

9831A

BASIC Reference

Hewlett • Packard
Desktop Computer



BASIC Reference HP 9831A Desktop Computer



Hewlett-Packard Calculator Products Division
P.O. Box 301, Loveland, Colorado 80537, Tel. (303) 667-5000
(For World-wide Sales and Service Offices see back of manual.)

Copyright by Hewlett-Packard Company 1977



HP Computer Museum
www.hpmuseum.net

For research and education purposes only.

Table of Contents

Introduction	1
ROMs	4
Language Terms	4
Operators	4
BASIC Syntax Guidelines	6
Syntax Listing	8
Error Messages	29

Introduction

This book lists the BASIC language syntaxes and the error codes available with your HP 9831A Desktop Computer. All language syntaxes and error codes for the plug-in ROMs listed on page 4 are also included here.

Turn-on

Your desktop computer is ready to use when its power is switched on and the \uparrow appears in the display. No other start-up procedure is necessary.

Memory Size

The standard 9831A has 3,581 words of available read/write memory (2 bytes per word). The memory can be expanded in 4K word increments, to 16K (15,869) words. The current memory size is stated on a decal under the 9831A's top cover.

To determine the number of words used by a program, subtract the remaining memory from the total memory. The number of words remaining in memory is displayed when LIST 9999 is executed.

Computing Range

The computing range is $-9.99999999999 \times 10^{99}$ thru $9.99999999999 \times 10^{99}$, in 1×10^{-99} increments.

Data Precision

Four words of memory are allocated per data element for full-precision (12-digit) accuracy. All calculations are performed with full-precision accuracy. Split-precision or integer-precision accuracy can be used when it is necessary to conserve memory storage.

Precision	Words Per Data Element	Accuracy	Range	Indicator In DIM or COM Statement
Full	4	12 Digits	$\pm 9.99999999999E\pm 99$	(None)
Split	2	6 digits	$\pm 9.99999E\pm 63$	S
Integer	1	Integer	± 32767	I

Line Length

Even though only 32 characters can be displayed at any one time, up to 80 characters can be keyed in per line. After the 72nd character is keyed in, a beep informs you that only eight more characters can be keyed in.

Display Character Set

```

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
0123456789!@<=>?!"#$%&'()*,+,-./\^_`

```

These additional characters are available by using string functions –

```

^x~αβΓδσλμτφθδΑαÄöÜ@²£%[]+Σ†

```

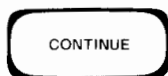
Error Codes

When an error occurs, the machine beeps and an error code appears on the display. The error codes are listed at the back of this book.

Control Keys



Clears the display.



Automatically continues a program from where it was stopped.



Executes the line in the display.



Runs the program, beginning at the lowest numbered line.



Stops the program at the completion of the currently executing line.



Stores an individual program line or special function key definition in memory.



When used with an alphanumeric key, the shifted form of the character or symbol is typed. The SHIFT key also releases shift lock.




Locks the keyboard in the shifted state so that multiple shifted characters or symbols can be typed. The small light above the key indicates that shift lock is in effect.

Line Editing Keys

- STEP** Steps through the program, executing one line at a time.
- DELETE** Deletes the program line in the display from the program in memory.
- RECALL** Recalls the previously-executed line back into the display.
- FETCH** This typing-aid is used with the FETCH Command.

Character Editing Keys

- BACK** Moves the editing cursor () backwards in the display.
- FWD** Moves the editing cursor forward in the display.
- DELETE** Deletes the character under the editing cursor.
- INSERT** Inserts a blank space at the editing cursor.

System Command Keys

- RESET** Returns the 9831A and I/O cards to the power-on state without erasing programs or variables.
- PRT ALL** Sets the print-all mode on or off. When “on”, all executed lines, stored lines, messages and commands which are normally displayed are also printed.
- REWIND** Automatically rewinds the tape cartridge to its beginning.
- INIT** Assigns space for all string and array variables in the current program in memory.
- ERASE** This typing aid is used with the ERASE Command.
- LOAD** This typing aid is used with the LOAD statement.
- STORE** This typing aid is used with the STORE statement.
- TRACE** This typing aid is used with the TRACE command.

ROMs

Plug-in ROMs (read-only memories) expand the language of the standard desktop computer. This book includes the language syntaxes available with these ROMs –

- 98218A Flexible Disk ROM (disk)
- 98223A/B Matrix/Plotter ROMs (mat/plot)

The description in parentheses on the right is used in this book to indicate the required ROM. There are two Matrix/Plotter ROMs. The 98223A Matrix/Plotter ROM is used with the 9862 Plotter whereas the 98223B Matrix/Plotter ROM is used with the 9872 Plotter. Where syntaxes are available only with the 98223B Matrix/Plotter ROM (9872 Plotter) the term (mat/plot – B only) is used.

Language Terms

The 9831A BASIC language consists of **operators**, **functions**, **statements** and **commands**. Operators are used with variables and numbers in creating mathematical **expressions**. Expressions and functions can be included in statements and executed from the keyboard. Each statement can also be preceded by a line number and stored as a program line. Some functions can also be executed separately from the keyboard. Commands can only be executed from the keyboard; they are not programmable.

The available operators are described next. The statements, functions, and commands are listed alphabetically later. In the listing, (O) indicates an operator, (F) indicates a functions, and (C) indicates a command. All other syntaxes are statements.

Operators

Arithmetic

- + Add
- Subtract
- * Multiply
- / Divide
- ↑ Exponentiate

Relational

- = Equal to (also used in the assignment statement)
- > Greater than
- < Less than
- >= Greater than or equal to
- <= Less than or equal to
- # or <> Not equal to (either form is acceptable)

Logical

expression AND expression

expression OR expression

NOT expression



Truth Table

A	B	A AND B	A OR B	NOT A
0	0	0	0	1
0	T	0	1	1
T	0	0	1	0
T	T	1	1	0

T = Any non-zero value or 1 = True

0 = False

Math Heirarchy

Functions

↑

NOT unary, +, -

*, /

+, -

Relational Operators (<, >, <=, >=)

AND

OR

Performed first



Performed last

The order of execution for operations of the same level is from left to right, except when parentheses are used; operations within parentheses are executed first.

BASIC Syntax Guidelines

These terms and conventions are used in the syntax listings –

brackets [] – items enclosed within brackets are optional.

dot matrix – these items must appear as shown.

... – dots indicate that the preceding item can be repeated.

array name – the letter used to define the array (A thru Z).

character – a letter, number or a symbol.

constant – a number within the 9831A's range.

drive number – an integer expression from 1 thru 3 indicating which disk drive should be used.

expression – a constant [like 16.4], a variable [like B or D(6)] or an expression [like $8 \cdot A^2$ or $A = 6$].

file – the tape file number; can be a constant, a variable, or an expression.

file name – the name used to define a disk file, containing up to six characters, with the following restrictions:

- no quotation marks (") within name
- no commas or colons
- no blanks (i.e., spaces)
- no leading asterisk (*)

Except with the FILES statement, the name can be either text (characters within quotes) or a string variable name (characters without quotes).

file number – the number assigned to a disk file by a FILES statement. It can be any integer (constant, variable or expression) from 1 thru 10.

1st line number – the first line number designated.

2nd line number – the second line number designated; it can appear only if the first line number is designated.

length – the file length; can be a constant, variable, or expression.

letter – an alphabetic character from A thru Z.

- line number** – an integer from 1 thru 9999.
- list** – the characters designated in a PRINT or READ statement. This parameter can consist of alphanumeric or string variables or text in quote fields.
- local variable** – a simple variable defined only in relation to a user-defined function.
- n** – an integer.
- number of files** – the number of files; can be a constant, variable, or expression.
- number of records** – the total number of records in a disk data file.
- record number** – the number that represents the location of a record in a specific disk file. This number can be any integer which does not exceed the number of records in the associated file.
- return variable** – the variable returned from the specified operation (e.g., location with SEARCH, status with ASSIGN).
- select code** – an integer expression from 2 thru 15. In addition, 1 can be specified with TAPE and 0 can be specified with ENTER and RBYTE. When controlling devices via the HP-IB, a two-digit device address can be added to the select code. See the Peripheral Control Manual for details.
- text** – characters within quotes.
- track** – the tape cartridge track to be used, either 0 or 1. If not specified, track 0 is automatically used.
- variable** – a simple variable [like B or B7], an array variable [like F(9)], or a string variable [like A\$].
- word pointer** – An integer expression from 1 thru 128 specifying the starting point (word) for logical PRINT and READ operations.

Syntax Listing

a

ABS expression

Returns the absolute value of the expression. (F)

expression AND expression

Compares two expressions. The result is true only if both expressions are true.
(O)

ASSIGN file name : file number : return variable [: drive number]

Assigns a file name to a position in the previous FILES statement. (disk)

Return Value	Meaning
0	File is available.
1	File type is not data.
2	Drive number not from 0 thru 3.
3	File has not been opened.
4	File number is not from 1 thru 10.

variable = expression

Assignment Statement, assigns a value to a variable.

ATN expression

Returns the arctangent of the expression. (F)

AUTO [line number [: spacing interval]]

Numbers line numbers consecutively from the line number specified, in intervals of the specified spacing interval. If the line number is not specified, the line number starts with 10. If the spacing interval is not specified, a spacing interval of 10 is assumed. (C)

AVAIL drive number

Returns the total number of records available (unused) on the specified file. (F)
(disk)

b**BEEP**

Sounds the 9831A's error signal.

BIAND (decimal value₁ : decimal value₂)

Combines the decimal values in a binary **AND** operation and returns the result.

(F)

c**CAT** [drive number [: printer select code]]

Prints information about all user files on the disk. (disk)

CERROR

Cancels any error recovery routine set by **SERROR**. (disk)

CFLAG flag number

Clears a flag, 0 thru 15, to the value 0 (false).

CHAIN file name [: 1st line number [: 2nd line number]]

Loads the program specified from the disk into memory and retains the values of all variables. Whenever the 1st line number is specified, the reproduced program lines are renumbered beginning with the specified 1st line number. If the 2nd line number is specified, program execution begins at that line number. (disk)

COM variable₁ [: variable₂ : ...]

Reserves memory for the specified variables and allows data to be transferred from one program to another. Must be both the first statement entered and the lowest numbered statement. I or S can be used with variables to specify integer or split precision (e.g., **COM AI, AS**).

CONT

Continues a program that was previously halted. If the program was halted by **STOP**, the program continues from the line number where it was halted; if not, it continues at the lowest line in memory. (C)

CONT [line number]

Continues execution of a program starting at the line number specified. (C)

COS expression

Returns the cosine of the expression. (F)

CPLLOT number of character spaces wide, number of character spaces high

Raises pen and moves it horizontally and vertically by the number of character spaces specified. (mat/plot)

d

DATA constant₁ [; constant₂ ; ...]

Specifies data for READ statement variables.

DBYTE expression ; string variable

Converts an expression to a string character and stores the character in the string or substring. (disk)

DCOPY file name [; drive number] TO file name [; drive number]

Duplicates contents of one data file into another. (disk)

DEF FNletter (local variable) = expression

DEF FNletter (local variable)

Defines a function in one line (first syntax) or in several lines (second syntax); in the latter case, a RETURN statement is needed.

DEG

Computes angles in degrees. If not specified, RAD is assumed.

DEL [1st line number [; 2nd line number]]

Erases the lines from memory between first specified line number and second specified line number. If a second line number is not specified, all program lines, following and including the first line, are deleted. If no line number parameter is specified, all lines in memory are erased. (C)

DET matrix name

Function to calculate the determinant of a square matrix. (mat/plot)

DEXP expression ; string variable

Converts the value of the specified expression into a 4-digit character string with leading zeros. (disk)

DGET file name [; 0]

Loads source (non-compiled) program into the memory and checks for syntax errors. Program automatically runs unless 0 parameter is used. (disk)

DIG X variable ; Y variable [; pen status variable]

The X, Y coordinates of the pen location are entered into the desktop computer; optional pen status (up = 0 or down = 1) can also be entered. (mat/plot B-only)

DIM variable name₁ [* variable name₂ * ...]

Reserves memory for the specified variables when the 9831A is initialized. I or S can follow variable to specify integer or split precision.

DISP [any combination of text and expressions]

Allows text and values to be output on the display.

DREN old file name **TO** new file name

Changes the name of any file. (disk)

e

END

Terminates program execution and resets the program line counter to the lowest numbered statement in memory.

ENTER (select code * or line number [* conversion table]) list [FOR parameter]

Allows data to be entered from an external device. Code conversion is optional.

ERASE

Erases all variables from memory and program lines from mainline memory. (C)

ERASE A

Erases all memory; it is the same as turning the 9831A OFF and then ON again. (C)

ERASE K

Erases all Special Function Keys. (C)

ERASE V

Erases the values of all variables. (C)

ERASE special function key

Erases the particular special function key that is pressed. (C)

EXP expression

Raises the constant, e (2.718...), to the power of the computed expression. (F)

f

FETCH[line number]

Brings the specified program line into the display. If no line number is specified, the lowest numbered line in memory is displayed. (C)

FETCH special function key

Brings the first line of the specified special function key to the display. (C)

FIL drive number

Returns the size (in records) of the largest unused space available on the specified disk. (F) (disk)

FILES file name₁ or * [#drive number₁] [; file name₂ or * [#drive number₂] ...]

Declares which files are to be used for successive disk operations. Quotes and string variables are not allowed for file names. (disk)

FIND [#track ;] file number

Locates a specific tape file.

FIXED n

Specifies numerical output form for PRINT and DISP statements; if Fixed or Float is not specified, STANDARD is assumed.

FLAG expression

Allows testing of flags 0 thru 15. A 0 indicates false and a 1 indicates true. (F)

FLOAT n

Specifies numerical output form for PRINT and DISP statements; if Fixed or Float is not specified, STANDARD is assumed.

FOR simple variable = initial expression TO final expression [STEP step expression]

Executes the program lines between FOR and the corresponding NEXT statement a designated number of times. Each time the loop is executed, the simple variable is incremented by 1, unless STEP is specified. When specified, STEP increments the simple variable by the value of the STEP expression.

FORMAT specification₁ [; specification₂ ; ...]

Gives output specifications to the WRITE, OUTPUT, ENTER and LABEL statements that referenced it; specifications can be: Fw .d (for fixed point format), Ew .d (for exponential format), X (for a character space), / (for a carriage-return linefeed), B (for binary). Any specification can be repeated (e.g., 6Fw .d). Specifications must be separated by commas.

`FRAC` expression

Returns the fractional part of the value of the expression. (F) (disk)

g

`GET` file name [: 1st line number [: 2nd line number]]

Loads a program or portions of a program from the disk to the memory. Whenever the 1st line number is specified, the reproduced program lines are renumbered beginning with the specified 1st line number. If the 2nd line number is specified, program execution begins at that line number. (disk)

`GET BIN` file name

Loads a binary program from the disk into the memory. (disk)

`GET KEY` file name

Loads all special function key definitions from the specified file to the special function keys. (disk)

`GET MEM` file name

Loads a memory file previously stored with `SAVE MEM`. (disk)

`GOSUB` line number

Begins executing the subroutine at the specified line number. Must have a corresponding `RETURN` statement.

`GOSUB` expression `OF` line number₁ [: line number₂ : ...]

Begins executing the subroutine at the first line number if the expression is rounded to 1, at the second line number if the expression is rounded to 2, up to 10 line numbers are allowed. Must have a corresponding `RETURN` statement.

`GOTO` line number

Transfers program execution to the specified line number.

`GOTO` expression `OF` line number₁ [: line number₂ : ...]

Transfers program execution to the first line number if the expression is rounded to 1, to the second line number if the expression is rounded to 2, up to 10 line numbers are allowed.

`GRAD`

Computes angles in grads. If `GRAD` or `DEG` is not specified, `RAD` is assumed.

i

IF expression **THEN** line number

Expression is logically evaluated; if it is evaluated as “true”, program execution is transferred to the specified line number.

IF END# file number **;** **THEN** line number

Sets up an exit procedure which branches the program to a specific line number when an end of file or end of record condition is encountered. (disk)

INOR (decimal value₁ **;** decimal value₂)

Combines the decimal values in an inclusive OR operation and returns the result. (F)

INPUT variable₁ [**;** variable₂ **;** ...]

Allows values to be assigned to the variables from the keyboard during program execution when ? appears on the display.

INT expression

Gives the expression an integer value less than or equal to the value of the expression. (F)

IPLOT X value **;** Y value [**;** pen control]

Moves pen in X-direction and in Y-direction by the amounts specified by the values of X value and Y value. Pen control parameters are the same as IPLOT. (mat/plot)

k

KILL file name

Erases the file from the disk and makes the file space available. (disk)

1

LABEL (# or line number [: character height : character height/width ratio : angle of rotation [: paper height/width ratio]]) [list]

Establishes size of plotter characters and direction of printout; prints contents of optional list, if included according to **FORMAT** statement (if referenced). (mat/plot)


LEN (string name)

Obtains the length of a string or substring. (F)

[LET] variable = expression

Assignment statement; assigns a value to a variable.

LETTER

Establishes typewriter mode for the plotter. Prints characters of each key pressed. Display keys move the pen without printing and the **EXECUTE** key gives a CR/LF.  terminates mode. (mat/plot)

LEX (string variable : "text " or string variable)

Compares the two strings, character by character, according to the ASCII value of their characters. If the first string is greater than the second, 1 is returned. If the strings are of equal value, 0 is returned. If the first string is less than the second, -1 is returned. (F) (disk)

LGT expression

Determines the logarithm of a positive expression to base 10. (F)

LIN expression

Output a number of linefeeds and/or carriage returns. (F)

LINE [pattern number [: pattern length%]]

Allows seven other line patterns for plotting, besides the normal solid line. (mat/plot B-only)

LINK [file]

LINK [# track :] file [: 1st line number [: 2nd line number]]

Works like **LOAD** but, additionally, retains variables currently in memory. Whenever the 1st line number is specified, the reproduced program lines are renumbered beginning with the specified 1st line number. If the 2nd line number is specified, program execution begins at that line number.

LIST [# select code] [: 1st line number [: 2nd line number]]

Prints all program lines between the two line numbers specified. If no line number parameters are specified, all program lines currently in memory are printed. (C)

LOAD [file]

LOAD [# track :] file [: 1st line number [: 2nd line number]]

Reproduces programs from tape into memory. Whenever the 1st line number is specified, the reproduced program lines are renumbered beginning with the specified 1st line number. If the 2nd line number is specified, program execution begins at that line number.

LOAD BIN [# track :] file

Reproduces binary programs from tape into memory.

LOAD DATA [# track :] file [: array or string variable]

Reproduces data from tape into the memory.

LOAD KEY [# track :] file

Reproduces, into the special function keys, information that was stored on tape via STORE KEY.

LOAD MEM [# track :] file

Reproduces a memory file from tape into the memory.

LOG expression

Returns the natural logarithm of a positive expression. (F)

m

MAP [X_{p1} # X_{p2} # Y_{p1} # Y_{p2}]

Scaling points P1 (lower left) and P2 (upper right) can be set from the computer. P1 and P2 must be specified in absolute units (which correspond to .025 millimeters). (mat/plot B-only)

MARK [# track #] number of files # length [#]

Establishes tape files with specified lengths. The optional comma suppress the auto-erase feature.

MAT CON expression # array list

Initializes each element of each specified array to the value of the expression. (disk)

MAT matrix name = **CON** [(expression [# expression])]

Generates a constant matrix, all elements equal to 1. A new working size can be specified. (mat/plot)

MAT matrix name = (expression) # matrix name

performs scalar multiplication on the specified matrix. (mat/plot)

MAT matrix name = **IDN**[expression # expression]

Generates the identity matrix, a square matrix containing zeros with the principal diagonal containing all ones. A new working size can be specified. (mat/plot)

MAT matrix name = **INV** (matrix name)

Generates the inverse of a square matrix. A matrix multiplied by its inverse produces the identity matrix. (mat/plot)

MAT matrix name = **TRN** (matrix name)

Transposes a matrix (causes the rows to become columns and columns to become rows). (mat/plot)

MAT matrix name = **ZER** [(expression [# expression])]

Generates the zero matrix (all elements equal to zero). A new working size can be defined. (mat/plot)

MAT matrix name = matrix name

Duplicates a matrix into another matrix. (mat/plot)

MAT matrix name = matrix name + or - matrix name

Performs addition or subtraction on the two specified matrices of the same dimension. (mat/plot)

MAT matrix name = matrix name * matrix name

Matrix multiplication. If $A(P,N) * B(N,Q)$, the resulting matrix has the dimensions (P,Q) . The same matrix name cannot appear on both sides of the equal sign.

MAT PRINT matrix name [: matrix name : ...]

Prints an entire matrix row by row. (mat/plot)

MAT PRINT # file number [: record number [: word pointer]] # matrix list

Prints an entire matrix onto a specified record or file. (disk)

MAT READ matrix name [(expression [: expression : ...])]

Causes an entire matrix to be read. A new working size can be specified. (mat/plot)

MAT READ# file number [: record number [: word pointer]] # matrix list

Reads a matrix from a specified record or file. (disk)

MAT ZERO array list

Sets all elements in the specified array(s) to 0. (disk)

MERGE [file]

MERGE [#track :] file [: 1st line number [: 2nd line number]]

Inserts, between program lines in memory, program lines that are on tape via STORE.

n

NEXT simple variable

Indicates the end of the corresponding FOR loop.

NORMAL

Cancels a previously executed TRACE command. (C)

NOT expression

Changes the logic value of an expression. (O)

NUM (string variable)

Returns the ASCII-decimal value of the first character of the specified string or substring. (F) (disk)

O

OF

See GOSUB and GOTO statements.

OFFSET X value : Y value

Defines specified X,Y point to be the new origin (0,0) of the coordinate system until another OFFSET or SCALE statement is executed. (mat/plot)

OPEN file name : number of records

Creates a data file with a specified number of physical records and assigns it a name. (disk)

expression OR expression

Compares two expressions. The result is true if one or both of the expressions is true. (O)

OUTPUT (select code or string name : * or line number [: conversion table]) list

Sends data or coded commands to an external device. Code conversion may be effected by the use of the optional conversion table parameter.

P

PEN

Raises pen off the plotter. (mat/plot)

PLOT X value : Y value [: pen control]

Moves the pen to specified X,Y point. (mat/plot)

Plotter pen control:

- no parameters – leaves pen down or lowers pen after movement.
- positive – pen control before movement.
- negative – pen control after movement.
- odd – raises pen.
- even – lowers pen.
- zero – pen status unchanged.

PI

Pi (π) is 3.14159265360. (F)

POS (string name ; string name or text)

Returns the position of a substring within a string. (F)

PRINT [any combination of text and expressions]

Output text and values on the standard printer; successive expressions must be separated either by commas (for maximum spacing between successive outputs) or by semicolons (for minimum spacing between successive outputs). If no parameters follow PRINT, the printer performs a carriage-return linefeed. Parameters can also include TAB, SPA and LIN functions.

PRINT# file number ; record number ; word pointer [; data list [; END]]

(Logical) Prints data on a disk file, beginning in the specified record and at the specified word. (disk)

PRINT # file number ; record number [; data list [; END]]

PRINT# file number ; record number [; END]

(Random) Prints data on a disk file from the beginning of a specified physical record. (disk)

PRINT# file number; data list [,END]

PRINT# file number ; END

(Serial) Prints data on a disk file, after the last item previously read or printed or at the beginning of the file. (disk)

PRINT LABEL; drive number ; "text " or string variable

Assigns an alphanumeric label, up to 224 characters long, to the disk in the specified drive. (disk)

PTA select code

PTAPE select code

Allows reading in program statements from a specified input device, ASCII character by ASCII character. (C)

**I****RAD**

Computes angles in radians. RAD set at turn-on.

RBYTE select code

Reads one byte of data from the device specified and returns the ASCII-decimal value. (F)

READ variable₁ [; variable₂ ; ...]

Reads, from the DATA statement (beginning at the current data pointer position), values for the specified variables. Use the RESTORE statement to reset the data pointer.

READ# file number ; record number ; word pointer [; data list]

(Logical) Reads numbers and strings into variables from a specified record, starting from a specified word. (disk)

READ# file number ; record number [; data list]

(Random) Reads data from a specified file, starting at a specified record. When the data list is omitted, this statement repositions the file pointer to the beginning of the specified record in the file. (disk)

READ# file number [; data list]

(Serial) Reads data from the specified disk file, starting after the last item printed or read. (disk)

READ LABEL ; drive number ; string variable

Reads the label on the disk and stores it in the specified string or substring. If the disk doesn't have an assigned label, the null string is returned. (disk)

REC file number

Returns the current position of the record pointer within the specified file. (F) (disk)

REDIM matrix name [expression [; expression]]

Specifies a new working size for a matrix. The working size must not be greater than the physical size specified in the DIM or COM statement. (mat/plot, disk)

REM[any combination of characters]

Inserts non-executable remarks in a program.

REN

Renumbers program lines from line number 10, in intervals of 10. (C)

`REN` line number [: spacing interval]

Renumbers program lines from the line number by the specified interval. If the spacing interval is not specified, a spacing interval of 10 is assumed. (C)

`RES`

The value which is displayed after pressing the execute key is stored in a location called result.

`RESAVE` file name [: 1st line number [: 2nd line number]]

Stores a new program, or the lines indicates by the line numbers, on the disk using a previous file name. The same line number rules apply as for the `SAVE` statement. (disk)

`RESTORE` [line number]

Resets data pointer (see `READ`, `Mat READ` and `DATA`) to the first constant in the lowest numbered `DATA` statement if the line number is not specified, or resets the data pointer to the first constant in the `DATA` statement with the specified line number.

`RETURN` [return value]

With no expression specified, `RETURN` is the subroutine exit, transferring program execution to the line following the `GOSUB` statement. If an expression is specified, `RETURN` is the multiple-line function exit, transferring the value of the function to the statement that called it. See `DEF FN`.

`REWIND`

Rewinds the tape.

`RND` expression

Returns a random number between 0 and 1; the expression is a dummy argument. If the expression is negative, it reseed the random sequence. (F)

`ROT` (decimal value : number of places)

Performs right rotation on the binary equivalent of the decimal value, the number of positions specified. (F)

`RUN` [line number]

Runs a program, starting at either the specified line number or the lowest numbered line in memory. (C)

S

SAVE file name [: 1st line number [: 2nd line number]]

Stores an entire program, or the lines between and including the specified line numbers, into the file named. (disk)

SAVE KEY file name

Stores all present special function key definitions in the named file. (disk)

SAVE MEM file name

Stores the entire read/write memory into the specified file.

SCALE Xmin : Xmax : Ymin : Ymax

Scales plotting area to user units and establishes the origin (0,0) of the coordinate system. (mat/plot)

SEARCH array name : C : column number : match expression : return variable

SEARCH array name : R : row number : match expression : return variable

Provides a fast way to locate a specific element in any row or column of a numeric array.

SEC [1st line number [: 2nd line number]]

Secures specified program lines from being listed. If no line number parameters are specified, all program lines in memory are secured. (C)

SEERR variable : line number

Provides automatic error recovery from most errors.

SFLAG flag number

Set any of flags, 0 thru 15, to the value 1 (true)

SGN expression

Returns a 1 if the expression is greater than zero; returns a 0 if the expression equals zero; returns a -1 if the expression is less than zero. (F)

SIN expression

Returns the sine of an expression. (F)

SIZE file number

Returns the size, in records, of a specified file. (F) (disk)

SLANT [angle from vertical]

Characters are printed at any angle from vertical. Angle can be any value except: odd multiple of 90 degrees, odd multiples of $\pi/2$ radians or odd multiples of 100 grads. No parameter results in vertical characters. (mat/plot B-only)

SLEN file number

Checks for strings in the specified disk file. If the next item is a string variable, its length, in characters, is returned. -1 is returned if the next item is not a string. (F) (disk)

SORT array name : C : column number [: secondary column numbers]**SORT** array name : R : row number [: secondary row numbers]

Numeric arrays are sorted quickly, by row or by column, in ascending order. Using the TRANSFER statement, strings can be sorted.

SPA number of spaces

Advances the printer carriage the specified number of spaces. (F)

SPEN [pen number]

One of four pens can be selected. Pen number can be 0 thru 4. (mat/plot B-only)

SQR expression

Returns the square root of any non-negative expression. (F)

STANDARD

Specifies the numerical output form for PRINT and DISP statements.

STAT select code

Returns a decimal code indicating status of the specified interface card or peripheral device. (F)

STD

Returns the currently specified standard printer select code. (F) (disk)

STDPLT [select code]

Specifies the select code of the standard plotter; all subsequent plotting operations take place at the specified select code. If no select code is specified, the default select code for the 9862 is 5 and the 9872 is 705. (mat/plot)

STDPRT select code

Specifies the select code of the standard printer, for PRINT, LIST, TRACE, PRINT-ALL, CAT, MAT PRINT, etc.

STEP

See FOR statement.

STOP [1st line number [: 2nd line number]]

Terminates program execution but, unlike END, it retains the current position of the program line counter. (C)

STORE [# track #] file [# 1st line number [# 2nd line number]]

Reproduces, onto tape, the program that is in memory.

STORE DATA [# track #] file [# array or string variable]

Reproduces, onto tape, data that is in memory.

STORE KEY [# track #] file

Reproduces, onto tape, information that is on the special function keys.

STORE MEM [# track #] file

Reproduces the entire read/write memory onto tape.

STRING numeric # string name # number of decimal places

Places numbers in a formatted string to output money values in any currency format.

t

TAB character position

Outputs an incremental number of spaces to the printer. (F)

TAN expression

Returns the tangent of the expression. (F)

TAPE select code

Specifies the tape drive for successive tape operations. 1 is the internal drive and is specified at turn-on.

TLIST [#track]

Prints information about each tape file.

File Type	Meaning	Data Type	Meaning
0	An unused file.	0	A full-precision array.
1	A binary file.	1	A split-precision array.
2	A data file.	2	An integer-precision array.
3	A program file.	3	Variables stored via the COM Statement.
4	A key file.	4	String variables.

TRACE [1st line number [: 2nd line number]]

Establishes an operating mode in which line numbers of a program are printed in the order in which they are accessed. By specifying the numbers, lines between the first and second line numbers are printed as they are accessed. (C)

TRANSFER integer array name (subscripts) TO string name

TRANSFER string name TO integer array name (subscripts)

Allows strings to be converted to numeric data and vice versa, simplifying multiple string storage.

TYP file number

TYP (-file number)

Identifies the type of the next item in a specified file. When the file number is positive, TYP (number) advances the word pointer, when negative the word pointer is not advanced. (F) (disk)

Type Code	Meaning
0	Item not printed via a 9831A.
1	Next item is a full-precision number.
2	Next item is a string variable contained in one record.
2.1	First part of a multirecord string.
2.2	Intermediate part of a multirecord string.
2.3	Last part of a multirecord string.
3	Next item is an EOF or the physical end of file.
4	Next item is an EOR or the physical end of record.
5	Next item is a split-precision number.
6	Next item is an integer-precision number.

U

UCASE string variable

Converts the string to uppercase. (disk)

UNIT drive number [: select code]

Specifies the disk drive number (0 thru 3) and optionally, the drive select code (8 thru 15), to be used by subsequent disk operations. (disk)

UPOS (string variable : "text " or string variable)

Returns the position of the first character of the substring within the first string. The strings are temporarily converted to uppercase before being compared. (F) (disk)

V

VAL (string name)

Returns the numeric value of the first sequence of numeric characters within the string. (F)

VEL [centimeters/second [: pen number]]

Pen velocity can be from 1 cm/sec to 36 cm/sec using the numbers 1 thru 36. If pen number is omitted, the specified velocity applies to all pens. (mat/plot B-only)

VERIFY[ON]

VERIFY OFF

Switches data verification routine on or off, for both tape and disk read operations.

W

WAIT number of milliseconds

Causes the program to halt the specified number of milliseconds; the delay can vary from 0 thru 32767 milliseconds.

WBYTE expression

Outputs the 16-bit binary equivalent of the expression, used in WRITE, PRINT or OUTPUT statements. (F)

WCTL select code : expression

Outputs a binary number for controlling various functions on the specified interface card. (disk)

WINDOW [Xmin : Xmax : Ymin : Ymax]

Restricts programmed pen motion to a specific rectangular area on the platen.
(mat/plot B-only)

WRD file number

Returns the current position of the word pointer for the specified file. (F) (disk)

WRITE (select code : * or line number) [any combination of text and expressions]

With the * specification, WRITE is like the PRINT statement except that any printer can be specified by the select code. With the line number specification, the parameters are output according to the specifications in the corresponding FORMAT statement.

x

XAXIS Y-offset [: + or - tic [: start point : end point]]

Draws a horizontal line from Xmin to Xmax, crossing Y axis at the point defined by Y-offset. Tic specifies spacing between tic marks; first tic at start of axis. If start point and end point parameters are specified, the horizontal line is drawn between those points, rather than Xmin and Xmax. (mat/plot)

XREF





Each variable and the line numbers in which the variable appears are printed on the standard printer. (C) (mat/plot)

y

YAXIS X-offset [: + or - tic [: start point : end point]]

Draws a vertical line from Ymin to Ymax; crossing X axis at the point defined by X-offset. Tic specifies spacing between tic marks; first tic at start of axis. If start point and end point parameters are specified, the vertical line is drawn between those points, rather than Ymin and Ymax. (mat/plot)

Error Messages

ERROR	Meaning
1	Plug-in ROM missing – attempt to run a program without having the ROM installed.
2	Insufficient memory – the 9831A needs more memory than is available.
3	Statement cannot be executed from the keyboard.
4	Missing line number, or integer missing or out of range – caused by pressing  instead of  , or by using a variable where an integer constant must be used.
5	Statement or command not recognized – caused by pressing  instead of  , or vice versa.
6	Improper arithmetic expression. Also, missing number or expression.
7	Extra characters or parameters not allowed.
8	Missing punctuation in program statement.
9	Invalid command unless in special function key mode.
10	Special function key is undefined.
11	Exponent is out of range.
12	Two decimal points in number.
13	Sign given without number.
14	Missing comma.
15	Missing left parenthesis.
16	Missing right parenthesis.
17	Missing subscript.
18	String operation not permitted.
19	No opening quote or missing string variable.
20	No closing quote.

- 21 Missing or improper function name.
- 22 Missing function parameter.
- 23 Missing or incorrect DATA item.
- 24 Improper IF statement.
- 25 Missing OF in computed GOTO statement.
- 26 Missing variable.
- 27 Missing or improper FOR variable.
- 28 Missing TO in FOR statement.
- 29 Missing STEP, or illegal characters following FOR statement.
- 30 Missing assignment (=) operator.
- 31 Missing or improper assignment.
- 32 Improper FORMAT specification.
- 33 COM statement rules not followed.
- 34 Improper COM declaration.
- 35 Array or string variable is doubly dimensioned.
- 36 Precision of variable is doubly defined.
- 37 Inconsistent dimensions are given.
- 38 Array has unknown dimensions.
- 39 Dimensions are either ≤ 0 or too large.
- 40 Variable of function is undefined – often caused by using a variable which does not have a value.
- 41 Array or string has not been initialized – check for COM or DIM statement.
- 42 Array or string subscript exceeds bounds.
- 43 Select code out of range of 2 thru 15. The range is extended to 1 thru 15 for TAPE and 0 thru 15 for ENTER and RBYTE.
- 44 Line not found – often caused by incorrect branching statement.

- 45 Improper statement type referenced.
- 46 Improper statement nesting in multiline function.
- 47 Improper RETURN.
- 48 FOR statement has no matching NEXT. Also incorrect FOR nesting.
- 49 Out of DATA.
- 50 Last statement is not END.
- 51 LOG or LGT of negative number.
- 52 SQR of negative number.
- 53 Zero raised to zero power.
- 54 Non-integer power of negative number.

Tape Cartridge Errors –

- 55 Syntax error in tape cartridge statement.
- 56 Wrong file or file not found.
- 57 Improper operation on secured (SEC) program.
- 58 Tape cartridge status error: no cartridge in transport; tape is write protected (RECORD slide); external tape drive is switched off.
- 59 Tape verification error – tape head is dirty or tape is damaged. Also, tape position is unknown (execute REWIND or FIND to re-establish position). ERROR 59 also indicates a data verification error during PRINT# and MAT PRINT# (flexible disk) operations.
- 60 Incorrect file size. Also caused by an attempt to STORE DATA without an allocated memory area (COM).
- 61 Wrong precision or data type.
- 62 Wrong file type.
- 63 Cartridge LOAD or MERGE operation would overlay new program over old one – operation not performed.

String Variable Errors –

- 64 Incomplete IF statement.
- 65 Incorrect LEN, POS, or VAL syntax.
- 66 Current string length exceeded.
- 67 Operation is on a non-continuous string. Substring requested is beyond the logical boundary for the string and is undefined.
- 68 Maximum string length exceeded. Additional string length must be specified in the DIM statement.
- 69 Illegal DATA encountered during READ statement execution. Character data found; numeric data expected.

I/O Errors –

- 72 End of data reached or data contains more than ten blanks in a row.
- 73 Invalid FORMAT specification.
- 74 Numeric input has syntax error: multiple decimal points; more than one E; other non-numeric input.
- 75 Conversion table or code not found. Check for integer initialization in DIM or COM statement.
- 76 Select code does not match interface card. For example, select code without HP-IB address code addressed to HP-IB Interface, or vice versa. Also, I/O operation not allowed with select code 1 (internal tape cartridge).
- 77 Interface card not connected.

Flexible Disk Drive Errors –

78	I/O interrupt. For example, an interface card is plugged in while power is on.
79	All disk drives not switched on.
80	Disk drive door open.
81	Disk not installed or specified drive number not set.
82	Write-protected disk.
83	Disk drive record header error.
84	Disk track not found.
85	Disk data checksum error.
86	Disk drive hardware failure. Press RESET to regain system control.
87	Read-data error: try to reprint the data.

Flexible Disk ROM Errors –

88	Miscellaneous Disk ROM syntax error. For example, storing an incorrect IF END# statement.
89	Incorrect disk drive number or select code. Also, incorrect record pointer or word pointer.
90	Incorrect disk file name or file not found.
91	Available disk file space exceeded. Directory or availability table is full.
92	File name already exists on drive.
93	EOF (end of file) mark reached or physical end of file encountered.
94	Disk file format error. For example, a multirecord string not intact.

Recoverable Errors -

100	Numeric overflow (assumes + or - ∞).
101	Numeric underflow (assumes 0).
102	LOG or LGT of zero (assumes - ∞).
103	Division by zero (assumes + or - ∞).
104	Zero to negative power (assumes + ∞).
105	Integer variable overflow (assumes + or -32767).
106	Split variable overflow (assumes + or -9.99999E+63).
107	Split variable underflow (assumes 0).

NOTE

The machine approximates + and - infinity (∞) by 9.9999999999E+99 and -9.9999999999E+99, respectively.

Matrix Errors -

366	Matrix must be square for the attempted operation.
368	Matrix has no inverse. The data contained in the matrix does not have a solution.
369	Incompatible dimensions. Dimensions of added, subtracted, multiplied, copied, or transposed matrices must agree.

Plotter Errors –

- 370 Attempt to execute a 9872A Plotter operation on the 9862A Plotter.

Invalid plotter select code. 9862A requires a select code between 2 and 15. The 9872A Plotter uses a 3 or 4 digit select code with the format ccdd, where cc is a number from 1 thru 15 designating the interface select code and dd is a number from 00 thru 30 designating the device number on the HP-IB.
- 371 Instruction not recognized. The plotter has received an illegal character sequence. (9872A only.)
- 372 Wrong number of parameters. Too many or too few parameters have been sent with an instruction. (9872A only.)
- 373 Bad parameter. The parameters sent to the plotter with an instruction are out of range for that instruction. (9872A only.)
- 374 Illegal character. The character specified as a parameter is not in the allowable set for that instruction. (9872A only.)
- 375 Unknown character set. A character set out of the range 0 thru 4 has been designated as either the standard or alternate character set. (9872A only.)
- 376 Position overflow. An attempt to draw a character or perform a cplot that is located outside the plotters numeric limits. (9872A only.)
- 377 Transmission error. The computer has received an illegal ASCII input from the plotter. (9872A only.)
- 378 Attempt to scale on 9872A when P1 (lower left) is not less than P2 (upper right). (9872A only.)
- 379 Stop key pressed during plot execution. (9872A only.)
- 380 Attempt to execute an AXIS, OFFSET, PLOT, or IPLOT statement before executing a SCALE statement.

381

9862A only.

Character height specification in a LABEL statement is greater than 18.4% of the height of the plotting area.

Aspect ratio in a LABEL statement specifies a character width greater than 18.4% of the height of the plotting area.

The X or Y parameter in a CPLOT statement requires a pen movement greater than 18.4% of the height of the plotting area.

382

Attempt to execute an AXIS statement with the specified start point outside of the plotting area.

Attempt to execute an AXIS statement with the tic mark spacing too small (i.e., space between tics is less than 1/9999 of the maximum width or height of the plotting area). (9862A only.)

- 371 Instruction not recognized. The plotter has received an illegal character sequence. (9872A only.)
- 372 Wrong number of parameters. Too many or too few parameters have been sent with an instruction. (9872A only.)
- 373 Bad parameter. The parameters sent to the plotter with an instruction are out of range for that instruction. (9872A only.)
- 374 Illegal character. The character specified as a parameter is not in the allowable set for that instruction. (9872A only.)
- 375 Unknown character set. A character set out of the range 0 thru 4 has been designated as either the standard or alternate character set. (9872A only.)
- 376 Position overflow. An attempt to draw a character or perform a cplot that is located outside the plotters numeric limits. (9872A only.)
- 377 Transmission error. The computer has received an illegal ASCII input from the plotter. (9872A only.)
- 378 Attempt to scale on 9872A when P1 (lower left) is not less than P2 (upper right). (9872A only.)
- 379 Stop key pressed during plot execution. (9872A only.)
- 380 Attempt to execute an AXIS, OFFSET, PLOT, or IPLOT statement before executing a SCALE statement.
- 381 9862A only.
Character height specification in a LABEL statement is greater than 18.4% of the height of the plotting area.
Aspect ratio in a LABEL statement specifies a character width greater than 18.4% of the height of the plotting area.
The X or Y parameter in a CPLOT statement requires a pen movement greater than 18.4% of the height of the plotting area.
- 382 Attempt to execute an AXIS statement with the specified start point outside of the plotting area.
Attempt to execute an AXIS statement with the tic mark spacing too small (i.e., space between tics is less than 1/9999 of the maximum width or height of the plotting area). (9862A only.)



9831A Error Messages

63 Cartridge LOAD or MERGE operation would overlay new program over old one - operation not performed.

String Variable Errors -

64 Incomplete IF statement.

65 Incorrect LEN, POS, or VAL syntax.

66 Current string length exceeded.

67 Operation is on a non-continuous string. Substring requested is beyond the logical boundary for the string and is undefined.

68 Maximum string length exceeded. Additional string length must be specified in the DIM statement.

69 Illegal DATA encountered during READ statement execution. Character data found; numeric data expected.

I/O Errors -

72 End of data reached or data contains more than ten blanks in a row.

73 Invalid FORMAT specification.

74 Numeric input has syntax error: multiple decimal points; more than one E; other non-numeric input.

75 Conversion table or code not found. Check for integer initialization in DIM or COM statement.

76 Select code does not match interface card. For example, select code without HP-IB address code addressed to HP-IB Interface, or vice versa. Also, I/O operation not allowed with select code 1 (internal tape cartridge).

77 Interface card either not connected or not set to correct select code.

Flexible Disk Drive Errors -

78 I/O interrupt. For example, an interface card is plugged in while power is on.

79 All disk drives not switched on.

80 Disk drive door open.

81 Disk not installed or specified drive number not set.

82 Write-protected disk.

83 Disk drive record header error.

84 Disk track not found.

85 Disk data checksum error.

86 Disk drive hardware failure. Press **RESET** to regain system control.

87 Read-data error: try to reprint the data.

- 33 COM statement rules not followed.
- 34 Improper COM declaration.
- 35 Array or string variable is doubly dimensioned.
- 36 Precision of variable is doubly defined.
- 37 Inconsistent dimensions are given.
- 38 Array has unknown dimensions.
- 39 Dimensions are either ≤ 0 or too large.
- 40 Variable of function is undefined - often caused by using a variable which does not have a value.
- 41 Array or string has not been initialized - check for COM or DIM statement.
- 42 Array or string subscript exceeds bounds.
- 43 Select code out of range of 2 thru 15. The range is extended to 1 thru 15 for TAPE and 0 thru 15 for ENTER and RBYTE.
- 44 Line not found - often caused by incorrect branching statement.
- 45 Improper statement type referenced.
- 46 Improper statement nesting in multiline function.
- 47 Improper RETURN.
- 48 FOR statement has no matching NEXT. Also incorrect FOR nesting.
- 49 Out of DATA.
- 50 Last statement is not END.
- 51 LOG or LGT of negative number.
- 52 SQR of negative number.
- 53 Zero raised to zero power.
- 54 Non-integer power of negative number.

Tape Cartridge Errors -

- 55 Syntax error in tape cartridge statement.
- 56 Wrong file or file not found.
- 57 Improper operation on secured (SEC) program.
- 58 Tape cartridge status error: no cartridge in transport; tape is write protected (RECORD slide); external tape drive is switched off.
- 59 Tape verification error - tape head is dirty or tape is damaged. Also, tape position is unknown (execute REWIND or FIND to re-establish position). ERROR 59 also indicates a data verification error during PRINT# and MAT PRINT# (flexible disk) operations.
- 60 Incorrect file size. Also caused by an attempt to STORE DATA without an allocated memory area (COM).
- 61 Wrong precision or data type.
- 62 Wrong file type.

ERROR	Meaning
1	Plug-in ROM missing - attempt to run a program without having the ROM installed.
2	Insufficient memory - the 9831A needs more memory than is available.
3	Statement cannot be executed from the keyboard.
4	Missing line number, or integer missing or out of range - caused by pressing STORE instead of ENTER , or by using a variable where an integer constant must be used.
5	Statement or command not recognized - caused by pressing STORE instead of ENTER , or vice versa.
6	Improper arithmetic expression. Also, missing number or expression.
7	Extra characters or parameters not allowed.
8	Missing punctuation in program statement.
9	Invalid command unless in special function key mode.
10	Special function key is undefined.
11	Exponent is out of range.
12	Two decimal points in number.
13	Sign given without number.
14	Missing comma.
15	Missing left parenthesis.
16	Missing right parenthesis.
17	Missing subscript.
18	String operation not permitted.
19	No opening quote or missing string variable.
20	No closing quote.
21	Missing or improper function name.
22	Missing function parameter.
23	Missing or incorrect DATA item.
24	Improper IF statement.
25	Missing OF in computed GOTO statement.
26	Missing variable.
27	Missing or improper FOR variable.
28	Missing TO in FOR statement.
29	Missing STEP, or illegal characters following FOR statement.
30	Missing assignment (=) operator.
31	Missing or improper assignment.
32	Improper FORMAT specification.

HEWLETT  PACKARD