Program transfer is to the subprogram specified by {label}.

ON INT #isc [, priority] GO SUB {line identifier}

This statement enables end-of-line program branches for the specified interface. The priority parameter sets the priority level for the end-of-line branch, and the system priority level is set to the level of the end-of-line branch for the duration of the subroutine. Program transfer is to the subroutine at the specified line identifier.

ON INT #isc [, priority] GO TO {line identifier}

This statement enables end-of-line program branches for the specified interface. The priority parameter sets the priority level for the end-of-line branch. System priority is not redefined, and program transfer is to the specified line identifier.

ON KBD [priority] GO TO {line identifier} [, ALL]

This statement activates the character buffer for entry of keypress data from the System 35 keyboard. The live keyboard mode is disabled.

[S]OUTPUT {dest} {transfer} ; data list

This statement transfers data in the list to the specified destination. Items in the data list are separated by commas or semicolons and include:

- Full precision variables
- Short precision variables
- String variables
- String arrays
- Numeric arrays
- Integers

If a variable-to-variable OUTPUT is specified, the optional keyword BYTE can be included in the statement as the transfer type. This results in each byte of data in the data list being transferred to a word (16 bits) of the destination variable.

OUTPUT image specifiers must be separated by a comma, @, or slash, and include the following:

{n}D Specifies {n} digit positions with a blank fill character.

{n}Z Specifies {n} digit positions with a fill character of zero.

{n}* Specifies {n} digit positions with a fill character of an asterisk.

{n}X Causes {n} blanks to be printed.

{n}A Specifies {n} single string character positions.

. Indicates placement of a decimal point radix indicator. There may be only one radix indicator per numeric specifier.

R Indicates placement of a comma radix indicator. There may be only one radix indicator per numeric specifier.

C Indicates placement of a comma in a numeric specification. It is a conditional character and is output only if there is a digit to its left.

P Indicates placement of a period in a numeric specification. It is a conditional character and is output only if there is a digit to its left.

S Indicates a sign position for a + or −. The sign floats to the left of the leftmost significant digit if S appears before all digit symbols.

M Indicates a sign position; + is replaced by a blank. The sign floats to the left of the leftmost significant digit if M appears before all digit symbols.

E Causes output of an E, sign and two digit exponent. This is used for output of numbers in scientific notation.

K Specifies an entire string or numeric field. A numeric is output in STANDARD format, except that no leading or trailing blanks are output. The current value of a string is output.

Y Causes two bytes to be packed into the next two available bytes in the output buffer. If the source of data is a real variable, it is converted to an integer value and placed into the output buffer. Values must be greater than −32768 and less than 32767.

W Causes two bytes to be placed in the next available word boundary of the output buffer. If the source of data is a real variable, it is converted to an integer value and placed into the output buffer. Values must be greater than −32768 and less than 32767.

B Causes one byte of data to be placed into the output buffer. Values must be greater than −128 and less than 255.

{n}L Outputs an EOL sequence and delay.

+ Suppresses line-feed, and must precede any other image specifiers.

- Suppresses carriage-return, and must precede any other image specifiers.

Suppresses carriage-return/line-feed, and must precede any other image specifiers.

@ Outputs a form-feed.

{n}/ Causes a carriage-return/line-feed sequence to be output.

{n} ( ) Image specifiers can be replicated {n} times by enclosing the item or group of items in parentheses.

" " Text is enclosed in quotes.

PASS CONTROL sc

This statement can be used if the System 35 is the active controller on the HP-IB to specify another inactive controller on the bus to assume controller functions. The System 35 then takes the role of a device.

PPOLL (isc)

This function returns a byte representing the 8 Status Bit messages of those devices on the bus capable of responding to a parallel poll. The byte is returned in the form of a decimal value.

PPOLL CONFIGURE sc; mask

This statement programs the logical sense and data bus line on which the specified devices are to respond for a parallel poll. The mask can be specified as a string or numeric value: the three least significant bits determine the data bus line for the response, and the fourth bit determines the logical state of the response.

PPOLL UNCONFIGURE sc

This statement disables the parallel poll response of selected devices. By specifying only the interface select code, the parallel poll response of all bus devices is disabled.

READBIN (sc)

This function returns one 16 bit word from the specified interface. If the interface is an 8 bit interface, the most significant 8 bits are reset to 0.

READ IO isc, reg; var

This statement inputs a 16 bit value from the register specified by the {reg} parameter on the selected interface. The value is returned in the numeric variable specified by {var}.

REMOTE sc

This statement has two conditional effects:

- If individual devices are not specified, the remote state for all devices on the bus is enabled.

- If individual devices are specified, those devices being addressed are put into the remote state.

When the System 35 is switched on or reset, bus devices are automatically enabled for the remote state. When a device is addressed to listen, it automatically switches to the remote state.

REQUEST isc; exp

This statement is used when the System 35 is not the active controller on the bus and requires service from the active controller. The numeric or string expression {exp} is sent in response to a serial poll from the active controller. If {exp} is a numeric expression, it must have a value between 0 and 127: as a string expression, it must consist of the characters 1 and Ø. Bit 6 of {exp} should be set to specify that the System 35 requested service.

RESET sc

This statement has four effects depending on the manner in which the select code is specified:

- If the select code of a non-HP-IB type interface is specified, the Reset bit (bit 5) of the interface control register (R5) is set true (logical 1).
- If the select code specifies an HP-IB interface with no device addresses, a Device Clear (DCL) message is sent.
- If the select code specifies an HP-IB interface and one or more HP-IB device addresses, the specified devices are sent a Selected Device Clear (SDC) message.
- If the negative select code of a 98034A interface is specified (i.e. RESET-7), those devices addressed to listen from a prior bus configuration are sent a Selected Device Clear (SDC) message.

ROTATE (exp 1, exp 2)

This function rotates the 16 bit binary value specified by {exp 1} as specified by {exp 2}:

- If {exp 2} is positive, the binary value of {exp 1} is rotated to the right by {exp 2} bit positions.
- If {exp 2} is negative, the binary value of {exp 1} is rotated to the left by {exp 2} bit positions.

The last bit shifted out of the word is saved in the save bit, which can be accessed by using the LASTBIT function.

SELECT CODE isc ACTIVE
SELECT CODE isc INACTIVE

These statements activate or deactivate I/O activities on the specified interface. I/O statements and functions are affected as follows:

Statement	Result
OUTPUT =	No Output
ENTER =	No Change
READBIN =	0
IOSTATUS =	1
IOFLAG =	1
STATUS =	0
PPOLL =	0

SENDBUS sc; commands [; data [; commands [; data]]]...

This statement provides complete HP-IB programming flexibility. The commands parameter can specify talker and listener addresses, multiline universal commands, and addressed and secondary commands. All commands are sent with the ATN line set true; no parity is generated. The data parameter can specify any desired device-dependent information; all items in the data parameter are sent with the ATN line set false.

Individual numeric items in the commands and data fields are separated by commas.

SENTER (See ENTER)

SET TIMEOUT isc; exp

This statement establishes a minimum time limit of {exp} milliseconds for the System 35 to wait for a peripheral to respond to an input or output operation. An end-of-line branch is requested when the timeout limit is exceeded.

SHIFT (exp 1, exp 2)

This function shifts the 16 bit binary value specified by {exp 1} by the number of bit positions specified by {exp 2}:

- If exp 2 is a positive value, {exp 1} is shifted to the right.
- If exp 2 is a negative value, {exp 1} is shifted to the left.

The last bit shifted out of the {exp 1} is put into the save bit. This bit can be accessed by using the LASTBIT function.

SOUTPUT (See OUTPUT)

STATUS sc; var 1 [, var 2 [, var 3 [, var 4]]]

This statement returns the interface or device status into the variables as follows:

- If the specified interface is not a 98034A, only 1 byte of status is returned. The status bit patterns are illustrated in this manual in the section covering the STATUS statement.

- If the specified interface is a 98034A, then up to 4 status bytes are returned:

  var 1 = fourth interface status byte

  (The following three variables are optional and need not be specified in the STATUS statement.)

  var 2 = first status byte of the 98034A interface.

  var 3 = second status byte of the 98034A interface.

  var 4 = third status byte of the 98034A interface.
- If an HP-IB device address is specified, the serial poll status byte of the device is returned in {var 1}.

SYSTEM TIMEOUT OFF

This statement disables the System 35 message:

DEVICE TIMEOUT ON SELECT CODE n

All select codes are affected.

SYSTEM TIMEOUT ON

This statement enables the System 35 message:

DEVICE TIMEOUT ON SELECT CODE n

All select codes are affected.

TIMEOUT (isc)

The timeout function returns a 1 or 0 value dependent on the cause of the end-of-line branch. A value of 1 indicates the cause of the end-of-line branch was a device timeout; a 0 value indicates the branch was not a result of a device timeout.

TRIGGER sc

This statement is used to initiate device-dependent action from either a selected device or all devices addressed to listen on the HP-IB.

- If only the select code of the interface is specified, all devices addressed to listen are triggered; the Group Execute Trigger (GET) message is sent on the bus.

- If one or more device addresses are specified, only those devices specified are triggered.

TRL (stop byte/word)

This function specifies the data list terminator for the enter list. Stop byte/word is a numeric expression reduced to a 16 bit value. Default is linefeed (decimal 10).

WAIT READ isc, reg; var ;

This statement inputs a 16 bit value from the register specified by the {reg} parameter on the selected interface. The value is returnd in the numeric variable specified by {var}.

WAIT READ will not execute until the I/O flag (**FLG**) returns a ready status (1).

WAIT WRITE isc, reg#; var

This statement outputs the 16 bit binary value specified by {var} to the specified register (4-7) of the interface. {reg #} = the specified interface register.

WAIT WRITE will not execute until the I/O flag (**FLG**) returns a ready status (1).

WRITE IO isc, reg #; var

This statement outputs the 16 bit binary value specified by {var} to the specified register(4-7) of the interface.

{reg #} = the specified interface register.

WRITE BIN

This statement outputs the 16-bit binary-equivalent of each expression in the output list. WRITEBIN will output only the 8 least significant bits to an 8-bit interface.

Functions

ABS numeric expression

Returns the absolute value of the numeric expression.

ACS numeric expression

Returns the principal value of the arccosine of the numeric expression in current angular units.

ASN numeric expression

Returns the principal value of the arcsine of the numeric expression in current angular units.

ATN numeric expression

Returns the principal value of the arctangent of the numeric expression expressed in the current angular unit mode.

CHR$ numeric expression

Converts a numeric value between − 32 768 and 32 767 into a string character. Any number out of the range 0 through 255 is converted MOD 256 to that range.

COL array variable

Returns the number of columns (rightmost subscript) in the working size of the specified numeric or string array.

COS numeric expression

Returns the cosine of the angle which is represented by the numeric expression.

DET [matrix variable]

Returns the determinant of the specified numeric matrix or of the last numeric matrix which was inverted if no matrix is specified.

DOT (vector name, vector name)

Returns the inner product of two vectors.

DROUND (numeric expression, number of significant digits)

Returns the numeric expression rounded to the specified number of significant digits.

ERRL

Returns the line number in which the most recent program execution error occurred.

ERRM$

Returns the most recent program execution error message.

ERRN

Returns the number of the most recent program execution error.

EXP numeric expression

Returns the value of Napierian e (= 2.71828182846 to twelve place accuracy) raised to the power of the computed expression.

FRACT numeric expression

Returns the fractional part of the evaluated expression defined by the formula: argument − INT (argument).

INT numeric expression

Returns the greatest integer which is less than or equal to the evaluated expression.

LEN string expression

Returns the current character length of the string expression.

LGT numeric expression

Returns the common logarithm (base 10) of a positive numeric expression.

LIN number of line feeds

Causes a carriage return and the specified number of line feeds to be output with PRINT. The range of the numeric expression specifying the number of line feeds is − 32 768 through 32 767; a negative number suppresses the carriage return.

LOG numeric expression

Returns the natural logarithm (base e) of a positive numeric expression.

LWC$ string expression

Returns a string with all uppercase letters converted to lowercase.

MAX (list of numeric expressions)

Returns the greatest value in the list. The numeric expressions must be separated by commas.

MIN (list of numeric expressions)

Returns the smallest value in the list. The numeric expressions must be separated by commas.

NUM string expression

Returns the decimal equivalent of the 8-bit binary value of the first character of the string expression.

PAGE

Causes a form feed to be output with PRINT. If directed to the CRT, the printout area is cleared.

PI

Returns the value of PI (π). It equals 3.1415926536 to eleven place accuracy.

POS (in string expression, of string expression)

Determines the position of a substring within a string and returns the character position of the first character of the second string within the first or 0 if it is not present.

PROUND (numeric expression, power-of-ten position)

Returns the numeric expression rounded to the specified power-of-ten position.

RES

Returns the result of the last numeric computation that was executed from the keyboard.

REV$ string expression

Returns a string whose value is the value of the specified string with the order of the elements reversed.

RND

Generates a pseudo random number greater than or equal to 0 and less than 1.

ROW array variable

Returns the number of rows (second subscript from right) in the working size of the specified numeric or string array.

RPT$ (string expression, number of repetitions)

Causes the specified string expression to be repeated the specified number of times. The range of repetitions is 0 through 32767.

SGN numeric expression

Returns a 1 if the expression is positive, 0 if it is zero and − 1 if it is negative.

SIN numeric expression

Returns the sine of the angle which is represented by the numeric expression.

SPA number of spaces

Is used with PRINT and DISP to output a specified number of blank spaces up to the end of the current line. The number of spaces is a positive numeric expression rounded to an integer.

SQR numeric expression

Returns the square root of a non-negative expression.

SUM array name

Returns the sum of all the elements in a numeric array.

TAB character position

Is used with PRINT and DISP and causes the next item to be output beginning in the specified character position. The character position is a non-negative numeric expression and is rounded to an integer. If the value exceeds the number of columns in the standard printer, it is reduced by the formula: character position MOD N, N being the number of columns specified as standard printer width. The item is output in the last column if the specified position is a multiple of the width and is reduced to 0 with the formula. If the specified position is already filled, a new line is generated and the item output in the specified character position.

TAN numeric expression

Returns the tangent of the angle which is represented by the numeric expression.

TRIM$ string expression

Deletes any leading or trailing blanks from the string expression.

TYP ([−]file number)

Returns a value which indicates what type of data will be accessed next in the specified file. A positive value allows the data pointer to advance until it is positioned on something other than an EOR mark.

Value	Meaning
0	Option ROM missing or file pointer lost.
1	Full precision number
2	Total string
3	End-of-file mark
4	End-of-record mark
5	Integer precision number
6	Short precision number
7	Unused
8	First part of a string
9	Middle part of a string
10	Last part of a string

UPC$ string expression

Returns a string with all lowercase letters converted to uppercase.

VAL string expression

Returns the numeric value, including any exponent, of a string of digits so that the value can be used in calculations.

VAL$ numeric expression

Returns a string representing the numeric expression in current output mode.

Commands

AUTO [beginning line number[, increment value]]

Numbers program lines automatically as lines are stored. If no parameters are specified, numbering begins with ten and is incremented by ten.

CONT [line identifier]

Resumes execution of a program at the specified line, or where it was paused, without altering program conditions and modes.

DEL first line identifier[, second line identifier]

Deletes a line or section of a program. If only one line identifier is specified, just that line is deleted. If two line identifiers are specified, the block of lines is deleted.

EDIT KEY key number

EDIT Kn

Specifies an SFK to be defined or redefined as a series of keystrokes for use as a typing aid.

EDIT [LINE] [line identifier[, increment value]]

Accesses the edit line mode which allows program lines to be changed, added or deleted. If no line identifier is specified, the first line in the program is accessed. The increment value is ten if not specified.

LIST [beginning line identifier[, ending line identifier]]
LIST # select code[, HP-IB device address] [; beginning line identifier[, ending line identifier]]

Outputs a listing of all or part of a program in memory from lowest numbered to highest numbered line. If one line identifier is specified, the listing begins with that line. If two line identifiers are specified, that block of lines is listed. The second syntax directs the listing to the specified device.

LIST KEY [key number] or Kn
LIST KEY # select code [, HP-IB device address] [; key number]

Lists the typing aid definitions of one or all SFKs.

LOAD ALL file specifier

Causes an implied SCRATCH A to be executed, loads a file stored previously with the STORE ALL statement and restores the entire memory to the state it was in when STORE ALL was executed. All files used must be reassigned, however.

READY # select code

Allows I/O to a device to resume after it was suspended because of an I/O error at that select code. The select code must be an integer.

REN [beginning line number[, increment value]]

Renumbers the program in memory. If no parameters are specified, numbering begins with 10 and is incremented by 10.

RUN [line identifier]

Begins execution of a program at either the specified line or the lowest numbered line in memory. The specified line must be in the main program.

SCRATCH

Erases program lines and DATA pointers from memory.

SCRATCH A

Erases the entire memory.

SCRATCH C

Erases the values of all variables including those in common.

SCRATCH KEY [key number]

Erases one or all SFK typing aid definitions including pre-defined definitions.

SCRATCH P

Erases program, binary routines, variables and the files table from memory.

SCRATCH V

Erases the values of all variables except those in common.

SCRATCH

Erases the typing aid definition of the SFK that is pressed.

Error Messages

Mainframe Errors

1 Missing ROM or configuration error

2 Memory overflow; subprogram larger than block of memory.

3 Line not found or not in current program segment

4 Improper return

5 Abnormal program termination; no END or STOP statement

6 Improper FOR/NEXT matching

7 Undefined function or subroutine

8 Improper parameter matching

9 Improper number of parameters

10 String value required

11 Numeric value required

12 Attempt to redeclare variable

13 Array dimensions not specified

14 Multiple OPTION BASE statements or OPTION BASE statement preceded by variable declarative statements

15 Invalid bounds on array dimension or string length in memory allocation statement

16 Dimensions are improper or inconsistent; more than 32 767 elements in an array

17 Subscript out of range

18 Substring out of range or string too long

19 Improper value

20 Integer precision overflow

21 Short precision overflow

22 Real precision overflow

23 Intermediate result overflow

24 TAN (N*3)2), when N is odd

25 Magnitude of argument of ASN or ACS is greater than 1

26 Zero to negative power

27 Negative base to non-integer power

28 LOG or LGT of negative number

29 LOG or LGT of zero

30 SQR of negative number

31 Division by zero; X MOD Y with Y = 0

32 String does not represent valid number or string response when numeric data required

33 Improper arguments for NUM, CHR$, or RPT$ function

34 Referenced line is not IMAGE statement

35	Improper format string
36	Out of DATA
37	EDIT string longer than 160 characters
38	I/O function not allowed
39	Function subprogram not allowed
40	Improper replace, delete or REN command
41	First line number greater than second
42	Attempt to replace or delete a busy line or subprogram
43	Matrix not square
44	Illegal operand in matrix transpose or matrix multiply
45	Nested keyboard entry statements
46	No binary in memory for STORE BIN or no program in memory for SAVE
47	Subprogram COM declaration is not consistent with main program
48	Recursion in single-line function
49	Line specified in ON declaration not found
50	File number less than 1 or greater than 10
51	File not currently assigned
52	Improper mass storage unit specifier
53	Improper file name
54	Duplicate file name
55	Directory overflow
56	File name is undefined
57	Mass Storage ROM is missing
58	Improper file type
59	Physical or logical end-of-file found
60	Physical or logical end-of-record found in random mode
61	Defined record size is too small for data item
62	File is protected or wrong protect code specified
63	The number of physical records is greater than 32 767
64	Medium overflow(out of user storage space)
65	Incorrect data type
66	Excessive rejected tracks during a mass storage initialization
67	Mass storage parameter less than or equal to 0
68	Invalid line numberation
69-79	See Mass Storage ROM errors
80	Cartridge out or door open
81	Mass storage device failure
82	Mass storage device not present
83	Write protected
84	Record not found

85	Mass storage medium is not initialized
86	Not a compatible tape cartridge
87	Record address error; information can't be read
88	Read data error
89	Check read error
90	Mass storage system error
91-99	See Mass Storage ROM errors
100	Item in print using list is string but image specifier is numeric
101	Item in print using list is numeric but image specifier is string
102	Numeric field specifier wider than printer width
103	Item in print using list has no corresponding image specifier
104-109	Unused
110-113	See-Plotter ROM errors
150-184	See I/O ROM errors

System Error octal number; octal number

This error indicates an error in the machine's firmware system; it is a fatal error. If reset does not bring control back, the machine must be turned off, then on again. If the problem persists, contact your Sales and Service Office.

I/O Device Errors

Two error messages can occur when attempting to direct an operation to an I/O device that is not ready for use. A printer which is out of paper or no device at a specified select code are examples. The first message that appears is —

I/O ERROR ON SELECT CODE select code

If the condition is not corrected, the machine beeps intermittently and the following message replaces the first —

I/O TIMEOUT ON SELECT CODE select code

The I/O device can be made usable by correcting the error (loading paper for example), then executing the READY# command —

READY# select code

This command readies the I/O device and the operation which was attempted is attempted again. The select code must be specified by an integer.

In some cases, such as an interface which is not connected, READY# for that select code may not solve the I/O error. In this case, STOP should be pressed to regain control of the computer. Be sure to turn the power off before inserting an interface. After the problem is remedied, the operation or program can be tried again.

Mass Storage ROM Errors

69	Format switch off
70	Not a disc interface
71	Disc interface power off
72	Incorrect controller address, or controller power off
73	Incorrect device type in mass storage unit specifier
74	Drive missing or power off
75	Disc system error
76	Incorrect unit code in mass storage unit specifier
77-79	Unused
91-99	Unused

Plotter ROM Errors

110	Plotter type specification not recognized
111	Plotter has not been specified
112	Unused
113	LIMIT specifications out of range.
114-119	Unused

I/O ROM Error Messages

150	Improper select code.
151	A negative select code was specified that does not match present bus addressing.
152	Parity error.
153	Either insufficient input data to satisfy enter list or attempt to ENTER from source into source.
154	Integer overflow, or ENTER count greater than 32 767 bytes or 16 383 words.
155	Invalid interface register number. (Can only specify 4-7)
156	Improper expression type in READIO, WRITEIO, or STATUS list.
157	No line-feed was found to satisy ENTER image specifier or no line-feed record delimiter was found in 512 characters of input.
158	Improper image specifier or image specifiers nested more than 4 levels deep.
159	Numeric data was not received for numeric enter list item.
160	Repetition of input character more than 32 768 times.
161	Attempted to create CONVERT table or EOL sequence for source or destination variable which is locally defined in a subprogram.

162 Attempted to delete a nonexistent CONVERT table or EOL sequence.

163 I/O error, such as interface card not present, device timeout, or interface or peripheral failure. (Interface FLAG line = 0).

164 Transfer type specified is incorrect type for interface card.

165 An FHS or DMA type NOFORMAT transfer specifies a count that exceeds the size of the variable, or an image specifier indicates more characters than will fit in the specified variable.

166 A NOFORMAT FHS or DMA type transfer does not start on an odd-numbered character position, such as A$[3]..

167 Interface status error or an EOI was received on an HP-IB interface before ENTER list or image specification was satisfied.

184 Argument out of range for DECIMAL or OCTAL conversion.

Notes

HEWLETT hp PACKARD

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