

ATO LIBRARY

**HP BASIC
Language Reference
Volume 1: A-N**



**HP Part No. 98616-90201
Printed in USA**

Notice

The information contained in this document is subject to change without notice.

Hewlett-Packard Company (HP) shall not be liable for any errors contained in this document. HP MAKES NO WARRANTIES OF ANY KIND WITH REGARD TO THIS DOCUMENT, WHETHER EXPRESS OR IMPLIED. HP SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. HP shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory, in connection with the furnishing of this document or the use of the information in this document.

Warranty Information

A copy of the specific warranty terms applicable to your Hewlett-Packard product and replacement parts can be obtained from your local Sales and Service Office.

Restricted Rights Legend

Use, duplication or disclosure by the U.S. Government is subject to restrictions as set forth in subparagraph (c)(1)(ii) of the Rights in Technical Data and Computer Software clause of DFARS 252.227-7013.

Hewlett-Packard Company
3000 Hanover Street
Palo Alto, CA 94304 U.S.A.

Rights for non-DOD U.S. Government Departments and Agencies are as set forth in FAR 52.227-19(c)(1,2).

Use of this manual and magnetic media supplied for this product are restricted. Additional copies of the software can be made for security and backup purposes

HP Computer Museum
www.hpmuseum.net

For research and education purposes only.

only. Resale of the software in its present form or with alterations is expressly prohibited.

Copyright © Hewlett-Packard Company 1987, 1988, 1990, 1991, 1994

This document contains information which is protected by copyright. All rights are reserved. Reproduction, adaptation, or translation without prior written permission is prohibited, except as allowed under the copyright laws.

Copyright © AT&T Technologies, Inc. 1980, 1984, 1986

Copyright © The Regents of the University of California 1979, 1980, 1983, 1985-86

This software and documentation is based in part on the Fourth Berkeley Software Distribution under license from the Regents of the University of California.

MS-DOS ® is a U.S. Registered trademark of Microsoft Corporation.

Printing History

First Edition - January 1994

Product Compatibility

This manual supports:

- HP BASIC/WS (Version 6.2)
- HP BASIC/UX 300/400 (Version 6.3)
- HP BASIC/UX 700 (Version 7.0)
- HP BASIC/DOS (Version 6.2)

Contents

This manual consists of two parts. Part I, the “Keyword Dictionary,” is divided between the two volumes. Part II, “Reference Information,” provides additional information in the back of Volume 2.

Volume 1

Part I — Keyword Dictionary

A through N

Volume 2

Part I — Keyword Dictionary (continued)

O through Z

Part II — Reference Information

1. Keyword Summary
2. Interface Registers
3. Error Messages
4. Useful Tables
- G. Glossary

Part I - Keyword Dictionary

This reference presents all HP BASIC keywords alphabetically, giving a detailed syntax description for each. Refer to part II, "Reference Information," in volume 2 of this manual for a summary of the keywords by category.

BASIC Versions Supported

This reference documents the keywords supported by various implementations of HP BASIC. Different versions exist to support different hardware and operating systems. The keyword entries are coded with a two or three letter abbreviation indicating which implementations support a particular keyword. This coding is useful when you want to create an HP BASIC program on a convenient development system and execute it on a different target system.

HP BASIC Support Codes

Support Code	Meaning
WS	Supported by HP BASIC Workstation version 6.2 and above
UX	Supported by HP BASIC/UX 300/400 version 6.3 and above, and HP BASIC/UX 700 version 7.0 and above
DOS	Supported by HP BASIC/DOS version 6.2 and above for the Measurement Coprocessor
IN	Supported by HP Instrument BASIC version 2.1 and above

Unless stated otherwise, the two or three letter support code refers to the particular software version in the preceding table. For example, BASIC/WS refers to the HP BASIC Workstation version 6.2. If the word "BASIC" appears without a support code, it refers to all versions of BASIC.

If a support code is followed by an asterisk (e.g., DOS*), it indicates that some special conditions or restrictions may apply. The syntax diagram, examples, or discussion explain these special conditions.

Also, please note that Series 700 computers do not support SRM interface cards; thus, BASIC/UX 700 does not support the SRM driver. Access to SRM/UX files is still available directly on an SRM/UX server or via LAN (NFS) for remote servers. However, BASIC/UX 700 is not able to participate in the SRM/UX locking mechanism.

I-2 Keyword Dictionary

Two-Byte Languages and Characters

Some versions of BASIC support the two-byte characters used by certain non-Roman languages, such as Japanese. Two-byte characters are typically used by Asian languages to describe their large, complex alphabets.

Some keyword entries explain details specific to two-byte languages. You do not need understand these details unless you plan to write programs for a local language, such as Japanese.

Legal Usage Table

At the beginning of the entry for each keyword is a small table like this:

Supported On	UX WS DOS*
Option Required	PDEV
Keyboard Executable	Yes
Programmable	No
In an IF..THEN..	No

Supported On indicates which versions of BASIC support a particular keyword.

- UX means that all versions of BASIC/UX support the keyword. Additional notice is given for keywords not supported on BASIC/UX 300/400 or BASIC/UX 700.
- WS means that BASIC/WS supports the keyword.
- DOS* means that BASIC/DOS supports the keyword, but some special conditions apply. These special conditions are explained in the keyword description or examples.

Option Required indicates what binary or binaries must be resident in the computer in order to use the basic capabilities of the keyword. The syntax diagram or description indicates what other binaries may be required to use the extended features of a keyword.

BASIC/UX/IN automatically loads all applicable binaries. You must manually configure BASIC/WS/DOS to include the binaries required by keywords in your programs. Refer to LOAD BIN for details.

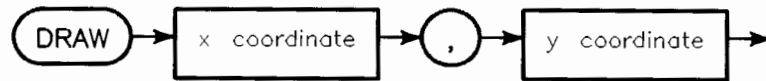
Keyboard Executable means that a properly constructed statement containing that keyword can be typed into the keyboard input line and executed by pressing **EXECUTE**, **ENTER**, or **Return**.

Legal Usage Table

Programmable	means that a properly constructed statement containing that keyword can be placed after a line number and stored in a program.
In an IF ... THEN ...	means that a properly constructed statement containing that keyword can be placed after "THEN" in a <i>single-line</i> IF ... THEN statement. Keywords that are prohibited in a single-line IF ... THEN are not necessarily prohibited in a multiple-line IF ... THEN structure.

Syntax Diagrams Explained

Syntax is represented pictorially using **syntax diagrams**.



All characters enclosed by a rounded envelope must be entered exactly as shown. An example of this is the keyword **DRAW**. Single characters shown in circular envelopes must also be entered exactly as shown.

You must substitute appropriate values for the named **parameters** enclosed by rectangular envelopes. An example of a named parameter is *x coordinate*. A description of each parameter and the range of allowed values is given either in the table following the drawing, another drawing, or the Glossary.

Statement elements are connected by lines. Each line can be followed in only one direction, as indicated by the arrow at the end of the line. Any combination of statement elements that can be generated by following the lines in the proper direction is syntactically correct. An element is optional if there is a path around it. Optional items usually have default values. The table or text following the drawing specifies the default value that is used when an optional item is not included in a statement.

Comments may be added to any valid line. A comment is created by placing an exclamation point after a statement, or after a line number or line label.

```
100 PRINT "Hello" ! This is a comment.  
110 ! This is also a comment.
```

The text following the exclamation point may contain any characters in any order.

The drawings do not necessarily deal with the proper use of spaces (ASCII blanks). In general, whenever you are traversing a line, any number of spaces may be entered. If two envelopes are touching, it indicates that no spaces are allowed between the two items. However, this convention is not always possible in drawings with optional paths, so it is important to understand the following rules for spacing.

I-6 Keyword Dictionary

Keywords and Spaces

The computer uses spaces, as well as required punctuation, to distinguish the boundaries between various keywords, names, and other items. In general, at least one space is required between a keyword and a name if they are not separated by other punctuation. Spaces cannot be placed in the middle of keywords or other reserved groupings of symbols. Also, keywords are recognized whether they are typed in uppercase or lowercase. Therefore, to use the letters of a keyword as a name, the name entered must contain some mixture of uppercase and lowercase letters.

Space Between Keywords and Names

The keyword `NEXT` and the variable `Count` are properly entered with a space between them, as in `NEXT Count`. Without the space, the entire group of characters is interpreted as the name `Nextcount`.

No Spaces in Keywords or Reserved Groupings

The keyword `DELSUB` cannot be entered as `DEL SUB`. The array specifier `(*)` cannot be entered as `(*)`. A function call to `"A$"` must be entered as `FNA$`, not as `FN A $`. The I/O path name `"@Meter"` must be entered as `@Meter`, not as `@ Meter`. The "exceptions" are keywords that contain spaces, such as `END IF` and `OPTION BASE`.

Using Keyword Letters for a Name

Attempting to store the line `IF X=1 THEN END` will generate an error because `END` is a keyword not allowed in an `IF ... THEN`. To create a line label called "End", type `IF X=1 THEN ENd`. This or any other mixture of uppercase and lowercase will prevent the name from being recognized as a keyword.

Also note that names may begin with the letters of an infix operator (such as `MOD`, `DIV`, and `EXOR`). In such cases, you should type the name with a case switch in the infix operator portion of the name (e.g., `MOdULE`, `DiViSOR`).

Keyboards

Throughout the manuals which document HP BASIC, specific keys are mentioned. Because many key labels are different on each keyboard, your exact key labels may not be used in an example. For example, **ENTER** and **Return** normally have the same meaning, but only one of them appears on a given keyboard. The keyboard chapter of *Using HP BASIC/WS 6.2* or *Using HP BASIC/UX* discusses keyboards in more detail.

ABORT - AXES



ABORT

Supported On	UX WS DOS IN
Option Required	IO
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

ABORT terminates I/O activity on the specified HP-IB interface.

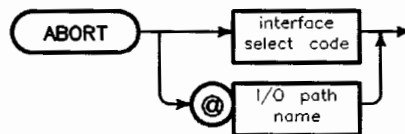
Example Statements

```
ABORT 7
```

```
ABORT Isc
```

```
IF Stop_code THEN ABORT @Source
```

Syntax



Item	Description	Range
interface select code	numeric expression, rounded to an integer	5, 7 through 31
I/O path name	name assigned to an HP-IB interface	—

Semantics

Do not use this statement to specify other types of interfaces. Error 150 results if you specify a select code for any other type of interface.

If the computer is the system controller but not currently the active controller, executing ABORT causes the computer to assume active control.

Note that ABORT *interface_select* is allowed, but ABORT *primary_address* is not. For example:

```
ABORT 7      allowed
ABORT 721   not allowed
```

The details of interface select codes and primary addresses are introduced in the "Data Flow" chapter of the *HP BASIC Programming Guide*.

Summary of Bus Actions

	System Controller	Not System Controller
Active Controller	IFC (duration ≥100 μsec) REN ATN	ATN MTA UNL ATN
Not Active Controller	IFC (duration ≥100 μsec) ¹ REN ATN	No Action

¹ The IFC message allows a non-active controller (which is the system controller) to become active.

ABORTIO

Supported On	UX WS DOS
Option Required	TRANS
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

ABORTIO terminates a **TRANSFER** which is taking place through an **I/O path** assigned to a device, group of devices, mass storage file, or pipe in HP BASIC/UX.

Example Statements

```
ABORTIO @Isc
IF Stop_flag THEN ABORTIO @Device
```

Syntax



Item	Description	Range
I/O path name	name assigned to a device, a group of devices, mass storage file, or pipe	any valid name

Semantics

This statement terminates a **TRANSFER** (in either direction) currently taking place through the specified I/O path name. The specified I/O path *must* correspond to one of the following:

- an interface select code
- a device selector
- a mass storage file
- a pipe (HP BASIC/UX)

A-4 ABORT - AXES

ABORTIO

If ABORTIO is used for I/O paths assigned to buffers, error 170 is reported.

An end-of-transfer (EOT) branch is initiated if an ON EOT branch is currently defined for the I/O path name; however, no currently defined EOR branch is initiated.

ABORTIO has no effect if no TRANSFER is taking place through the I/O path name.

If a TRANSFER to or from an I/O path name was terminated by an error, executing ABORTIO on that I/O path name causes the error to be reported.

ABS

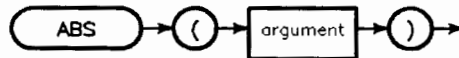
Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

ABS returns the absolute value of its argument.

Example Statements

```
Magnitude=ABS(Vector)
PRINT "Value =";ABS(X1)
```

Syntax



Item	Description/Default	Range Restrictions
argument	numeric expression	within valid ranges of INTEGER and REAL data types for INTEGER and REAL arguments. See "Range Restriction Specifics" for COMPLEX arguments

Semantics

To compute the absolute value of a COMPLEX value, the COMPLEX binary must be loaded.

Range Restriction Specifics

The formula for computing ABS for COMPLEX arguments is:

$$\text{SQRT}(\text{Real_part} * \text{Real_part} + \text{Imag_part} * \text{Imag_part})$$

where `Real_part` is the real part of the COMPLEX argument and `Imag_part` is the imaginary part of the COMPLEX argument in the ABS function. Some values of a COMPLEX argument may cause errors in this computation. For example:

```
ABS(CMPLX(MAXREAL,MAXREAL))
```

will cause error 22 (error 21 in HP BASIC/UX 700) due to the computation `Real_part*Real_part`.

The result returned when executing the ABS function for COMPLEX numbers is always a positive REAL value.

Taking the ABS of the INTEGER -32768 will cause an error.

ACS

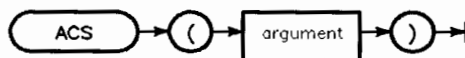
Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

ACS returns the arccosine of its argument.

Example Statements

```
Angle=ACS(Cosine)
PRINT "Angle = ";ACS(CMPLX(2.67,-6))
```

Syntax



Item	Description/Default	Range Restrictions
argument	numeric expression	-1 through +1 for INTEGER and REAL arguments. See "Range Restriction Specifics" below for COMPLEX arguments and underflow conditions.

Semantics

If the argument of ACS is REAL or INTEGER, the value returned is REAL. If the argument is COMPLEX, the value returned is COMPLEX. To compute the ACS of a COMPLEX value, the COMPLEX binary must be loaded.

The angle mode (set by RAD or DEG) determines whether the value returned is in degrees or radians. If the current angle mode is DEG, the range of the result is 0 to 180 degrees. If the current angle mode is RAD, the range of the

A-8 ABORT - AXES

result is 0 to π radians. The angle mode is radians unless you specify degrees with the DEG statement.

Range Restriction Specifics

The formula used for computing the ACS of a COMPLEX value is:

$$-i * \text{LOG}(\text{Argument} + \text{SQRT}(\text{Argument} * \text{Argument} - 1))$$

where i is the COMPLEX value `CMPLX(0,1)` and `Argument` is a COMPLEX argument to the ACS function. Some values of a COMPLEX argument may cause errors in this computation. For example,

`ACS(CMPLX(MAXREAL,0))`

will cause error 22 (error 21 in HP BASIC/UX 700) due to the `Argument*Argument` computation. Also, the COMPLEX argument

`ACS(CMPLX(MINREAL,0))`

will cause error 21 in HP BASIC on Series 700 due to underflow if the underflow mode is set to Error. The principle value, which has a real part between 0 and π radians, is returned for COMPLEX arguments.

The following range restrictions apply in HP BASIC/UX 700 when underflow mode (`CONTROL 32,7;mode`) is set to Error or Ignore.

Range	Underflow Mode Error	Underflow Mode Ignore
Positive Maximum	+1.00000000000000E+000	+1.00000000000000E+000
Negative Minimum	-1.00000000000000E+000	-1.00000000000000E+000
Positive Minimum	+5.11091385101442E-103	+4.94065645841247E-324 ¹
Negative Maximum	-5.11091385101442E-103	-4.94065645841247E-324 ²

1 An underflow in Ignore mode results in a denormalized number that is less than the value for +MINREAL.

2 An underflow in Ignore mode results in a denormalized number that is greater than the value for -MINREAL.

ACSH

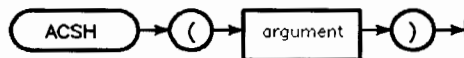
Supported On	UX WS DOS
Option Required	COMPLEX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

ACSH returns the hyperbolic arccosine of its argument.

Example Statements

```
Result=ACSH(5.7089)
PRINT "Hyperbolic Arccosine = ";ACSH(Expression)
```

Syntax



Item	Description/Default	Range Restrictions
argument	numeric expression	INTEGER and REAL arguments must be ≥ 1 and $< 1.340\ 780\ 792\ 99\ E\ 154$; see "Range Restriction Specifics" for COMPLEX arguments and underflow conditions.

Semantics

If an INTEGER or REAL argument is given, this function returns a REAL value. If a COMPLEX argument is given, this function returns a COMPLEX value.

Range Restriction Specifics

The formula for computing ACSH is as follows:

$$\text{LOG}(\text{Argument} + \text{SQRT}(\text{Argument} * \text{Argument} - 1))$$

where **Argument** is the argument to the ACSH function. Some values of an argument may cause errors in this computation. For example,

$$\text{ACSH}(\text{MAXREAL})$$

will cause error 22 (error 21 in HP BASIC/UX 700) due to the computation **Argument*Argument**.

Note that the hyperbolic arccosine of a COMPLEX number returns a principle value which has an imaginary part which falls in the range of 0 to positive π .

The following range restrictions apply in HP BASIC/UX 700 when underflow mode (CONTROL 32,7;mode) is set to Error or Ignore.

Range	Underflow Mode Error	Underflow Mode Ignore
Positive Maximum	+1.34078079299426E+154	+1.34078079299426E+154
Positive Minimum	+1.00000000000000E+000	+1.00000000000000E+000

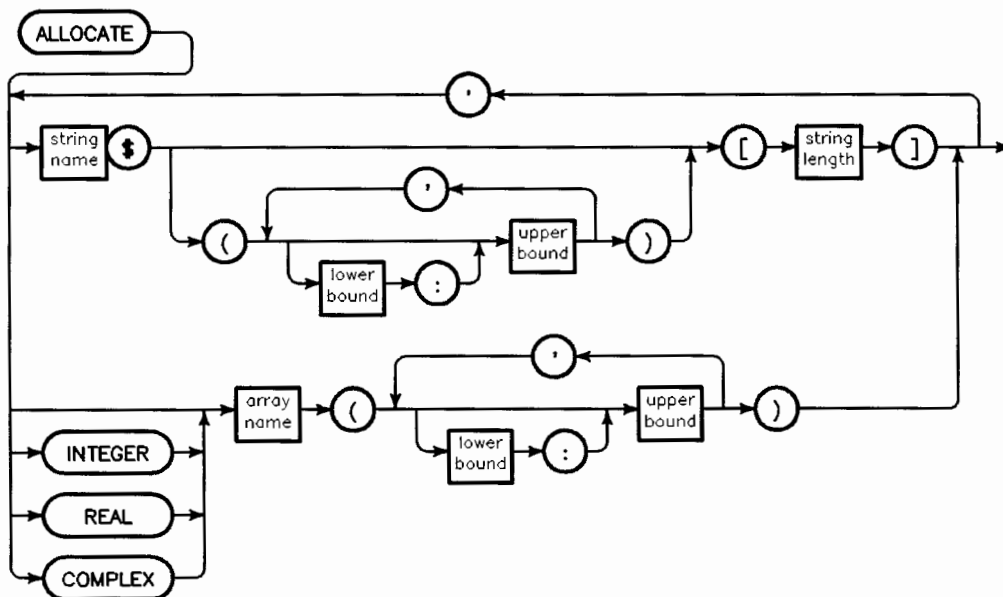
ALLOCATE

Supported On	UX WS DOS
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

ALLOCATE dynamically allocates memory for arrays and string variables during program execution.

Example Statements

```
ALLOCATE Temp(Low:High)
ALLOCATE INTEGER Array(Index,2,8)
ALLOCATE R$[LEN(A$)+1]
ALLOCATE Text$(Lines)[80]
```



ALLOCATE

Item	Description	Range
array name	name of a numeric array	any valid name
lower bound	numeric expression, rounded to an integer; Default = OPTION BASE value (0 or 1)	-32 768 through +32 767 (see "array" in Glossary)
upper bound	numeric expression, rounded to an integer	-32 768 through +32 767 (see "array" in Glossary)
string name	name of a string variable	any valid name
string length	numeric expression, rounded to an integer	1 through 32 767

Semantics

Memory reserved by the **ALLOCATE** statement can be freed by the **DEALLOCATE** statement. However, because of the stack discipline used when allocating, the freed memory space does not become available unless all subsequently allocated items are also deallocated. For example, assume that **A\$** is allocated first, then **B\$**, and finally **C\$**. If a **DEALLOCATE A\$** statement is executed, the memory space for **A\$** is not available until **B\$** and **C\$** are deallocated. This same stack is used for setting up **ON-event** branches, so subsequent **ON-event** statements can also block the availability of deallocated memory.

The total number of elements that can be allocated for variables within any one context or **COM** area (i.e., any "value area") is limited to 16 777 215 bytes.

The variables in an **ALLOCATE** statement cannot appear in the same context in declaration statements such as **COM**, **DIM**, or **INTEGER**. If variable(s) are to be allocated in a subprogram, the variable(s) cannot have been included in the subprogram's formal parameter list. Implicitly declared variables cannot be allocated. Numeric variables for which a type is not specified are assumed to be **REAL**. A variable can be re-allocated in its program context only if it has been deallocated and its type and number of dimensions remain the same.

ALLOCATE allows you to dynamically allocate memory for arrays. However, the array dimensions are determined statically. Thus you can change the size of

ALLOCATE

the dimensions, but you cannot change the number of dimensions of an array within a program context.

Exiting a subprogram automatically deallocates any memory space allocated within that program context.

ALLOCATE can be executed from the keyboard while a program is running or paused. However, the variable must have been declared in an ALLOCATE statement in the current program context.

ALPHA HEIGHT

Supported On	UX WS DOS
Option Required	CRTX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

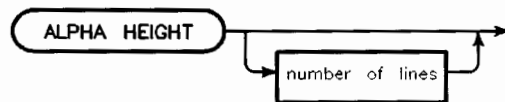
ALPHA HEIGHT sets the number of lines of text visible in the CRT's alpha area.

Example Statements

```
ALPHA HEIGHT Num_of_lines
ALPHA HEIGHT 18
IF Total_lines = 10 THEN ALPHA HEIGHT 18
ALPHA HEIGHT
```



Syntax



Item	Description/Default	Range Restrictions
number of lines	numeric expression	(see Semantics)

Semantics

ALPHA HEIGHT is used to restrict the alpha screen to the bottom n lines of the display, leaving the upper part of the display for graphics. This can be used to prevent alpha from interfering with graphics.

The number of lines available for alpha on the CRT depends on which display is being used. The following are the upper limits for the ALPHA HEIGHT

ALPHA HEIGHT

statement: 22, 25, 26, 30, 42, 48, 51, and 56. The lower limit is 9 in all cases (can be others in a windowing environment).

ALPHA HEIGHT without any parameters restores the default height (one of the upper limits mentioned above). The minimum argument to this statement is always 9; however, when you are in Edit mode the minimum alpha height is 14. Note that upon entering the Edit mode if the ALPHA HEIGHT is a value in the range of 9 to 13 it will be changed to 14 (in HP BASIC/UX, it will not be changed).

Note that the functionality of this statement can be achieved through CRT CONTROL register 13; however, you *cannot* execute the CONTROL statement without a parameter in order to get the default alpha height.

ALPHA ON/OFF

Supported On	UX* WS DOS*
Option Required	GRAPH
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

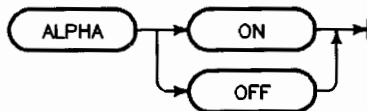
ALPHA turns the alphanumeric raster (but not graphics) on or off.

Example Statements

```
ALPHA ON
```

```
IF Graph THEN ALPHA OFF
```

Syntax



Semantics

Items sent to the PRINT area while the alpha display is off are placed in the display memory even though they are not visible. Items sent to the keyboard input line, the DISP line, or the system message line will turn ALPHA ON. The alphanumeric and graphic rasters can both be on at the same time.

The alphanumeric area is enabled after power-on, RESET, and SCRATCH A. Pressing the **ALPHA** key on the keyboard also enables the alphanumeric raster.

ALPHA ON/OFF

Bit-Mapped Alpha Displays

This statement has no effect on a bit-mapped alpha display when the alpha write-enable mask specifies all planes. This is the default state on those displays.

If ALPHA MASK $\langle \rangle 2^n - 1$, then planes enabled for alpha can be turned on and off. See SET ALPHA MASK in this reference for more information.

HP BASIC/UX Specifics

ALPHA ON and ALPHA OFF have no effect in a windowing environment or on single bit-plane terminals. It functions the same, however, on a bit-mapped console.

HP BASIC/DOS Specifics

ALPHA ON and ALPHA OFF functions only in SEPARATE ALPHA mode, which is supported only for VGA and EGA displays.

ALPHA PEN

Supported On	UX WS DOS
Option Required	CRTX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

ALPHA PEN sets the color or gray scale of text in the alphanumeric display.

Example Statements

```
ALPHA PEN Pen_value
```

```
ALPHA PEN 142
```

```
IF Cyan THEN ALPHA PEN 140
```

Syntax



Item	Description/Default	Range Restrictions
pen value	numeric expression	(see Semantics)

Semantics

The set of alpha colors for the Model 236C is given in the following table:

ALPHA PEN

Value	Result
< 16	The number is evaluated MOD 8 and resulting values produce the following: 0—black 1—white 2—red 3—yellow 4—green 5—cyan 6—blue 7—magenta
16 to 135	Ignored
136	White
137	Red
138	Yellow
139	Green
140	Cyan
141	Blue
142	Magenta
143	Black
144 to 255	Ignored

This statement has no effect on single plane monochrome displays. On gray scale (multi-plane monochrome) displays this statement changes the display color to a different shade of gray.

For bit-mapped alpha displays, ALPHA PEN specifies the pen to be used for subsequent alpha output. The range of values allowed with this statement are 0 through 255; these values are treated as MOD 2^n , where n is the number of display planes.

ALPHA PEN n or CONTROL CRT,5; n set the values of the CRT registers 15, 16, and 17 (or PRINT PEN, KEY LABELS PEN and KBD LINE PEN, respectively), but the converse is not true. That is, STATUS CRT,5 may not

A-20 ABORT - AXES

ALPHA PEN

accurately reflect the CRT state if control registers 15, 16, and/or 17 have been set.

Note that the functionality of this statement can be achieved through CRT CONTROL register 5.

AND

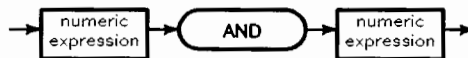
Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

AND returns a 1 or a 0 based on the logical AND of its two arguments.

Example Statements

```
IF Flag AND Test2 THEN Process
Final=Initial AND Valid
```

Syntax



Semantics

A non-zero value (positive or negative) is treated as a logical 1; only zero is treated as a logical 0.

A	B	A AND B
0	0	0
0	1	0
1	0	0
1	1	1

APPEND

See ASSIGN, DUMP DEVICE IS, PLOTTER IS, PRINTALL IS, and
PRINTER IS.

AREA

Supported On	UX WS DOS
Option Required	GRAPHX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

AREA defines or selects an area fill color. The fill color is used in all subsequent graphics operations requiring area fill.

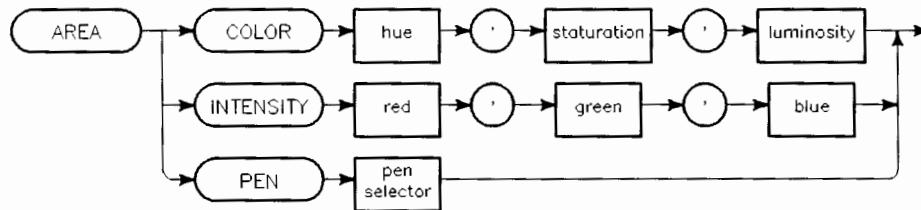
Example Statements

```

AREA COLOR Hue,Saturation,Luminosity
AREA INTENSITY Red(I),Green(I),Blue(I)
AREA PEN 3

```

Syntax



AREA

Item	Description	Range
hue	numeric expression	0 through 1
saturation	numeric expression	0 through 1
luminosity	numeric expression	0 through 1
red	numeric expression	0 through 1
green	numeric expression	0 through 1
blue	numeric expression	0 through 1
pen selector	numeric expression, rounded to an integer	-32 768 through +32 767

Semantics

The default fill color is the color specified by pen 1. This color is solid white after power-up, SCRATCH A, GINIT. It is also set to white after LOAD BIN "GRAPH" when this binary is not already resident in memory.

A fill color remains in effect until the execution of an AREA, GINIT, or SCRATCH A. Other statements which may alter the current fill color (if the data passed to them is an array) are:

- SYMBOL
- PLOT
- RPLOT
- IPLOT

SET PEN affects pen colors, and therefore can also affect fill colors specified with AREA statements.

Specifying color with the SET PEN and AREA PEN statements (resulting in non-dithered color) results in a much more accurate representation of the desired color than the same color requested with an AREA COLOR or AREA INTENSITY statement.

AREA

AREA PEN

A fill color specified with AREA PEN is guaranteed to be non-dithered, and the AREA PEN statement executes faster than AREA COLOR or AREA INTENSITY.

The pen numbers have the same effect as described in the PEN statement for line color except that in the alternate pen mode, negative pens erase as in the normal pen mode; they do not complement. Pen 0 in normal pen mode erases; it does not complement.

AREA COLOR

When AREA COLOR executes on a computer with a color display, the HSL parameters are converted to RGB values. Then, if the color requested is not available in the color map, the computer creates the closest possible color in RGB color space to the one requested by filling the 4 by 4 dither cell with the best combination of colors from the color map.

In non-color map mode, there are eight colors total, and they cannot be redefined. This simulates the operation of the HP 98627A.

In color map mode, there are 2^n total colors (where n is the number of planes in the graphics display), and they can be redefined with SET PEN.

The example program COLORS, on the MANUAL EXAMPLES disk, shows the effects of the AREA command. It shows the changes brought about by varying one of HSL parameters at a time. The bottom bar shows that when saturation (the amount of color) is zero, hue makes no difference, and varying luminosity results in a gray scale.

COLORS also displays a color wheel representing the colors selected as the hue value goes from 0 through 1. Any value between zero and one, inclusive, can be chosen to select color. The resolution (the amount the value can change before the color on the screen changes) depends on what the value of the hue is as well as the values of the other two parameters.

It then shows the effect that varying saturation and luminosity have on the color produced. Each of the small color wheels is a miniature version of the large one above, except it has fewer segments.

AREA INTENSITY

The example program `COLORS`, on the `MANUAL EXAMPLES` disk, demonstrates the effect of varying the intensity of one color component when the other two remain constant.

It also shows combinations of red, green and blue. The values are given in fifteenths: 0 fifteenths, 5 fifteenths, 10 fifteenths, and 15 fifteenths—every fifth value. The values for each color component are represented in that color.

The HP98627A

When an HP98627A is used, the HSL values specified in an `AREA COLOR` statement are converted to RGB. The parameters of an `AREA INTENSITY` statement are already in RGB. The RGB values specify the fraction of dots per 4-by-4 pixel area to be turned on in each memory plane. The red value corresponds to memory plane 1, the green value to memory plane 2, and the blue value to memory plane 3.

The `AREA PEN` selects one of the eight non-dithered colors available with no intensity control on the color guns. See the `PEN` entry for the order of these colors.

The HP 98627A dithers in a very similar way to the Model 236 with color monitor when the color map is not enabled (see `PLOTTER IS`), using only eight colors when calculating the closest combination.

Monochromatic Displays

When doing shading on a monochromatic display, dithering is always used. Dithering takes place in a 4-by-4 cell, which allows zero through sixteen of the dots to be turned on, for a total of seventeen shades of gray.

Since `AREA PEN` does not use dithering, only black and white are available. If the pen selector is positive, the resulting fill color is white; if zero or negative, the resulting fill color is black.

When an `AREA COLOR` is executed, the hue and saturation parameters are ignored. Only the luminosity value is used to determine the fraction of pixels to be turned on.

AREA

When an AREA INTENSITY is executed, the largest of the three values is used, and it specifies the fraction of pixels to be turned on.

Gray Scale Displays

Gray scale displays provide various intensities of gray by actually adjusting the luminosity of each pixel. Refer to PEN and PLOTTER IS for gray scale tables. For additional information, refer to the chapter "Color and Gray Scale Graphics" in the *BASIC Advanced Programming Techniques* manual.

Alternate Pen Mode Fills

If the alternate drawing mode is in effect when the fill is performed, the area will be filled with non-dominant color. See GESCAPE operation selectors 4 and 5.

In the alternate pen mode, negative pens erase as in the normal pen mode; they do not complement.

HP BASIC/DOS Specifics

For a VGA color display, the fill color selections are the same as for a Series 300 display. For an EGA display, the fill color selections are limited.

ARG

Supported On	UX WS DOS
Option Required	COMPLEX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

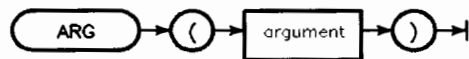
ARG returns the argument (the angle in polar coordinates) of a COMPLEX number.

Example Statements

```
X=ARG(Complex_expr)
```

```
Result=ARG(CMPLX(2.1,-8))
```

Syntax



Item	Description/Default	Range Restrictions
argument	numeric expression	Any valid INTEGER, REAL, or COMPLEX value. See "Semantics" for underflow conditions.

Semantics

This is equivalent to `ATN2(CMPLX(Imag_part,Real_part))` in FORTRAN. The value returned is REAL. If the current angle mode is DEG, the range of the result is -180° through $+180^\circ$. If the current angle mode is RAD, the range of the result is $-\pi$ through $+\pi$ radians. The default mode is radians.

This function returns 0 when given an INTEGER or REAL argument.

ARG

The following range restrictions apply in HP BASIC/UX 700 when underflow mode (CONTROL 32,7;mode) is set to Error or Ignore.

Range	Underflow Mode Error	Underflow Mode Ignore
Positive Maximum	+1.79769313486232E+308	+1.79769313486232E+308
Negative Minimum	-1.79769313486232E+308	-1.79769313486232E+308
Positive Minimum	+2.22507385850720E-308	+4.94065645841247E-324 ¹
Negative Maximum	-2.22507385850720E-308	-4.94065645841247E-324 ²

1 An underflow in Ignore mode results in a denormalized number that is less than the value for +MINREAL.

2 An underflow in Ignore mode results in a denormalized number that is greater than the value for -MINREAL.

ASCII

See CREATE ASCII and LEXICAL ORDER IS.

ASN

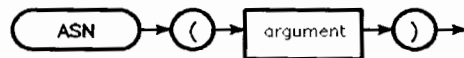
Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

ASN returns the arcsine of its argument.

Example Statements

```
Angle=ASN(Sine)
PRINT "Angle = ";ASN(CMPLX(-2.98,3))
```

Syntax



Item	Description/Default	Range Restrictions
argument	numeric expression	-1 through +1 for INTEGER and REAL arguments; see "Range Restriction Specifics" for COMPLEX arguments and underflow conditions.

Semantics

The angle mode (set by RAD or DEG) determines whether the value returned is in degrees or radians. If the current angle mode is DEG, the range of the result is -90 to +90 degrees. If the current angle mode is RAD, the range of the result is $-\pi/2$ to $+\pi/2$ radians. The angle mode is radians unless you specify degrees with the DEG statement.

ASN

If the argument is REAL or INTEGER, the value returned is REAL. If the argument is COMPLEX, the value returned is COMPLEX.

To compute the ASN of a COMPLEX value, the COMPLEX binary must be loaded.

Range Restriction Specifics



The formula for computing the ASN of a COMPLEX value is:

$$-i * \text{LOG}(i * \text{Argument} + \text{SQRT}(1 - \text{Argument} * \text{Argument}))$$

where i is the COMPLEX value `CMLX(0,1)` and `Argument` is a COMPLEX argument to the ASN function. Some values of a COMPLEX argument may cause errors in this computation. For example:

```
ASN(CMLX(MAXREAL,0))
```

will cause error 22 (error 21 in HP BASIC/UX 700) due to the `Argument*Argument` computation.

The principle value, which has a real part between $-\pi/2$ to $+\pi/2$, is returned for COMPLEX arguments.

The following range restrictions apply in HP BASIC/UX 700 when underflow mode (`CONTROL 32,7;mode`) is set to Error or Ignore.

Range	Underflow Mode Error	Underflow Mode Ignore
Positive Maximum	+1.0000000000000E+000	+1.0000000000000E+000
Negative Minimum	-1.0000000000000E+000	-1.0000000000000E+000
Positive Minimum	+5.11091385101442E-103	+4.94065645841247E-324 ¹
Negative Maximum	-5.11091385101442E-103	-4.94065645841247E-324 ²

1 An underflow in Ignore mode results in a denormalized number that is less than the value for +MINREAL.

2 An underflow in Ignore mode results in a denormalized number that is greater than the value for -MINREAL.

ASNH

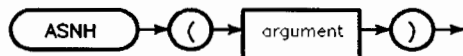
Supported On	UX WS DOS
Option Required	COMPLEX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

ASNH returns the hyperbolic arcsine of its argument.

Example Statements

```
Result=ASNH(-.2475)
PRINT "Hyperbolic Arcsine = ";ASNH(Expression)
```

Syntax



Item	Description/Default	Range Restrictions
argument	numeric expression	absolute value < 1.340 780 792 99 E+154 and > 1.491 668 146 24 E -154 for INTEGER and REAL arguments; see "Range Restriction Specifics" for additional restrictions.

Semantics

If an INTEGER or REAL argument is given, this function returns a REAL value. If a COMPLEX argument is given, this function returns a COMPLEX value.

Range Restriction Specifics

The formula use for computing the ASNH is as follows:

$$\text{LOG}(\text{Argument} + \text{SQRT}(\text{Argument} * \text{Argument} + 1))$$

where **Argument** is the argument to the ASNH function. Some values of a COMPLEX argument may cause errors in this computation. For example:

$$\text{ASNH}(\text{CMPLX}(\text{MAXREAL}, 0))$$

will cause error 22 (REAL overflow) (error 21 in HP BASIC/UX 700) due to the **Argument*Argument** computation.

Note that the ASNH of a COMPLEX number returns a principle value which has an imaginary part that falls in the range of $-\pi/2$ to $+\pi/2$.

The following range restrictions apply in HP BASIC/UX 700 when underflow mode (CONTROL 32,7;mode) is set to Error or Ignore.

Range	Underflow Mode Error	Underflow Mode Ignore
Positive Maximum	+1.34078079299426E+154	+1.34078079299426E+154
Negative Minimum	-1.34078079299426E+154	-1.34078079299426E+154
Positive Minimum	+2.22507385850720E-308	+4.94065645841247E-324 ¹
Negative Maximum	-2.22507385850720E-308	-4.94065645841247E-324 ²

1 An underflow in Ignore mode results in a denormalized number that is less than the value for +MINREAL.

2 An underflow in Ignore mode results in a denormalized number that is greater than the value for -MINREAL.

ASSIGN

Supported On	UX* WS DOS IN*
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

ASSIGN assigns an I/O path name and attributes to one of the following:

- a file
- an instrument
- group of devices
- a pipe
- a buffer

Example Statements

These statements assign an I/O path name to a file:

```
ASSIGN @File TO File_name$
ASSIGN @File TO File_name$; FORMAT OFF
ASSIGN @File TO File_name$; FORMAT OFF, SWAP OFF
ASSIGN @File TO * ! Close the file.
```

These statements assign an I/O path name to an instrument:

```
ASSIGN @Hpib_scope TO 724
ASSIGN @Serial_scope TO 9
ASSIGN @Buf_2 TO BUFFER Numeric_Array(*)
ASSIGN @Source;FORMAT ON
ASSIGN @Listeners TO 711,712,715
ASSIGN @File TO "/WORKSTATIONS/MyDir/MyFile:;,700"
ASSIGN @Srm_file TO "P1/FredsData<pass>:REMOTE"
ASSIGN @File TO Name$;APPEND
```

ASSIGN

The following examples require the TRANS binary:

```
ASSIGN @Buf_1 TO BUFFER String_variable$
ASSIGN @Buf_2 TO BUFFER Numeric_Array(*)
ASSIGN @Buf_3 TO BUFFER [128]
```

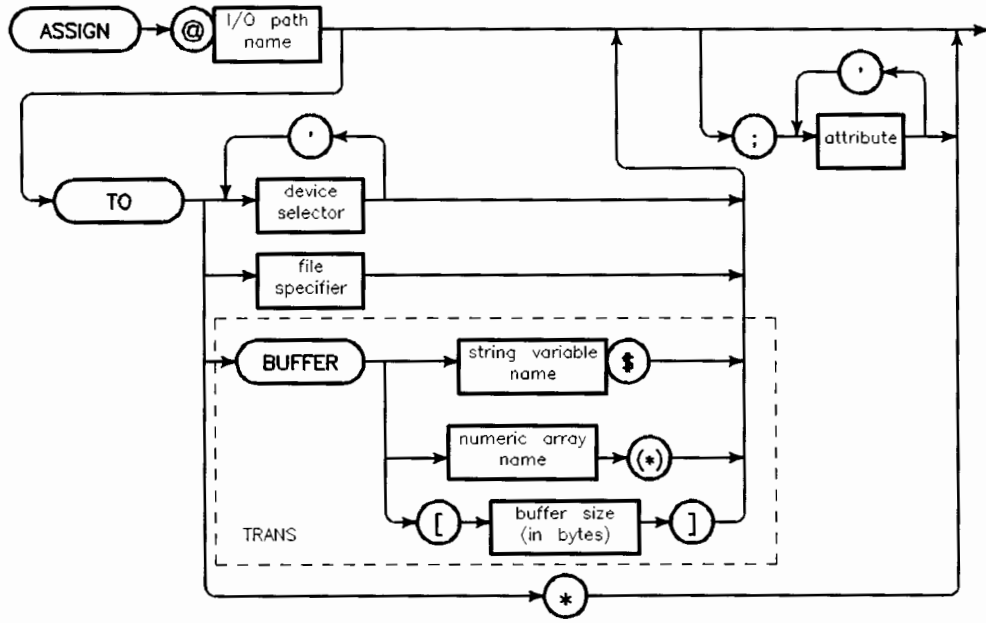
The following examples require the IO binary:

```
ASSIGN @Resource TO Gpio;WORD,CONVERT IN BY INDEX In$
ASSIGN @Resource;CONVERT OUT BY INDEX Out$
ASSIGN @Resource TO Hpib;EOL Eol$ END DELAY .05
ASSIGN @Resource TO Rs_232;PARITY ODD
```

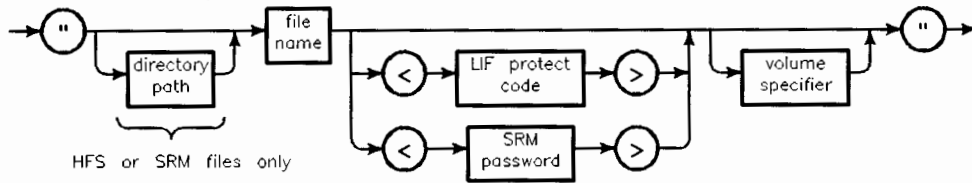
The following examples require the LANGUAGE binary:

```
ASSIGN @Printer TO 701;EXCHANGE "HP-16"
ASSIGN @Printer;EXCHANGE OFF
ASSIGN @Printer TO 701;EXCHANGE "JIS" SHIFT IN In$ OUT Out$
```

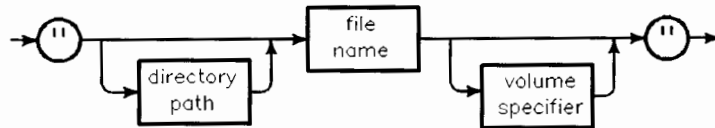
ASSIGN



literal form of file specifier:

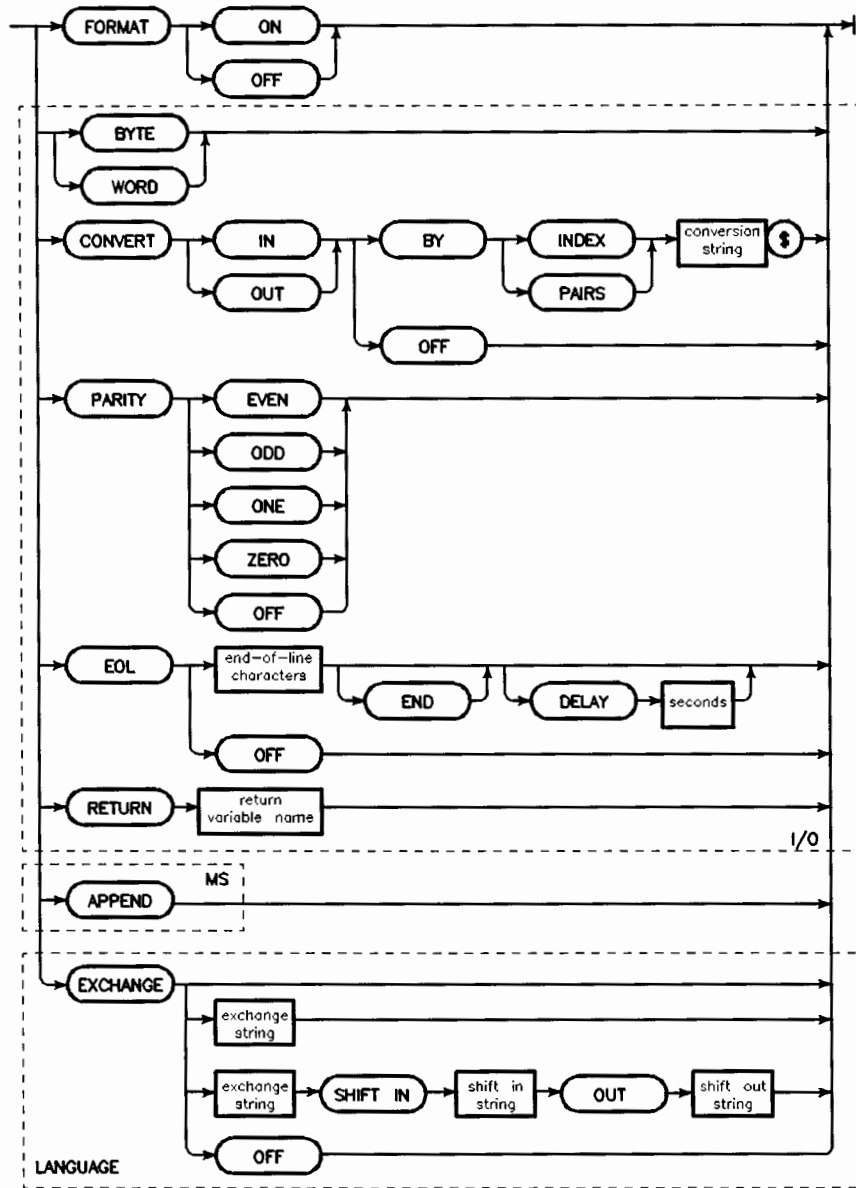


literal form of DFS file specifier:



ASSIGN

literal form of attribute:



ASSIGN

Item	Description	Range
I/O path name	name identifying an I/O path	any valid name
device selector	numeric expression	(see Glossary)
file specifier	string expression	(see drawing)
string variable name	name of a string variable	any valid name (see Glossary)
numeric array name	name of a numeric array	any valid name
buffer size (in bytes)	numeric expression, rounded to an integer	1 through available memory minus 690
attribute	attribute to be assigned to the I/O path	(see drawing)
directory path	literal	(see MASS STORAGE IS)
file name	literal	depends on volume's format (see Glossary)
LIF protect code	literal; first two non-blank characters are significant	> not allowed
SRM password	literal; first 16 non-blank characters are significant	> not allowed
volume specifier	literal	(see MASS STORAGE IS)
conversion string	name of a string variable	up to 256 characters (with INDEX); even number of characters (with PAIRS)
end-of-line characters	string expression; Default=CR and LF	up to 8 characters
time period	numeric expression, rounded to the nearest 0.001 seconds; Default=0	0.001 through 32 767
return variable name	name of a numeric variable	any valid name
exchange string	string expression	choices depend on LANGUAGE
shift in string	string expression	depends on printer used; six bytes maximum
shift out string	string expression	depends on printer used; six bytes maximum

A-40 ABORT - AXES

Semantics

The ASSIGN statement serves a variety of purposes. Its main purpose is to open (create) an I/O path name and assign that name to a resource. ASSIGN can specify attributes that describe how data is shared with the resource. ASSIGN can also close (terminate) an I/O path.

An I/O path name is associated with a unique internal structured data type. I/O path names can be placed in COM statements and can be passed by reference as parameters to subprograms. They cannot be evaluated in a numeric or string expression and cannot be passed by value.

Once an I/O path name has been assigned to a resource, OUTPUT, ENTER, TRANSFER, STATUS, and CONTROL operations can be directed to that I/O path name. This provides the convenience of re-directing I/O operations in a program by simply changing the appropriate ASSIGN statement. The resource assigned to the I/O path name may be an interface, a device, a group of devices on HP-IB, a mass storage file, pipe, or a buffer. Note that the STATUS and CONTROL registers of an I/O path are different from the STATUS and CONTROL registers of an interface. All STATUS and CONTROL registers are summarized in the "Interface Registers" section at the back of this book.

Wildcards

If you are using a version of HP BASIC that supports wildcards, you can use them in file specifiers with ASSIGN. Wildcard file specifiers used with ASSIGN must match one and only one file name. You must first enable wildcard recognition using WILDCARDS. Refer to the keyword entry for WILDCARDS for details.

Using FORMAT Attributes

Assigning the FORMAT ON attribute to an I/O path name directs the computer to use its ASCII data representation while sending and receiving data through the I/O path. Assigning the FORMAT OFF attribute to an I/O path name directs the computer to use its internal data representation when using the I/O path.

If the file was created with the CREATE ASCII statement, the file is always accessed as a LIF ASCII file. LIF ASCII is a file type used by certain HP

ASSIGN

computers, such as the HP BASIC Workstation. If you specify **FORMAT ON** or **FORMAT OFF** for such a file, it is ignored.

If a **FORMAT** attribute is not explicitly given to an I/O path, a default is assigned. The following table shows the default **FORMAT** attribute assigned to computer resources.

Resource	Default Attribute
interface/device	FORMAT ON
ASCII file	(always ASCII format)
BDAT file	FORMAT OFF
DOS file	FORMAT OFF
HP-UX file	FORMAT OFF
buffer	FORMAT ON
pipe	FORMAT ON

The **FORMAT OFF** attribute cannot be assigned to an I/O path which currently possesses any non-default **CONVERT** or **PARITY** attribute(s), and vice versa.

Using Files

Assigning an I/O path name to a file associates the I/O path with the file and opens the file for reading and writing. The file must be a data file. You cannot, for example, **ASSIGN** an I/O path to a **PROG** (program) file. The file must already exist; **ASSIGN** does not do an implied **CREATE**.

Files have a position pointer which is associated with each I/O path name. The pointer identifies the next byte to be written or read. The pointer is reset to the beginning of the file when the file is opened, and updated with each **ENTER** or **OUTPUT** that uses that I/O path name. It is best if a file is open with only one I/O path name at a time.

ASSIGN

BDAT and HP-UX files have an additional *physical* end-of-file pointer. This end-of-file pointer (which resides on the media) is read when the file is opened. This end-of-file pointer is updated on the media at the following times:

- the current end-of-file changes
- END is specified in an OUTPUT statement directed to the file
- a CONTROL statement directed to the I/O path name changes the position of the end-of-file pointer

Using Instruments

I/O path names are assigned to instruments and other devices by placing the device selector after the keyword TO. The statement **ASSIGN @Meters TO 710,711,712** creates the I/O path name **@Meters** and assigns it to a group of three devices on HP-IB. When multiple devices are specified, they must be connected to the same interface.

When an I/O path name which specifies multiple devices is used in an OUTPUT statement, all devices referred to by the I/O path name receive the data. When an I/O path name which specifies multiple devices is used in an ENTER statement, the first device specified sends the data to the computer and to the rest of the devices. When an I/O path name which specifies multiple HP-IB devices is used in either CLEAR, LOCAL, PPOLL CONFIGURE, PPOLL UNCONFIGURE, REMOTE, or TRIGGER statement, all devices associated with the I/O path name receive the HP-IB message.

A device can have more than one I/O path name associated with it. Each I/O path name can have different attributes (such as FORMAT and SWAP), depending upon how the device is used. The specific I/O path name used for an I/O operation determines which set of attributes is used for that operation.

Using APPEND

Using ASSIGN with APPEND requires the MS binary.

Normally, opening a file with ASSIGN will reset the current position pointer to the beginning of the file. Thus, an existing file is overwritten. If instead you wish to append more data to an existing file, use ASSIGN with APPEND.

ASSIGN

Note that APPEND works with HPUX, LIF, and BDAT file types on SRM or HFS File Systems.

HFS Permissions

ASSIGN opens any existing ASCII, BDAT, or HP-UX file if you currently have R (read) or W (write) access permission on the file as well as X (search) permission on the parent and all superior directories. Otherwise, error 183 is reported.

SRM Access Capabilities (not supported on HP BASIC/UX 700)

ASSIGN opens any existing ASCII, BDAT, or HP-UX file, regardless of protection on the file *except* when *all* access capabilities (MANAGER, READ and WRITE) are taken from the public. Attempts to use ASSIGN with a file whose capabilities are fully protected (without supplying the necessary passwords) will result in error 62.

The file's specific access capabilities are not checked at ASSIGN time. A subsequent operation on the file associated with the I/O path name is not performed, however, unless you have the proper access capability for that operation. For example, you may ASSIGN an I/O path name to a file that has only the READ capability public; but attempting to perform an OUTPUT operation generates error 62, since the WRITE access capability is not public (this operation would be successful if you specify the WRITE password in the ASSIGN statement).

Locked SRM Files (not supported on HP BASIC/UX 700)

With SRM volumes, existing ASCII, BDAT, and HP-UX files opened via ASSIGN are opened in shared mode, which means that several users can open a file at the same time. If you lock a file (refer to LOCK) and subsequently open that file via ASSIGN using the same @name (for example, to reset the file pointer), the ASSIGN automatically unlocks the file (refer to UNLOCK). To maintain sole access to the file, you must LOCK it again.

Closing an I/O path via ASSIGN (ASSIGN @Io_path TO *) unlocks as well as closes the file (regardless of the number of LOCKs in effect for the file at the time).

A-44 ABORT - AXES

Using Buffers

Using ASSIGN to create a buffer requires the TRANS binary.

The ASSIGN statement is also used to create a buffer (called an “unnamed” buffer) and assign an I/O path name to it or to assign an I/O path name to a buffer (called a “named” buffer) which has been previously declared. Once assigned an I/O path name, a buffer may be the source or destination of a TRANSFER, the destination of an OUTPUT, or the source of an ENTER statement.

I/O path names assigned to buffers contain information describing the buffer, such as buffer capacity, current number of bytes, and empty and fill pointers. This information can be read from STATUS registers of the I/O path name; some of this information may be modified by writing to CONTROL registers.

See the “Interface Registers” section at the back of this manual for I/O path register definitions; the *HP BASIC Interface Reference* provides tutorial information about these interface registers.

The ASSIGN statement that assigns the I/O path name to a named buffer (or creates an unnamed buffer) sets these registers to their initial values: the buffer type is set to either 1 (named buffer) or 2 (unnamed buffer); the empty and fill pointers are set to 1; the current-number-of-bytes register and all other registers are set to 0.

Named buffers can also be accessed through their variable names in the same manner that other variables of that data type can be accessed. However, with this type of access, the buffer registers are not updated; only the data in the buffer changes. For example, using LET to place characters in a named string-variable buffer does not change the empty and fill pointers or the current-number-of-bytes register; only the buffer contents and string's current length can be changed. It is highly recommended that the string's current length (set to the string's dimensioned length by ASSIGN) not be changed in this manner. Unnamed buffers can be accessed only through their I/O path names.

Using ENTER, OUTPUT, or TRANSFER to access a named buffer through its I/O path name updates the appropriate buffer registers automatically; this is unlike accessing a named buffer through its declared variable name (as above).

ASSIGN

An I/O path name cannot be assigned to a buffer which will not exist for as long as the I/O path name; this “lifetime” requirement has several implications. Buffers cannot be declared in ALLOCATE statements. If a buffer’s I/O path name is to appear in a COM block, the buffer must appear in the same COM block; thus, I/O path names assigned to unnamed buffers cannot appear in COM. If a buffer’s I/O path name is to be used as a formal parameter of a subprogram, the buffer to which it will be assigned must appear in the same formal parameter list or appear in a COM which is accessible to that subprogram context. An I/O path name which is a formal parameter to a subprogram cannot be assigned to an unnamed buffer in the subprogram.

Other Secondary Keywords

Using ASSIGN with the secondary keywords discussed in this section requires the IO binary.

Using ASSIGN with BYTE and WORD

The BYTE attribute specifies that all data is to be sent and received as bytes when the I/O path name is used in an ENTER, OUTPUT, PRINT, or TRANSFER statement that accesses a device, file, or buffer, and when the I/O path name is specified as the PRINTER IS or PRINTALL IS device. In a TRANSFER, the attribute of BYTE or WORD associated with the non-buffer I/O path name determines how the data is sent.

When neither BYTE nor WORD is specified in any ASSIGN statement for an I/O path, BYTE is the default attribute. Once the BYTE attribute is assigned (either explicitly or by default) to an I/O path name, it cannot be changed to the WORD attribute by using the normal method of changing attributes (see Changing Attributes below); the converse is also true for the WORD attribute.

The WORD attribute specifies that all data is to be sent and received as words (in the same situations as with BYTE above). If the interface to which the I/O path is assigned cannot handle 16-bit data, an error will be reported when the ASSIGN is executed; similarly, if the buffer has a capacity which is an odd number of bytes, an error will be reported. If the FORMAT ON attribute is in effect, the data will be buffered to allow sending words. The first byte is placed in a two-character buffer; when the second byte is placed in this buffer, the two bytes are sent as one word. A Null character, CHR\$(0), may be sent to this

ASSIGN

buffer by HP BASIC to force alignment on word boundaries at the following times: before the first byte is sent, before a numeric item is sent with a W image, after an EOL sequence, or after the last byte is sent to the destination. These Nulls may be converted to another character by using the CONVERT attribute (see below). If WORD has been set explicitly, it remains in effect even when the other defaults are restored (see Changing Attributes). The only way to change the WORD attribute is to explicitly close the path name.

Using ASSIGN with CONVERT

The CONVERT attribute is used to specify a character-conversion table to be used during OUTPUT and ENTER operations; OUT specifies conversions are to be made during all OUTPUTs through the I/O path, and IN specifies conversions with all ENTERs. The default attributes are CONVERT IN OFF and CONVERT OUT OFF, which specify that no conversions are to be made in either direction. No non-default CONVERT attribute can be assigned to an I/O path name that currently possesses the FORMAT OFF attribute, and vice versa.

CONVERT ... BY INDEX specifies that each original character's code is used to index the replacement character in the specified conversion string, with the only exception that CHR\$(0) is replaced by the 256th character in the string. For instance, CHR\$(10) is replaced by the 10th character, and CHR\$(0) is replaced by the 256th character in the conversion string. If the string contains less than 256 characters, characters with codes that do not index a conversion-string character will not be converted.

CONVERT ... BY PAIRS specifies that the conversion string contains pairs of characters, each pair consisting of an original character followed by its replacement character. Before each character is moved through the interface, the original characters in the conversion string (the odd characters) are searched for the character's occurrence. If the character is found, it will be replaced by the succeeding character in the conversion string; if it is not found, no conversion takes place. If duplicate original characters exist in the conversion string, only the first occurrence is used.

The conversion-string variable must exist for as long as the I/O path name (see explanation of the "lifetime" requirement in the preceding section on Using Buffers). Changes made to the value of this variable immediately affect all subsequent conversions which use the variable.

ASSIGN

When CONVERT OUT is in effect, the specified conversions are made after any end-of-line (EOL) characters have been inserted into the data but before parity generation is performed (if in effect). When CONVERT IN is in effect, conversions are made after parity is checked but before the data is checked for any item-terminator or statement-terminator characters.

Using ASSIGN with EOL

The EOL attribute specifies the end-of-line (EOL) sequence sent after all data during normal OUTPUT operations and when the "L" image specifier is used. Up to eight characters may be specified as the EOL characters; an error is reported if the string contains more than eight characters. The characters are put into the output data before any conversion is performed (if CONVERT is in effect). If END is included in the EOL attribute, an interface-dependent END indication is sent with the last character of the EOL sequence (such as the EOI signal on HP-IB interfaces); however, if no EOL sequence is sent, the END indication is also suppressed. If DELAY is included, the computer delays the specified number of seconds (after sending the last character) before continuing. END and DELAY apply only to devices; both are ignored when a file or buffer is the destination. The default EOL sequence consists of sending a carriage-return and a line-feed character with no END indication and no delay period. This default is restored when EOL is OFF.

Using ASSIGN with PARITY

The PARITY attribute specifies that parity is to be generated for each byte of data sent by OUTPUT and checked for each byte of data received by ENTER. The parity bit is the most significant bit of each byte (bit 7). The default mode is PARITY OFF. No non-default PARITY attribute can be assigned to an I/O path name which currently possesses the FORMAT OFF attribute, and vice versa.

The following PARITY options are available:

ASSIGN

Option	Effect on Incoming Data	Effect on Outbound Data
OFF	No check is performed	No parity is generated
EVEN	Check for even parity	Generate even parity
ODD	Check for odd parity	Generate odd parity
ONE	Check for parity bit set (1)	Set parity bit (1)
ZERO	Check for parity bit clear (0)	Clear parity bit (0)

Parity is generated after conversions have been made on outbound data and is checked before conversions on inbound data. After parity is checked on incoming data, the parity bit is cleared; however, when PARITY OFF is in effect, bit 7 is not affected.

If a PARITY attribute is in effect with the WORD attribute, the most-significant bit of each byte of the word is affected.

Using ASSIGN with RETURN

Using ASSIGN with RETURN requires the IO binary.

Although RETURN is not an attribute, including it in the list of attributes directs the system to place a code in a numeric variable to indicate the ASSIGN operation's outcome. If the operation is successful, a 0 is returned. If a non-zero value is returned, it is the error number which otherwise would have been reported. When the latter occurs, the previous status of the I/O path name is retained; the default attributes are not restored. If more than one error occurs during the ASSIGN, the outcome code returned may not be either the first or the last error number.

If RETURN is the only item in an ASSIGN statement, the default attributes are not restored to the I/O path (see Changing Attributes below). For example, executing a statement such as `ASSIGN @Io_path;RETURN Outcome` does not restore the default attributes.

ASSIGN

Changing Attributes

The attributes of a currently valid I/O path may be changed, without otherwise disturbing the state of that I/O path or the resource(s) to which it is assigned, by omitting the *TO resource* clause of the ASSIGN statement. For example, `ASSIGN @File;FORMAT OFF` assigns the `FORMAT OFF` attribute to the I/O path name `@File` without changing the file pointers (if assigned to a mass storage file). The only exception is that once either the `BYTE` or `WORD` attribute is assigned to the I/O path name, the attribute cannot be changed in this manner; the I/O path name must either be closed and then assigned to the resource or be re-assigned to change either of these attributes.

A statement such as `ASSIGN @Device` restores the default attributes to the I/O path name, if it is currently assigned.

As stated in the preceding paragraph, the only exception is that once the `WORD` attribute is explicitly assigned to an I/O path name, the default `BYTE` attribute cannot be restored in this manner.

Using ASSIGN With SWAP

The secondary keyword `SWAP` sets the order in which bytes are transferred for an I/O path assigned with `FORMAT OFF`. If the ASSIGN statement does not create the I/O path with `FORMAT OFF`, any `SWAP` clause in the statement is ignored. The default behavior of ASSIGN is `SWAP OFF`.

When `SWAP` is `OFF`, data is transferred by sending the least significant byte first. When `SWAP` is `ON`, data is transferred by sending the most significant byte first.

`SWAP` affects only these types of data:

- two-byte integers (such as `INTEGER` variables)
- eight-byte reals (such as `REAL` variables)
- strings written to `BDAT` files with `FORMAT OFF`

Note that no other type of data is handled properly by `SWAP`. For example, you cannot properly read a long integer (a four-byte integer) into two `INTEGER` variables with `SWAP ON`.

`SWAP` is useful in these situations:

A-50 ABORT - AXES

ASSIGN

- You want to transfer integer or real numbers between an instrument and HP BASIC with FORMAT OFF to increase throughput. Use SWAP ON/OFF as necessary to transfer bytes in the order that is compatible with the instrument.
- You want to share BDAT or DOS data files written with FORMAT OFF between HP BASIC and other versions HP BASIC. In this case, you must use SWAP ON.

Suppose you want to send commands to an instrument as strings and receive numeric data from the instrument as unformatted bytes. You also want to read string data from the instrument, such as error messages. You could use this approach:

```

100 ASSIGN @Device TO Dev_selector
110 ASSIGN @Device_bin TO Dev_selector;FORMAT OFF,SWAP ON
120 OUTPUT @Device;Cmd$          ! Cmd$ contains an instrument command.
130 ENTER @Device_bin;Real_var ! Real_var is a REAL variable.
140 ENTER @Device;Err_msg$      ! Err_msg$ contains an error message string.

```



Suppose you want to read a BDAT file written on a DOS disk by the HP Measurement Coprocessor. These are the statements that wrote the file:

```

100 INTEGER Int_var
110 CREATE BDAT "MYFILE"
120 ASSIGN @File TO "MYFILE" ! Default for BDAT files is FORMAT OFF.
130 OUTPUT @File;Real_var,Int_var,String$

```

It is important to note that the default formatting for I/O paths assigned to BDAT files is FORMAT OFF. To read MYFILE with HP BASIC, you must use these statements:

```

100 INTEGER Int_var
110 ASSIGN @File TO "MYFILE";SWAP ON
120 ENTER @File;Real_var,Int_var,String$

```

Closing I/O Paths

There are a number of ways that I/O paths are closed and the I/O path names rendered invalid. Closing an I/O path cancels any ON-event actions for that I/O path. I/O path names that are *not* included in a COM statement are closed at the following times:

- When they are explicitly closed; for example, ASSIGN @File TO *

ASSIGN

- When a currently assigned I/O path name is re-assigned to a resource, the original I/O path is closed after the new one is opened. The re-assignment can be to the same resource or a different resource. No closing occurs when the ASSIGN statement only changes attributes and does not include the "TO ..." clause.
- When an I/O path name is a local variable within a subprogram, it is closed when the subprogram is exited by SUBEND, SUBEXIT, ERROR SUBEXIT, RETURN..expression, or ON-event..RECOVER.
- When SCRATCH, SCRATCH A, or SCRATCH C is executed; any form of STOP occurs; or an END, LOAD, or GET is executed.

I/O path names that *are* included in a COM statement remain open and valid during a LOAD, GET, STOP, END, or simple SCRATCH. I/O path names in COM are only closed at the following times:

- When they are explicitly closed; for example, ASSIGN @File TO *
- When SCRATCH A or SCRATCH C is executed
- When a LOAD, GET, or EDIT operation brings in a program that has a COM statement that does not exactly match the COM statement containing the open I/O path names

Additionally, when **Reset** is pressed, all I/O path names are rendered invalid without going through some of the updating steps that are normally taken to close an I/O path. This is usually not a problem, but there are rare situations which might leave file pointers in the wrong state if their I/O path is closed by a **Reset**. Explicit closing is preferred and recommended.

When ASSIGN is used to close either the source or destination I/O path name of a currently active TRANSFER, the I/O path is not actually closed until the TRANSFER is completed. When I/O path names are closed in this manner, any pending (logged but not serviced) EOR or EOT events are lost (they do not initiate their respective branches). With buffers' I/O path names, the I/O path name might not be closed until two TRANSFERs (one in each direction) are completed.

HP BASIC/UX Specifics

ASSIGN allows you to use HP-UX piping commands, such as `|lp`.

Assigning an I/O path name to a pipe associates the I/O path with an HP-UX pipe. Outbound pipes allow direction of HP BASIC/UX output to an HP-UX filter or utility, and inbound pipes allow HP BASIC/UX to read input from an HP-UX filter or utility.

The pipe symbol `|` is used to specify a pipe. If this symbol appears at the beginning of the string (as in `|lp`) an outbound pipe is opened. If this symbol appears at the end of the string (as in `ps -ef|`) an inbound pipe is opened.

HP BASIC/UX treats output to a pipe as it would output to a file. The pipe must be explicitly closed before any output becomes permanent (or takes place). Output to a spooled device will not be sent to the spooler until the pipe has been closed. The closing of pipes can be achieved with a subsequent `ASSIGN @Pipe to *`, `QUIT`, or `SCRATCH` command.

Using EXCHANGE and SHIFT IN ... OUT

Using ASSIGN with the secondary keywords discussed in this section requires the LANGUAGE binary.

Some localized versions of HP BASIC, such as Japanese localized HP BASIC, support two-byte characters. The secondary keyword EXCHANGE allows you to automatically convert internal HP-15 character codes to the codes supported by your two-byte printer. The available choices and default values for the exchange string depend on the particular LANGUAGE localization binary that you are using. You can turn the EXCHANGE function off by specifying EXCHANGE OFF. If you specify EXCHANGE without an exchange string, "HP-16" is assumed.

If you are using EXCHANGE with an ASSIGNED file, you must use a file CREATED with one of the following types:

- BDAT, FORMAT ON
- HP-UX, FORMAT ON

Note that EXCHANGE cannot be used with these combinations of ASSIGN settings:

ASSIGN

- CONVERT ...
- PARITY ...
- FORMAT OFF (whether set explicitly or set by default for an ASSIGNED device or file).

The secondary keywords SHIFT IN and OUT are useful with certain printers that use special control strings to turn two-byte printing on and off. HP BASIC automatically sends the specified shift in string before two-byte characters. HP BASIC also sends the specified shift out string before one-byte characters that follow two-byte characters.

Note SHIFT IN and SHIFT OUT cause Error 257 if used with HP-15 characters. Use EXCHANGE to convert HP-15 characters to your LANGUAGE two-byte characters.

For a general discussion of globalization and localization including printers, refer to the *HP BASIC Porting and Globalization* manual. For LANGUAGE specific details, refer to *Using LanguageX with HP BASIC*, where *LanguageX* is your local language.

ATN

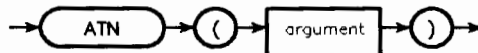
Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

ATN returns the arctangent of its argument.

Example Statements

```
Angle=ATN(Tangent)
PRINT "Angle = ";ATN(CMPLX(-1.5,3.5))
```

Syntax



Item	Description/Default	Range Restrictions
argument	numeric expression	within valid ranges of INTEGER or REAL data types for INTEGER and REAL arguments; see "Range Restriction Specifics" for COMPLEX arguments and underflow conditions.

Semantics

If the argument is COMPLEX, the value returned is COMPLEX. To compute the ATN of a COMPLEX value, the COMPLEX binary must be loaded. If the argument is REAL or INTEGER, the value returned is REAL.

The angle mode (set by RAD or DEG) determines whether the value returned is in degrees or radians. If the current angle mode is DEG, the range of the

ATN

result is -90 to $+90$ degrees. If the current angle mode is RAD, the range of the result is $-\pi/2$ to $+\pi/2$ radians. The angle mode is radians unless you specify degrees with the DEG statement.

Range Restriction Specifics

The formula for computing the ATN of a COMPLEX value is as follows:

$$(i/2)*\text{LOG}((i+\text{Argument})/(i-\text{Argument}))$$

where i is the COMPLEX value `CMPLX(0,1)` and `Argument` is a COMPLEX argument to the ATN function. Some values of a COMPLEX argument may cause errors in this computation. For example,

```
ATN(CMPLX(MAXREAL,MAXREAL))
```

will cause error 22 (error 21 in HP BASIC/UX 700) due to the computation of

$$(i+\text{Argument})/(i-\text{Argument})$$

ATN is not defined at i and $-i$ and will generate error 623 given those arguments.

The principle value, which has a real part between $-\pi/2$ to $+\pi/2$, is returned for COMPLEX arguments.

The following range restrictions apply in HP BASIC/UX 700 when underflow mode (CONTROL 32,7;mode) is set to Error or Ignore.

Range	Underflow Mode Error	Underflow Mode Ignore
Positive Maximum	+8.18773715074641E+076	+1.79769313486232E+308
Negative Minimum	-8.18773715074641E+076	-1.79769313486232E+308
Positive Minimum	+1.22133866975546E-077	+4.94065645841247E-324 ¹
Negative Maximum	-1.22133866975546E-077	-4.94065645841247E-324 ²

1 An underflow in Ignore mode results in a denormalized number that is less than the value for +MINREAL.

2 An underflow in Ignore mode results in a denormalized number that is greater than the value for -MINREAL.

ATNH

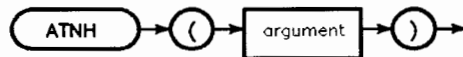
Supported On	UX WS DOS
Option Required	COMPLEX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

ATNH returns the hyperbolic arctangent of a numeric expression.

Example Statements

```
Result=ATNH(-.4571)
PRINT "Hyperbolic Arctangent = ";ATNH(X1)
```

Syntax



Item	Description/Default	Range Restrictions
argument	numeric expression	-1 through +1 for INTEGER and REAL arguments; see "Range Restriction Specifics" for COMPLEX arguments and underflow conditions

Semantics

If an INTEGER or REAL argument is given, this function returns a REAL value. If a COMPLEX argument is given, this function returns a COMPLEX value.

ATNH**Range Restriction Specifics**

The formula for computing ATNH is as follows:

$$\text{LOG}((1+\text{Argument})/(1-\text{Argument}))/2$$

where **Argument** is the argument to the ATNH function. Some values of the argument may cause errors in this computation. For example:

$$\text{ATNH}(\text{CMPLX}(\text{MAXREAL}, \text{MINREAL}))$$

will cause error 22 (REAL overflow) (error 21 in HP BASIC/UX 700) due to the divide operation in the formula.

Note that the hyperbolic arctangent of a COMPLEX number returns a principle value, that has an imaginary part which falls in the range of $-\pi/2$ to $+\pi/2$.

The following range restrictions apply in HP BASIC/UX 700 when underflow mode (CONTROL 32,7;mode) is set to Error or Ignore.

Range	Underflow Mode Error	Underflow Mode Ignore
Positive Maximum	+1.00000000000000E+000	+1.00000000000000E+000
Negative Minimum	-1.00000000000000E+000	-1.00000000000000E+000
Positive Minimum	+2.22507385850720E-308	+4.94065645841247E-324 ¹
Negative Maximum	-2.22507385850720E-308	-4.94065645841247E-324 ²

1 An underflow in Ignore mode results in a denormalized number that is less than the value for +MINREAL.

2 An underflow in Ignore mode results in a denormalized number that is greater than the value for -MINREAL.

AXES

Supported On	UX WS DOS
Option Required	GRAPH
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

AXES draws a pair of axes with optional, equally spaced tick marks.

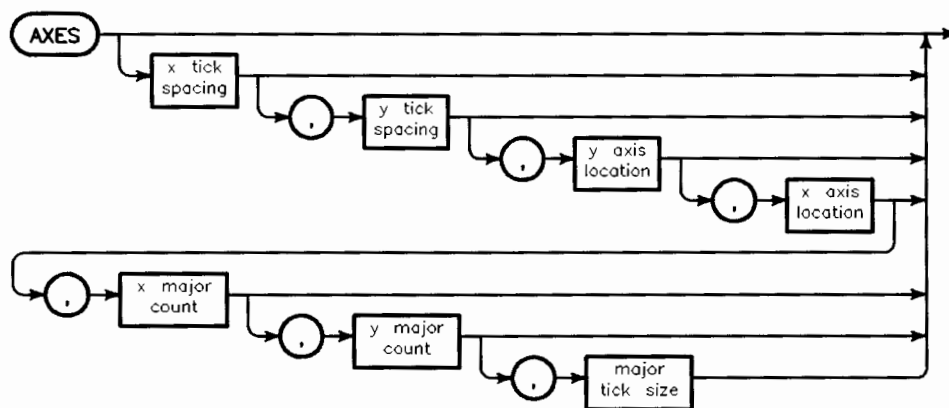
Example Statements

```
AXES 10,10
```

```
AXES Xspace,Yspace
```

```
AXES Xspace,Yspace,Xlocy,Ylocx,Xmajor,Ymajor,Majorsize
```

Syntax



AXES

Item	Description	Range
x tick spacing	numeric expression in current units; Default = 0, no ticks	(see text)
y tick spacing	numeric expression in current units; Default = 0, no ticks	(see text)
y axis location	numeric expression specifying the location of the y axis in x-axis units; Default = 0	—
x axis location	numeric expression specifying the location of the x axis in y-axis units; Default = 0	—
x major count	numeric expression, rounded to an integer, specifying the number of tick intervals between major tickmarks; Default = 1 (every tick is major)	1 through 32 767
y major count	numeric expression, rounded to an integer, specifying the number of tick intervals between major tick marks; Default = 1 (every tick is major)	1 through 32 767
major tick size	numeric expression in graphic display units; Default = 2	—

Semantics

Tick marks are positioned so that a major tick mark coincides with the axis origin, whether or not that intersection is visible. Both axes and tick marks are drawn with the current line type and pen. Minor tick marks are drawn half the size of major tick marks.

The X and Y tick spacing must not generate more than 32 768 tick marks in the clip area (including the axis), or error 20 will be generated.

AXES

Applicable Graphics Transformations

	Scaling	PIVOT	CSIZE	LDIR	PDIR
Lines (generated by moves and draws)	X	X			[4]
Polygons and rectangles	X	X			X
Characters (generated by LABEL)			X	X	
Axes (generated by AXES and GRID)	X				
Location of labels	[1]	[3]		[2]	

¹The starting point for labels drawn after lines or axes is affected by scaling.

²The starting point for labels drawn after other labels is affected by LDIR.

³The starting point for labels drawn after lines or axes is affected by PIVOT.

⁴RPLOT and IPLOT are affected by PDIR.

B

B

BASE - BYTE



B**BASE**

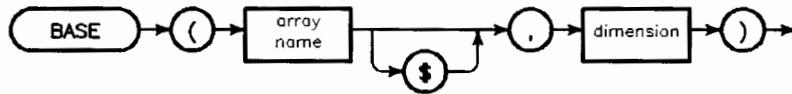
Supported On	UX WS DOS IN
Option Required	MAT
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

BASE returns the lower subscript bound of a dimension of an array. This value is always an INTEGER. (See also OPTION BASE.)

Example Statements

Lowerbound=BASE(Array,Dimension)

Upperbound(2)=BASE(A,2)+SIZE(A,2)-1

Syntax

Item	Description	Range
array name	name of an array	any valid name
dimension	numeric expression, rounded to an integer	1 through 6; ≤ the RANK of the array

BDAT

See CREATE BDAT.

B



B**BEEP**

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

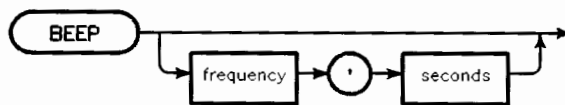
BEEP generates one of 64 audible tones.

Example Statements

BEEP

BEEP Freq,Duration

BEEP 81.38*Tone,Seconds

Syntax

Item	Description	Range
frequency	numeric expression, rounded to the nearest tone; Default = 1220.7	81 through 5208 (see table)
seconds	numeric expression, rounded to the nearest hundredth; Default = 0.2	

Semantics

The frequency and duration of the tone are subject to the resolution of the built in tone generator. The frequency specified is rounded to the nearest frequency supported by the sound hardware. For example, any specified frequency from 40.7 to 122.08 produces a beep of 81.38 Hz. If the frequency

specified is larger than 5167.63, a tone of 5208.32 is produced. If it is less than 40.69, it is considered to be a 0 and no tone is produced.

The resolution of the duration parameter is 0.01 seconds. Any duration shorter than 0.005 seconds is treated as 0. Any duration longer than 2.55 seconds is treated as 2.55 seconds.

Rounding is performed by the system to produce the number in the first column of the following table. With an HP-HIL interface, the frequency produced is the corresponding number in the second column. (Note that the frequencies generated by a computer with a 98203A/B style keyboard are slightly different than those generated by an HP-HIL keyboard/interface combination.)

B

BEEP**B****Rounding of BEEP Frequency Parameters**

Series 200	HP-HIL		Series 200	HP-HIL
81.38	81.45		2685.54	2688.16
162.76	162.12		2766.92	2777.77
244.14	244.37		2848.30	2873.55
325.52	324.25		2929.68	2976.18
406.90	408.49		3011.06	2976.18
488.28	496.03		3092.44	3086.41
569.66	578.70		3173.82	3205.12
651.04	651.03		3255.20	3205.12
732.42	744.04		3336.58	3333.32
813.80	833.33		3417.96	3472.21
895.18	905.79		3499.34	3472.21
976.56	992.06		3580.72	3623.17
1057.94	1096.49		3662.10	3623.17
1139.32	1157.40		3743.48	3787.86
1220.70	1225.49		3824.86	3787.86
1302.08	1302.08		3906.24	3968.24
1383.46	1388.88		3987.62	3968.24
1464.84	1461.98		4069.00	4166.65
1546.22	1543.20		4150.38	4166.65
1627.60	1633.98		4231.76	4166.65

Rounding of BEEP Frequency Parameters (continued)

B

Series 200	HP-HIL		Series 200	HP-HIL
1708.98	1700.67		4313.14	4385.95
1790.36	1773.04		4394.52	4385.95
1871.74	1851.84		4475.90	4385.95
1953.12	1937.98		4557.28	4629.61
2034.50	2032.51		4638.66	4629.61
2115.88	2136.74		4720.04	4629.61
2197.26	2192.97		4801.42	4901.94
2278.64	2252.24		4882.80	4901.94
2360.02	2380.94		4964.18	4901.94
2441.40	2450.97		5045.56	4901.94
2522.78	2525.24		5126.94	5208.31
2604.16	2604.16		5208.32	5208.31

In a few cases with an HIL interface, the frequency produced will not be the closest table entry. For example, BEEP 203.4, .5 will BEEP at 162.12 on an HIL interface even though the specified frequency is closer to 244.37 (in the HP-HIL column) because the closest Series 200 entry is 162.76.

Series 200	HP-HIL
162.76	162.12
244.14	244.37

B

BIN

BIN is a secondary keyword for the following statements:

LIST
LOAD
SCRATCH

BINAND

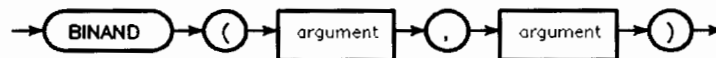
Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

BINAND returns the bit-by-bit logical AND of its arguments.

Example Statements

```
Low_4_bits=BINAND(Byte,15)
IF BINAND(Stat,3) THEN Bit_set
```

Syntax



Item	Description	Range
argument	numeric expression, rounded to an integer	-32 768 through +32 767

Semantics

The arguments for BINAND are represented as 16-bit two's-complement integers. Each bit in an argument is AND'ed with the corresponding bit in the other argument. The results of all the AND's are used to construct the integer which is returned.

In the following example, the statement `Ctrl_word=BINAND(Ctrl_word,-9)` clears bit 3 of `Ctrl_word` without changing any other bits.

```
12 = 00000000 00001100   old Ctrl_word
-9  = 11111111 11110111   mask to clear bit 3
-----
4   = 00000000 00000100   new Ctrl_word
```

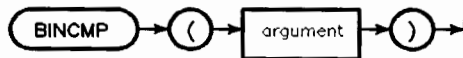

B**BINCMP**

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

BINCMP returns the value of the bit-by-bit complement of its argument.

Example Statements

```
True=BINCMP(Inverse)
PRINT X,BINCMP(X)
```

Syntax

Item	Description	Range
argument	numeric expression, rounded to an integer	-32 768 through +32 767

Semantics

The argument for BINCMP is represented as a 16-bit, two's-complement integer. Each bit in the representation of the argument is complemented, and the resulting integer is returned. For example, the complement of -9 equals +8:

```
-9 = 11111111 11110111  argument
    -----
+8 = 00000000 00001000  complement of argument
```

B-10 BASE - BYTE

BINEOR

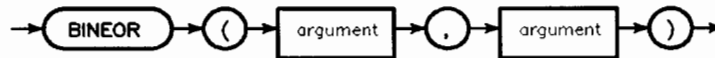
Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

BINEOR returns the bit-by-bit exclusive OR of its arguments.

Example Statements

```
Toggle=BINEOR(Toggle,1)
True_byte=BINEOR(Inverse_byte,255)
```

Syntax



Item	Description	Range
argument	numeric expression, rounded to an integer	-32 768 through +32 767

Semantics

The arguments for BINEOR are represented as 16-bit, two's-complement integers. Each bit in an argument is exclusively OR'ed with the corresponding bit in the other argument. The results of all the exclusive OR's compose the returned integer.

In the following example, the statement `Ctrl_word=BINEOR(Ctrl_word,4)` inverts bit 2 of `Ctrl_word` without changing any other bits.

```

12 = 00000000 00001100   old Ctrl_word
 4 = 00000000 00000100   mask to invert bit 2
-----
 8 = 00000000 00001000   new Ctrl_word
```

B**BINIOR**

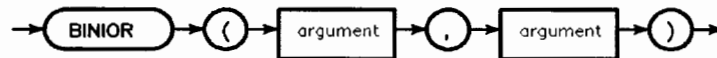
Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

BINIOR returns the bit-by-bit inclusive OR of its arguments.

Example Statements

```
Bits_set=BINIOR(Value1,Value2)
```

```
Top_bit_on=BINIOR(All_bits,2^15)
```

Syntax

Item	Description	Range
argument	numeric expression, rounded to an integer	-32 768 through +32 767

Semantics

The arguments for BINIOR are represented as 16-bit, two's-complement integers. Each bit in an argument is inclusively OR'ed with the corresponding bit in the other argument. The results of all the inclusive OR's are used to construct the integer which is returned.

In the following example, the statement `Ctrl_word=BINIOR(Ctrl_word,6)` sets bits 1 and 2 of `Ctrl_word` without changing any other bits.

```

19 = 00000000 00010011  old Ctrl_word
 6 = 00000000 00000110  mask to set bits 1 & 2
-----
23 = 00000000 00010111  new Ctrl_word

```

B-12 BASE - BYTE

BIT

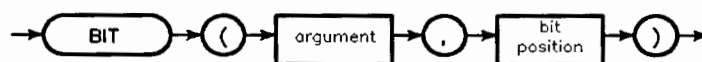
Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

BIT returns a 1 or 0 representing the value of the specified bit of its argument.

Example Statements

```
Flag=BIT(Info,0)
IF BIT(Word,Test) THEN PRINT "Bit #";Test;"is set"
```

Syntax



Item	Description	Range
argument	numeric expression, rounded to an integer	-32 768 through +32 767
bit position	numeric expression, rounded to an integer	0 through 15

Semantics

The argument for BIT is represented as a 16-bit, two's-complement integer. Bit 0 is the least-significant bit, and bit 15 is the most-significant bit.

The following example reads the controller status register of the internal HP-IB and takes a branch to "Active" if the interface is currently the active controller.

```
100 STATUS 7,3;S           Reg 3 = control status
110 IF BIT(S,6) THEN Active Bit 6 = active control
```

B**BREAK**

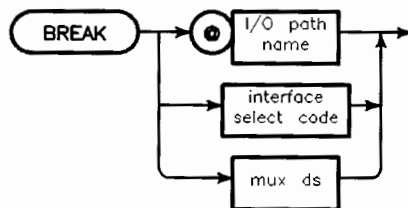
Supported On	UX WS DOS
Option Required	IO
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

BREAK directs the specified serial or datacomm interface to send a break sequence.

Example Statements

```
BREAK 9
```

```
BREAK @Datacomm
```

Syntax

Item	Description	Range
I/O path name	name assigned to an interface select code	any valid name
interface select code	numeric expression, rounded to an integer	8 through 31
mux ds	numeric expression, rounded to an integer	1600 through 1603, factory default select code=16, HP BASIC/UX 300/400 only

Semantics

A break sequence is a signal sent on the Data Out signal line.

On an HP 98626, 98644 Serial Interface, 98628 Datacomm Interface, or 98642 MUX Interface, a logic High of 400-ms duration followed by a logic Low of 60-ms duration is sent.

If an outbound TRANSFER is taking place through this interface, the Break is sent after the TRANSFER is finished; the Break is sent immediately if an inbound TRANSFER is taking place.

Note The HP 98642 MUX Interface is supported on HP BASIC/UX 300/400 only.

If the interface is not a serial-type interface, error 170 is reported. If an I/O path name assigned to a device selector with addressing information, error 170 is reported. If the specified interface is not present, error 163 is reported.

B

BUFFER

BUFFER is a secondary keyword for the following statements:

ASSIGN
COM
COMPLEX
DEF FN
DIM
INTEGER
REAL
SUB.

BYE**B**

Supported On	UX DOS WS*
Option Required	RMBUX Binary
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

BYE (and alias for QUIT) terminates HP BASIC for HP BASIC/UX and HP BASIC/DOS. The statement is accepted by the editor for HP BASIC/WS, HP BASIC/UX, and HP BASIC/DOS, but it will only execute on HP BASIC/UX and HP BASIC/DOS.

Example Statements

```
BYE
IF A$="DONE" THEN BYE
```

Semantics

When used within a program, BYE stops the program, and then HP BASIC terminates.

When BYE is executed from the command line while a program is running, an error is given. You must first stop (or pause) the program before using the BYE command.

If a program is not running, then HP BASIC terminates immediately.

B

BYTE

See ASSIGN.

C

CALL - CYCLE

c

CALL

Supported On	UX WS DOS IN*
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

CALL transfers program execution to the specified subprogram and optionally passes parameters to the subprogram.

Example Statements

```
CALL Process(Reference,(Value),@Path)
```

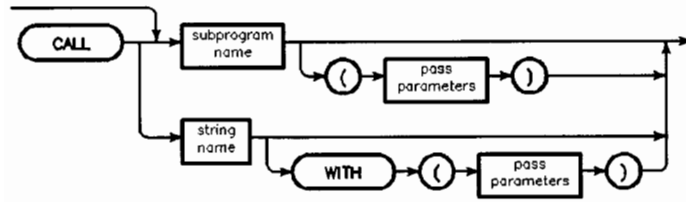
```
CALL Transform(Array(*))
```

```
Transform(Array(*))
```

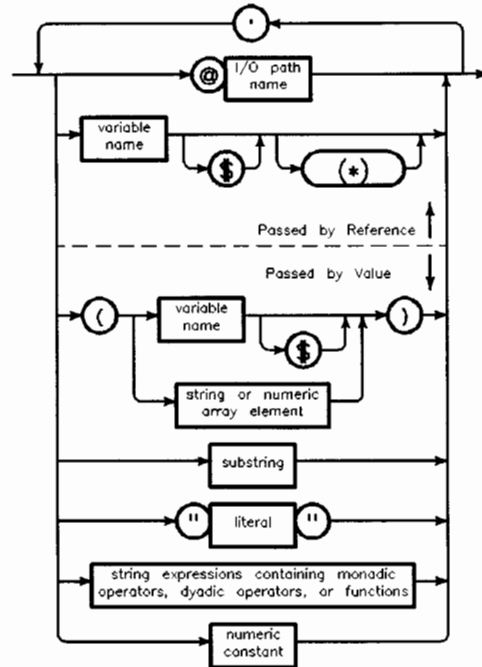
```
CALL MySub$
```

```
CALL MySub$ WITH (X,Y,A$)
```

CALL



pass parameters:



C



CALL

Item	Description	Range
subprogram name	name of the SUB or CSUB subprograms to be called	any valid name
string name	a simple string variable containing the name of a user-defined subprogram	loaded SUBs and CSUBS
I/O path name	name assigned to a device, devices, or mass storage file	any valid name (see ASSIGN)
variable name	name of a string or numeric variable	any valid name
substring	string expression containing substring notation	(see Glossary)
literal	string constant composed of characters from the keyboard, including those generated using the ANY CHAR key	—
numeric constant	numeric quantity expressed using numerals, and optionally a sign, a decimal point, and/or exponent notation	—

Semantics

A subprogram may be invoked by a stored program line, or by a statement executed from the keyboard. Invoking a subprogram changes the program context. Subprograms may be invoked recursively. The keyword `CALL` may be omitted if it is the first word in a program line. However, the keyword `CALL` is required in all other instances.

The pass parameters must be of the same type (numeric, string, or I/O path name) as the corresponding parameters in the SUB or CSUB statement. Numeric values passed by value are converted to the numeric type of the corresponding formal parameter. Variables passed by reference must match the corresponding parameter in the SUB statement exactly. An entire array may be passed by reference by using the asterisk specifier.

C-4 CALL - CYCLE

If there is more than one subprogram with the same name, the lowest-numbered subprogram is invoked by a CALL.

Program execution generally resumes at the line following the subprogram CALL. However, if the subprogram is invoked by an event-initiated branch, program execution resumes at the point at which the event-initiated branch was permitted.

When CALL is executed from the keyboard, the subprogram is executed in its own separate context. Furthermore, the current state of the system determines the system's state when the subprogram executes a STOP. If the computer was paused or stopped when CALL was executed, its state does not change. If the computer was running when the CALL was executed, the program pauses at the program line which was interrupted by the CALL for the subprogram, and resumes execution at that point after the subprogram is exited.

CALL Using String Names

You can specify the subprogram accessed by CALL using either the subprogram name or a string expression that evaluates to the subprogram name. All of the calls to Mysub in the following code segment are legal:

```

100 Name$="Mysub"           using subprogram name with CALL
110 CALL Mysub(1)
120 Mysub(2)               using subprogram name without CALL
120 CALL Name$ WITH (3)    using string name with CALL
130 END
140 !
150 SUB Mysub(I)
160     PRINT "HELLO";I
170 SUBEND

```

Note that the string name must match the subprogram name *exactly*, including upper and lower case letters. Also note that you *must* use the keyword CALL with string subprogram names.

CASE

See SELECT ... CASE.

C

CAT

Supported On	UX WS DOS* IN*
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

CAT lists the contents (files) in a specified directory or mass storage volume. CAT can also list selected information about the contents of a program (PROG-type) file.

Example Statements

```

CAT          ! List contents of current MSI volume/directory.

CAT TO A$(*) ! List contents of current MSI to string variable.

CAT ":",700,1" ! List contents of an HP-IB disk at 700.

CAT "Dir1/Dir2" ! List contents of a subdirectory.

CAT "PROG_File" ! List subprogams in PROG_file.

CAT TO #701     ! List to an HP-IB printer at 701.

CAT "Monday_?"

CAT "[0-9]*" ! WILDCARDS UX only

CAT ":REMOTE"

CAT ":REMOTE; LABEL Mastervol"

CAT "A/B/C:REMOTE"

CAT "../../"

CAT "Dir1/Dir2"

CAT "Dir_1/Sub_dir*"

CAT "HFS_Dir";Names

CAT "PROG_File"

```

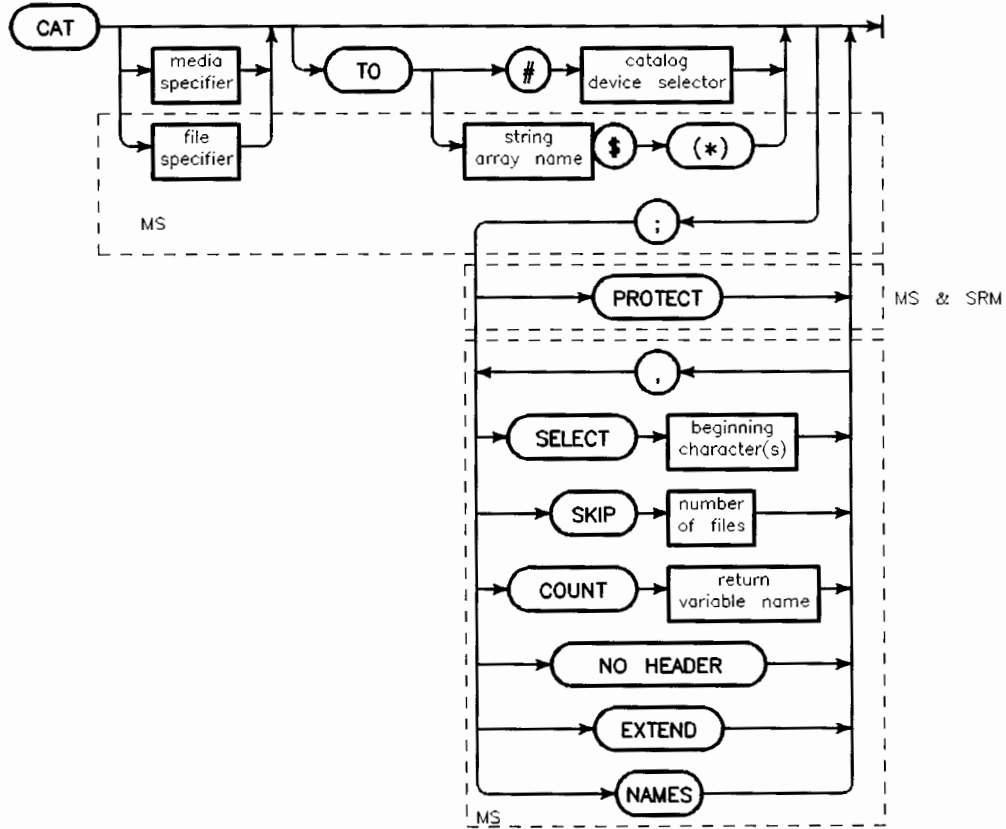

CAT

```
CAT;SELECT "D",SKIP Ten_files,NO HEADER
```

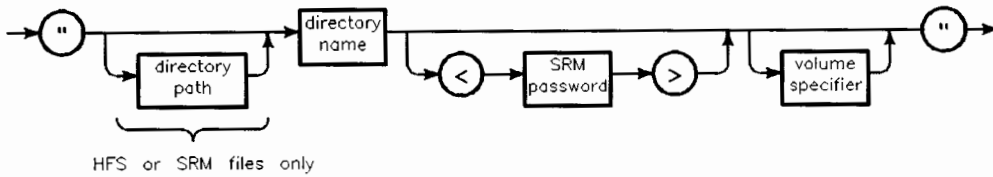
```
CAT TO String_array$(*)
```

```
CAT TO Hfs_dir$(*);EXTEND
```

C



literal form of directory specifier:



C-8 CALL - CYCLE

literal form of DFS directory specifier:



C

CAT

Item	Description	Range
directory specifier	string expression; Default=MASS STORAGE IS directory	(see MASS STORAGE IS)
volume specifier	string expression; Default=MASS STORAGE IS volume	(see MASS STORAGE IS)
file specifier	string expression specifying a PROG-type file	(see drawing)
directory path	literal	(see MASS STORAGE IS)
file name	literal	depends on volume's format (see Glossary)
LIF protect code	literal; first two non-blank characters are significant	> not allowed
SRM password	literal; first 16 non-blank characters are significant	> not allowed
catalog device selector	numeric expression, rounded to an integer; Default=PRINTER IS device	(see Glossary)
string array name	name of a string array (see text)	any valid name
beginning character(s)	string expression	1 to 10 characters (LIF); 1 to 14 characters (HFS; short file names); 1 to 255 characters (HFS; long file names); 1 to 16 characters (SRM)
number of files	numeric expression, rounded to an integer	1 through 32 767
return variable name	name of a numeric variable	any valid name

C-10 CALL - CYCLE

Semantics

The catalog shows information such as the name of each file, whether or not it is protected, the file's type and length, and the number of bytes per logical record.

The file types recognized in HP BASIC are: ASCII, BDAT (data), BIN (binary program), HP-UX, PROG (program), PROG2 (HP BASIC/UX 700 program), DOS (DOS File System), and SYSTM (operating system). An ID number is listed for any unrecognized file types.

See the WILDCARDS statement for more information regarding the use of wildcards with CAT.

LIF Catalogs

The LIF catalog format is shown below. This catalog format requires that the PRINTER IS device have the capability of displaying 65 or more characters. If the printer width is less than 65, the DATE and TIME columns are omitted.

```

:CS80,700
VOLUME LABEL: B9836
FILE NAME PRO TYPE REC/FILE BYTE/REC ADDRESS DATE TIME

MyProg      PROG      14      256      16 23-May-87 7:58
VisiComp    ASCII      29      256      30 8-Apr-87 6:00
GRAPH       BIN        171     256      59 1-May-87 1:00
GRAPHX      BIN        108     256     230 10-Aug-87 9:00

```

The first line of the catalog shows the volume specifier (:CS80,700 in this example).

The second line shows the volume label—a name, containing up to 6 characters, stored on the media (B9836 in this example).

The third line labels the columns of the remainder of the catalog. Here is what each column means:

FILE NAME lists the names of the files in the directory (up to 10 characters).

PRO indicates whether the file has a protect code (* is listed in this column if the file has a protect code).

FILE TYPE lists the type of each file.

CAT

REC/FILE indicates the number of records in the file.
BYTE/REC indicates the record size.
ADDRESS indicates the number of the beginning sector in the file.
DATE indicates when the date the file was last modified.
TIME indicates the time the file was last modified.

HFS Catalogs

In order to perform a CAT of an HFS directory, you need to have R (read) and X (search) permissions on the directory to be cataloged, as well as X (search) permissions on all superior directories.

In order to perform a CAT of an HFS file, you need to have R (read) permission on the file to be cataloged, as well as X (search) permissions on all superior directories.

Here is a typical catalog listing of an HFS directory. Note that a 50 column display truncates this catalog listing after the column with TIME in it. Therefore, the PERMISSION, OWNER, and GROUP columns will be not be listed.

```
:CS80, 700
LABEL: MyVol
FORMAT: HFS
AVAILABLE SPACE:      60168

      FILE   NUM  REC   MODIFIED
FILE NAME  TYPE  RECS  LEN DATE      TIME PERMISSION OWNER GROUP
=====
lost+found DIR    0    32 19-Nov-86 10:47  RWXRWXRWX  18  9
FILEIOD   PROG  191  256 21-Nov-86  9:03  RW-RW-RW-  18  9
RBDAT    BDAT   2   256 21-Nov-86  9:10  RW-RW-RW-  18  9
CATTOSTR PROG   2   256  1-Dec-86  8:02  RW-RW-RW-  18  9
```

The first line of the catalog shows the volume specifier (:CS80,700 in this example).

If the directory path specifier contains more characters than the display width, the last 49 or 79 characters (depending on the display width) are shown. An asterisk (*) as the left-most character in the path specifier indicates that leading characters were truncated for the display. In HP BASIC, the device type is always HFS, and no device selector is shown.

C-12 CALL - CYCLE

The second line shows the volume label—a name, containing up to 6 characters, stored on the media (**MyVol** in this example). In HP BASIC, the label is not shown.

The third line shows the format of the disk (**HFS** in this example). In HP BASIC, if the directory being displayed is on an HFS long file name volume (LFN), then the format will be shown as:

HFS LFN

The fourth line lists the number of available 256-byte sectors on the disk (60168 in this example). If the sector size is 1024 bytes, then each 1024-byte sector would count as 4 256-byte sectors.

The fifth line labels the columns of the remainder of the catalog. Here is what each column means:

FILE NAME Lists the name of the file. HP BASIC truncates file names longer than 14 characters and places an * at the end of the name. Note that **CAT;NAMES** does display the full name, even on long file name systems.

FILETYPE Lists the file's type (for instance, **DIR** specifies that the file is a directory; **PROG** specifies an HP BASIC program file; **PROG2** specifies an HP BASIC/UX 700; **BDAT** specifies a data file; etc.) if you have read permission. If you do not have read permission, the file type is left blank.

HP BASIC also has these file types in addition:

- CDEV, character device file
- BDEV, block device file
- SLINK, symbolic link without a valid target
- PIPE, named pipe
- NET, RFA network special file
- CDF, context dependent file (used in diskless clusters)
- LOCKD, the file was locked by another user and its true type could not be determined.

NUMRECS number of **logical** records (the number of records allocated to the file when it was created). For a **DIR** file, this indicates the number of directory entries.

CAT

RECLEN the **logical** record size (default is 256 bytes; BDAT files can have user-selected record lengths). For a DIR file, this indicates the size of the directory entry. You **cannot** specify record length for ASCII or HP-UX files. The record length for HP-UX files is 1.

C

MODIFIED DATE TIME the day and time when the file was last modified.

PERMISSION specifies who has access rights to the file:

R indicates that the file can be read;

W indicates that the file can be written;

X indicates that the file can be searched (meaningful for directories only).

S (HP BASIC only) set-id bit is on, and the search bit is off.

s (HP BASIC only) set-id bit is on, and the search bit is on.

There are 3 classes of user permissions for each file:

OWNER (left-most 3 characters);

GROUP (center 3 characters);

OTHER (right-most 3 characters).

See PERMIT for further information.

OWNER specifies the owner identifier for the file (for HP BASIC/WS files, the default owner identifier is always 18). HP BASIC/UX shows the user id of the user that owns the file.

GROUP specifies the group identifier of the file or directory (for HP BASIC/WS, the default group identifier is always 9, which is used for “workstations” such as Series 200/300 BASIC and Pascal). HP BASIC/UX shows the group-id of the group that the file belongs to.

DOS File System Catalogs

The HP Measurement Coprocessor includes the DFS binary, which allows direct access to the PC's DOS file system. The DFS binary provides many of the same features as HFS.

Here is a typical catalog listing of a DOS directory:

```

DIRECTORY: C:\PROJECTS\PROJECT.ONE
LABEL: HARD_DISK_C
FORMAT: DOS
AVAILABLE SPACE:      66776

      FILE      NUM  REC   MODIFIED
      NAME      TYPE RECS  LEN   DATE    TIME PERMISSION
=====
ASCII_1      ASCII    100  256  15-Apr-91  18:06  RW-RW-RW-
BDAT_1       BDAT      5   256  15-Apr-91  18:10  RW-RW-RW-
MEMOS        DIR       0    1   15-Apr-91  14:29  RWXRWXRWX

```

The first line of the catalog shows the path name of the directory to be cataloged (C:\PROJECTS\PROJECT_ONE in this example).

The second line gives the volume label of the MS-DOS disk.

The third line gives the format of the mass storage medium, which is "DOS" for any DOS volume.

The fourth line lists the number of 256-byte sectors on the disk (66776 in this example).

The fifth and sixth lines label the columns of the catalog.

- FILE NAME** Lists the name of the file. The standard MS-DOS file-name conventions are used (up to eight characters followed by an optional period and an extension of up to three characters).
- FILE TYPE** Lists the type of the file. DIR specifies a directory. ASCII, BDAT, PROG, and PROG2 specify the standard HP BASIC data and program file types. DOS specifies an "untyped" MS-DOS file.
- NUM RECS** Lists the number of logical records (the number of records allocated to the file when it was created). For a DIR file, NUM RECS is always 0.

CAT

REC LEN The logical record size. The record length is always 256 for an ASCII file, and always 1 for a DOS file. The default record length for a BDAT file is 256, but you can specify a user-defined record length. For a DIR file, REC LEN is always 1.

C

MODIFIED The date and time when the file was last modified.
DATE TIME

PERMISSION Specifies who has access rights to the file:

R indicates that the file can be read. W indicates that the file can be written to. X indicates that the file can be searched (meaningful for directories only).

There are three classes of user permissions for each file:

OWNER (left-most 3 characters). GROUP (center 3 characters). OTHER (right-most 3 characters).

By default, the DFS binary sets the permissions for all new files to "RW-RW-RW-" and for all new directories to "RWXRWXRWX". You can use the PERMIT statement to make a file read-only. However, if you change the OWNER bits, the GROUP and OTHER bits will also change. Refer to the PERMIT statement for more details.

CAT of an SRM Directory (not supported on HP BASIC/UX 700)

In order to perform a CAT of an SRM directory or file, you need to have R (read) access capability on the directory to be cataloged, as well as R capability on all superior directories.

The catalog listing format used by the SRM system depends upon the line-width capacity of the device used for display.

When cataloging a remote directory on a 50-column display, the SRM system uses the following catalog format:

```

USERS/STEVE/PROJECTS/DIR1:REMOTE 21,0
LABEL:   Disk1
FORMAT:  SDF
AVAILABLE SPACE:      54096

FILE NAME      PUB FILE  NUMBER RECORD  OPEN
              ACC TYPE  RECORDS LENGTH  STAT
=====
Common_data    MRW ASCII   48    256 OPEN
Personal_data          BDAT   33    256 LOCK
Program_alpha   RW  PROG   44    256
HP9845_DATA     R  DATA? 22    256
HP9845_STORE    MRW PROG?  9    256
Pascal_file.TEXT MRW  TEXT  37    256
Program_500     MRW PROG? 12    256

```

When cataloging an SRM directory on an 80-column display, the system uses the following catalog format:

```

USERS/STEVE/PROJECTS/DIR1:REMOTE 21,0
LABEL:   Disk1
FORMAT:  SDF
AVAILABLE SPACE:  54096 SYS FILE  NUMBER  RECORD  MODIFIED  PUB OPEN
FILE NAME      LEV TYPE  TYPE  RECORDS  LENGTH DATE   TIME ACC STAT
=====
Common_data      1      ASCII   48    256  2-Dec-83 13:20 MRW OPEN
Personal_data    1 98X6 BDAT   33    256  2-Dec-83 13:20      LOCK
Program_alpha    1 98X6 PROG   44    256  3-Dec-83 15:06  RW
HP9845_DATA      1 9845 DATA  22    256 10-Oct-83  8:45  R
HP9845_STORE     1 9845 PROG   9     256 10-Oct-83  8:47 MRW
Pascal_file.TEXT 1 PSCL TEXT  37    256 11-Nov-83 12:25 MRW
Program_500      1 9000 PROG   12    256 13-Dec-83  9:54 MRW

```

The header gives you the following information:

line 1 Directory specifier, including volume specifier. The full path to the specified directory is displayed. Passwords used in the path are not displayed.

If the directory path specifier contains more characters than the display width, the last 49 or 79 characters (depending on catalog format) in the path specifier are shown. An asterisk (*) as the left-most character in the path specifier indicates that leading characters were truncated for the display.

CAT

The system remembers a maximum of 160 characters for any directory path specifier at a single time. If a path specifier contains more than 160 characters, the excess characters are removed from the beginning of the specifier and are not retained. This restriction does not affect movement within the directory structure.

C

- line 2 Volume label of the volume containing the directory being cataloged.
- line 3 Directory format, such as SDF (Structured Directory Format).
- line 4 Number of bytes available on the volume (given in increments of 256 bytes).
- lines 5 Labels for columns of information given for each file. The
- and 6 information provided is summarized below.

Each *column* of the remaining catalog gives you the following information:

- | | |
|------------------|---|
| FILE NAME | lists the names of the files and directories in the directory being cataloged. |
| LEV | (80-column format only) shows the level of the file relative to the current working directory or specified directory. (The level is always shown as 1 in directory listings for Series 200/300/400 workstations.) |
| PUB ACC | lists the access capabilities available to all SRM system users. The three capabilities are READ, (R) WRITE (W) and MANAGER (M). <ul style="list-style-type: none">■ Public MANAGER capability on a file or directory allows any user on the SRM system to PURGE that file or directory and to modify or add to its passwords (with PROTECT). Password-protected MANAGER capability gives users who supply the required password both READ and WRITE capabilities as well as MANAGER capability.■ READ capability on a directory allows you to access any file or directory in the directory. The READ capability on a file allows you to read the contents of the file.■ WRITE capability on a directory allows you to create or delete a file or directory in that directory. The WRITE |

capability on a file allows you to write information into that file.

SYS TYPE	(80-column format only) shows the type of system used to create the file. The system type is not shown for ASCII files and directories. 98X6 denotes a Series 200/300 computer. (If the system does not recognize the system type, a coded identifier, obtained from the system being identified, appears in this column.)
FILE TYPE	<p>indicates the file's type. Directories are indicated as type DIR. In the 50-column format, a question mark is appended to the file type if the file was not created on a Series 200/300 computer and was a type other than ASCII or DIR. For example, in the display illustrated earlier, DATA and PROG files created on an HP 9845 are listed as such, but shown with the question mark.</p> <p>File types recognized by the HP BASIC system on SRM are: ASCII, BDAT, BIN, DIR, HP-UX, PROG, PROG2, and SYSTM, as well as Series 200/300 Pascal and Series 500 file types.</p> <p>If the system does not recognize a file's type, a coded file type identifier (obtained from the system originating the file) appears in the FILE TYPE column.</p>
NUMBER RECORDS	indicates the number of records in the file.
RECORD LENGTH	indicates the number of bytes constituting each of the file's records.
MODIFIED	(80-column format only) show the date and time the file's contents were last changed.
OPEN STAT	shows whether the file is currently open (OPEN), locked (LOCK) or corrupt (CORR). OPEN indicates that the file has been opened, via ASSIGN, by a user. An open file is available for access from other workstations. LOCK means the file is accessible only from the workstation at which the file was locked. CORR indicates that the disk lost power while accessing the file,

C

CAT

possibly altering the file's contents. If the entry is blank, the file is closed and available to any user.

Note

If a file's status is shown as corrupt (CORR), you should run the DSCK Utility program to check the directory structure and its integrity on the SRM system disk. Refer to the *SRM System Administrator's Guide* (or *SRM Operating System Manual*) for details.

CAT of an SRM/UX Directory (not supported on HP BASIC/UX 700)

To perform a CAT of an SRM/UX directory or file, you need R (read) and X (search) permissions on the directory to be cataloged, as well as X (search) permissions on all superior directories.

To perform a CAT of an SRM/UX file, you need R (read) permission on the file to be cataloged, as well as X (search) permissions on all superior directories.

The catalog format used by SRM/UX depends on the line-width capacity of the display device.

On SRM/UX, a catalog of a directory on a 50-column display has the following format:

```
:REMOTE 21,0
LABEL: BOOT
FORMAT: SRM-UX
AVAILABLE SPACE: 123456789
  FILE  NUMBER REC      OP
FILE NAME  TYPE RECORDS LEN  PERMS ST
=====
SYSTEMS    DIR         11  24  RWXR-XR-X
console    CDEV         0   1  RW--W--W-
EDITTEST.TEXT TEXT         8 256  RW-R--R--
AUTOST     PROG         2 256  RW-R--R--
srmdpipe   PIPE         0   1  RW-----
EST        ASCII        1 256  RW-RW-RW- L0
PTESTCAT   HP-UX       984  1  RW-RW-R-- 90
```

On SRM/UX, a catalog of a directory on an 80-column display has the following format:

```

:REMOTE 21,0
LABEL:  BOOT
FORMAT: SRM-UX
AVAILABLE SPACE: 123456789

```

FILE NAME	FILE TYPE	NUMBER RECORDS	REC LEN	MODIFIED DATE	TIME	PERMS	OWNER	GROUP	STAT	OPEN
SYSTEMS	DIR	11	24	1-Mar-90	16:56	RWXR-XR-X	0		1	
console	CDEV	0	1	12-Oct-90	17:05	RW--W--W-	0		1	
EDITTEST.TEXT	TEXT	8	256	12-Dec-89	15:20	RW-R--R--	175		54	
AUTOST	PROG	2	256	5-Jan-90	15:07	RW-R--R--	175		54	
srmdpipe	PIPE	0	1	12-Oct-90	11:45	RW-----	0		1	
PTEST	ASCII	1	256	2-Jan-90	10:51	RW-RW-RW-	17		9	LOCK
PTESTCAT	HP-UX	984	1	2-Mar-90	15:12	RW-RW-R--	175		54	OPEN

The header gives you the following information:

- line 1 Directory and volume specifier. The full path to the specified directory is displayed.
- If the directory path specifier contains more characters than the display width, the last 49 or 79 characters (depending on catalog format) in the path specifier are shown. An asterisk (*) as the left-most character in the path specifier indicates that leading characters were truncated for the display.
- line 2 Label of the volume containing the directory being cataloged.
- line 3 Directory format.
- line 4 Number of bytes available on the volume in 256-byte increments.
- lines 5 and 6 Labels for columns of information given for each file.

The columns in the catalog give you the following information:

- FILE NAME** lists the names of the files and directories in the directory being cataloged.
- FILE TYPE** indicates the file type. File types recognized by HP BASIC on SRM/UX are the following:
- DIR - directory

CAT

PROG - program file

PIPE - named pipe

The SRM/UX user can also see the following special HP-UX files in a CAT listing, but cannot manipulate them:

NET - network special file

SOCK - HP-UX socket

BDEV - block special file

CDEV - character special file

HP BASIC/WS on SRM/UX also recognizes TEXT and ASCII files.

If the system does not recognize a file type, it prints a numeric code or "OTHER".

NUMBER RECORDS	indicates the number of records in a file.
REC LEN	indicates the number of bytes in each file record (always 24 for directories (DIR), regardless of actual size).
MODIFIED DATE/TIME	(80-column format only) shows the date and time when the file's contents were last changed.
PERMS	specifies who has access rights to a file. R - indicates that a file can be read. W - indicates that a file can be written. X - indicates that a directory can be searched (meaningful for directories only). Three classes of user permissions exist for each file: OWNER - left-most three characters. GROUP - center three characters. OTHER - right-most three characters. See PERMIT for further information.
OWNER	specifies the owner identifier for the file. HP BASIC/WS on SRM/UX shows the user id of the user that owns the file.

GROUP specifies the group identifier of the file or directory. HP BASIC/WS on SRM/UX shows the group id of the group to which the file belongs.

OPEN STAT shows whether the file is currently open (**OPEN**) or locked (**LOCK**). **OPEN** indicates that the file has been opened, via **ASSIGN**, by a user. An open file is available for access from other workstations. **LOCK** means the file is accessible only from the workstation at which the file was locked. If the entry is blank, the file is closed and available to any user.



CAT to a Device

When the symbol # is included in a CAT statement, the numeric expression following this symbol must be a device selector. The catalog listing is sent to the device specified by this expression.

CAT to a String Array (Requires MS)

Catalog listings can be sent to a string array. The array must be one-dimensional, and each element of the array must contain at least 80 characters for a directory listing or 45 characters for a PROG-type file listing.

If the directory information does not fill the array, the remaining elements are set to null strings. If the directory information “overflows” the array, the overflow is not reported as an error. When a CAT of a mass storage directory is sent to a string array, the catalog’s format is different than when sent to a device. This format is shown below. Protect status is shown by letters, instead of an asterisk. An unprotected file has the entry **MRW** in the **PUB ACC** (public access) column. A protected **BDAT** file has no entry in that column. Other types of protected files show **R** (read access). In addition to the standard information, this format also shows **OPEN** in the **OPEN STAT** column when a file is currently assigned.

```

:CS80,702,0
VOLUME LABEL: B9836
FORMAT: LIF
AVAILABLE SPACE: 11

```

FILE NAME	SYS TYPE	FILE TYPE	NUMBER RECORDS	RECORD LENGTH	MODIFIED DATE	PUB TIME	OPEN ACC	STAT
-----------	----------	-----------	----------------	---------------	---------------	----------	----------	------

CAT

```
=====
SYSTEM_BA5      1 98X6  SYSTM   1024      256 29 Nov 86 15:24:55 MRW
AUTOST          1 98X6  PROG     38      256 29 Nov 86 09:25:07 MRW
```

To aid in accessing the catalog information in a string, the following table gives the location of some important fields in the string.

C

Field	Position (in String)
File Name	1 through 21
File Type	32 through 36
Number of Records	37 through 45
Record Length	46 through 54
Time Stamp	56 through 71
Public Access Capabilities	73 through 75
Open Status	77 through 80

The EXTEND Option (Requires MS)

If EXTEND is specified in a CAT TO String_array\$(*) operation, the directory catalog will be in HFS format for an HFS disk, LIF format for a LIF disk, and SRM/UX format for an SRM/UX directory.

With an HFS disk, each element of the array must contain at least 49 characters. If each element has less than 72 characters, the PERMISSION, OWNER, and GROUP are omitted. With a LIF disk, each element of the array must contain at least 47 characters. If each element has less than 65 characters, the DATE and TIME will be omitted. With an SRM or SRM/UX directory, each element of the array must contain at least 80 characters.

NAMES takes precedence over EXTEND if both are given.

Catalogs of PROG-Type Files (Requires MS)

If the file specifier is for a PROG or PROG2 file, the following information is included:

- a list of binary programs in the file,
- a list of all contexts in the program,
- and each context's type and size.

```

SAMPLE
NAME                SIZE TYPE
=====
MAIN                692 BASIC
Esc                 924 COMPILED UTILITY
FNDummy             166 BASIC
  AVAILABLE ENTRIES = 0

```

If any binary programs have a version code different from the HP BASIC, both a warning and the version codes of the binary program and HP BASIC system are included with the listing. CAT of a PROG-type file uses the same format, whether the destination is a device or a string.

Using CAT with SKIP (Requires MS)

Including the SELECT option directs the computer to list only the files that begin with or match the value of the specified string expression.

```
CAT; SELECT "B21"
```

If the string expression contains more characters than are allowed in a file name (10 for LIF, 14 for HFS, 255 for long file name systems, and 16 for SRM), then only the first 10 characters if LIF, 14 characters if HFS, or 16 characters if SRM are used. If SELECT is not included, all files are sent to the destination (if possible).

Including the SKIP option directs the computer to skip the specified number of (selected) file entries before sending entries to the destination.

```
CAT; SKIP 12
```

If SKIP is not included, no files are skipped.

CAT

If an option is given more than once, only the last instance is used.

Using CAT with COUNT (Requires MS)

Including COUNT provides a means of determining the number of lines sent to the destination, plus the number of files skipped, if any.

```
CAT; COUNT N_files
```

The variable that follows COUNT receives the sum of the number of selected files *plus* the number of lines in the catalog header (and trailer for PROG-type files); keep in mind that the number of selected files includes the number of files sent to the destination plus the number of files skipped, if any. Catalogs sent to external devices in the LIF format have a five-line header; in SRM and HFS formats they have seven-line headers. Catalogs to string arrays are SRM format unless EXTEND is added. Catalogs of individual PROG files have a three-line header and a one-line trailer. If an “overflow” of a string array occurs, the count is set to the number of string-array elements plus the number of files skipped. If no entries are sent to the destination (because the directory is empty, or because not entries were selected, or because all selected entries were skipped), the value returned depends on whether there is a header. If there is no header, then zero (0) is returned. If there is a header, then the value returned is the size of the header plus the number following the SKIP option (the number of files to be skipped).

When using WILDCARDS, COUNT receives the sum of the number of files matching the wildcard argument plus the number of lines in the catalog header plus the number of files skipped.

If an option is given more than once, only the last instance is used.

Using the NAMES Option (Requires MS)

Using the NAMES option, as shown in the following statement, will produce a multi-column listing of *only* the names of the files.

```
CAT ; NAMES Return
```

```
lost+found    WORKSTATIONS    SYSTEM_BA5    MY_PROG    DATA_13  
  
PROJECTS
```

Executing the following statement:

```
CAT TO A$(*);NAMES
```

will put one file name in each array element.

CAT TO *string*;NAMES in HP BASIC/UX may cause a string overflow if a file name is longer than 14 characters (since longer names are allowed in HP BASIC/UX), and the string array is not large enough to hold the entire name.

Suppressing the Heading (Requires MS)

Including the NO HEADER option directs the computer to omit the directory header (and trailer) that would otherwise be included.

```
CAT ; NO HEADER
```

When NO HEADER is specified, the lines of the header (and trailer) are then omitted from the COUNT variable.

When NAMES is specified, there is NO HEADER whether or not NO HEADER is specified.

The PROTECT Option (SRM Only; not supported on HP BASIC/UX 700)

PROTECT is a CAT option available *only* on SRM volumes. This option requires the SRM, DCOMM, and MS binaries. The PROTECT option displays the password(s) and associated access capabilities for the specified file or directory.

For example, the statement:

```
CAT "Test_file<MPASS>:REMOTE";PROTECT
```

might produce the display:

PASSWORD	CAPABILITY
=====	=====
MPASS	MANAGER,READ,WRITE
WPASS	WRITE
RPASS	READ

CAT

PASSWORD MANAGER

Use of this option requires **MANAGER** access capability on the file or directory. If the **MANAGER** capability is public, the **PROTECT** option may be used by any SRM user.

PROTECT must be specified separately from other **CAT** options, and is allowed only with SRM files and directories. Note that the **PROTECT** option is a no-op on SRM/UX. If you use this option on SRM/UX, you will see a header with no passwords listed.

Using **PROTECT** with media other than SRM returns **ERROR 1 Configuration Error**.

HP BASIC/DOS Specifics

CAT functions the same as for **HP BASIC/WS** except that the **HFS** binary is not included with the measurement coprocessor; it must be purchased separately if desired. The **DFS** binary provides additional **HP BASIC/DOS** functionality described earlier in this section.

CAUSE ERROR

Supported On	UX WS DOS
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

CAUSE ERROR simulates the occurrence of an error of the specified number.

Example Statements

```
CAUSE ERROR Err_num
IF Testing THEN CAUSE ERROR 80
```

Syntax



Item	Description	Range
error number	numeric expression, rounded to an integer	1 through 999; 1001 through 1080

Semantics

When this statement is executed, it initiates the normal error-reporting action taken by the system when an error is encountered in a program line.

If ON ERROR is in effect and CAUSE ERROR is executed in a program line, the appropriate branch is initiated—just as if an actual error occurred on that line. When executed from a running program, CAUSE ERROR affects the error indications ERRN, ERRM\$, ERRL, and ERRLN; each is set to the value appropriate for the specified error number and line number. However, ERRDS is not affected.



CAUSE ERROR

If CAUSE ERROR is executed at the keyboard, or if executed in a running program (while ON ERROR is not in effect), HP BASIC shows the error number (and error message, if the ERR binary is present) in the system message line of the display. (Note that errors caused by executing statements from the command line do not affect the error indications listed in the preceding paragraph.)

C

CDIAL

Supported On	UX* WS DOS
Option Required	KBD
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

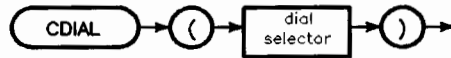
C

CDIAL returns information about “control dial” devices.

Example Statements

```
CDIAL(1)
IF BIT(CDIAL(0),3) THEN GOSUB Dial3_touched
```

Syntax



Item	Description	Range
dial selector	numeric expression, rounded to an integer	0 through 15

Semantics

Two different types of results can be returned by this function:

- If a value of 0 is passed to the CDIAL function, it returns a 16-bit status word specifying which knobs have been rotated. Bit 1 set indicates that dial 1 has been rotated; bit 2 set indicates that dial 2 has been rotated; and so forth through bit 15. (Bit 0 is not used.)
- If a value of 1 through 15 is passed, the function returns the number of pulses accumulated for that particular dial (and clears the corresponding pulse counter).

CDIAL

HP BASIC/UX Specifics

Devices to be addressed using CDIAL must not have been opened by the X Windows server. These devices must also be connected to a local system since they cannot be accessed on a remote system. See the section “Opening Input Devices” in the chapter “System-Level Customization” found in the *Using the X Window System, Version 11* manual, for details on how to prevent the X Window server from opening specified HIL devices.

C

CHANGE

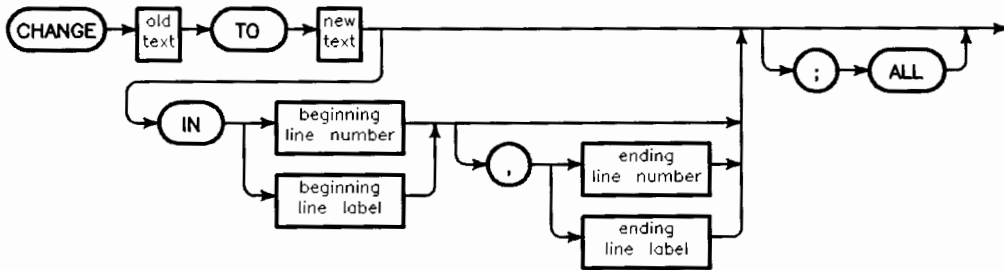
Supported On	UX WS DOS
Option Required	EDIT and PDEV
Keyboard Executable	Yes
Programmable	No
In an IF ... THEN ...	No

CHANGE provides search-and-replace operations for editing programs.

Example Statements

```
CHANGE "Old Text" TO "New Text"
CHANGE "Row" TO "Column" IN 2560,3310
CHANGE "November" TO "December";ALL
```

Syntax



CHANGE

Item	Description	Range
old text	literal	—
new text	literal	—
beginning line number	integer constant identifying a program line	1 through 32 766 (1 through 2 147 483 646 for HP BASIC/UX 700)
beginning line label	name of a program line	any valid name
ending line number	integer constant identifying a program line	1 through 32 766 (1 through 2 147 483 646 for HP BASIC/UX 700)
ending line label	name of a program line	any valid name

Semantics

CHANGE finds all occurrences of a specified character sequence and replaces it with another. This occurs whether the character sequence is found in variable names, keywords, literals, or line numbers. Note that if line numbers are changed, unexpected results may occur.

If ALL is specified, all legal changes are made automatically, without additional keyboard interaction. If ALL is not specified, the computer finds each occurrence, tentatively changes old text to new text, and asks you to confirm the change.

- You confirm a particular change by pressing **Return** or **ENTER**.
- You may bypass a particular change by pressing **CONTINUE** (**f2** on an ITF keyboard), or **Shift-Clear line** followed by **Return** (**CLR LN** followed by **ENTER** on a 98203 keyboard).

▲ and **▼** exit CHANGE mode. **EXECUTE** confirms a change, and exits CHANGE mode.

CHANGE

When the specified range is exhausted or the end of the program is reached, the CHANGE command is terminated and the message "*old text*" not found is displayed.

During the course of a CHANGE, if a syntax error is caused by the altered text, the appropriate error message is displayed. When the line is corrected and entered, the CHANGE command continues.

If a change causes a line to become longer than the maximum length of a line of code, a syntax error is generated, the erroneous change will not take place, and the CHANGE command is aborted. The CHANGE command will also be aborted if a replacement results in the alteration of a line number, although the line whose number was changed now exists in two locations.

If the starting line number does not exist, the next line is used. If the ending line number does not exist, the previous line is used. If a line label doesn't exist, an error occurs and the CHANGE is cancelled.

If there were no occurrences found, the cursor is left at the end of the first line searched. If one or more occurrences were found, the cursor is left at the end of the line containing the last occurrence.

CHANGE is not allowed while a program is running; however, it may be executed while a program is paused. The program is continuable if it has not been altered by pressing **Return** or **Delete line** (**ENTER** or **DEL LN**).

While in the CHANGE mode, keyboard execution of commands is only possible with the **EXECUTE** key on a 98203 keyboard. Using **ENTER** causes an error.

C

C CHECKREAD

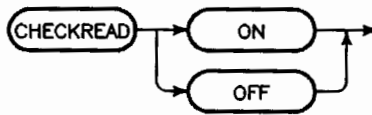
Supported On	UX WS DOS*
Option Required	MS
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

CHECKREAD enables or disables optional read-after-write verification of data sent to mass storage media. Default condition is OFF.

Example Statements

```
IF Important_data THEN CHECKREAD ON
CHECKREAD OFF
```

Syntax



Semantics

Executing CHECKREAD ON directs the computer to perform a read-after-write verification of every sector of data sent to mass storage files by any of the following statements (executed in any program context):

COPY	PRINT LABEL	RE-STORE
CREATE	PROTECT	SAVE
CREATE ASCII	PURGE	STORE
CREATE BDAT	RENAME	TRANSFER
OUTPUT	RE-SAVE	

If the bit-by-bit comparison does not detect an exact match, an error is reported.

Executing CHECKREAD OFF cancels this optional verification.

C-36 CALL - CYCLE

CHECKREAD

Keep in mind that using this feature may increase data reliability, but at the expense of reduced disk-access speed and increased disk wear.

CHECKREAD does not affect PRINTER IS file or PLOTTER IS file.

CHECKREAD of SRM Volumes (not supported on HP BASIC/UX 700)

For SRM, CHECKREAD is implemented as a no-op, because the CHECKREAD function is already performed (by the SRM system) for every HP BASIC operation that reads or writes an SRM file.

CHECKREAD of HFS Volumes with HP BASIC/UX

Because HP BASIC/UX uses the HP-UX operating system file system, buffer cache for all HFS file I/O, it is not possible to verify the data on the physical media. Therefore, CHECKREAD is not appropriate for HFS with HP BASIC/UX.

HP BASIC/DOS Specifics

For HFS, CHECKREAD functions the same as for HP BASIC/WS if the HFS binary has been installed. CHECKREAD is not supported for DFS.

C

C

CHGRP

Supported On	UX WS DOS
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

CHGRP modifies the group identifier of an HFS or SRM/UX file or directory (for HP-UX compatibility).

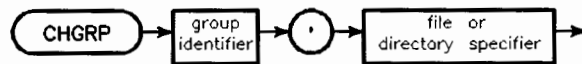
Example Statements

```
CHGRP New_group_id,"/DirPath/HFSfile"
```

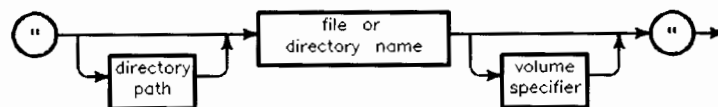
```
CHGRP 15,"*"
```

```
CHGRP 16,"[a-z]?" ! WILDCARDS UX only
```

Syntax



literal form of HFS or SRM/UX file or directory specifier:



Item	Description	Range
group identifier	numeric expression, rounded to an integer	0 through 32 767
file or directory specifier	string expression specifying a file on an HFS or SRM/UX volume	(see drawing)
directory path	literal	(see MASS STORAGE IS)
HFS directory or file name	literal	1 to 14 characters (short file name systems), 1 to 255 characters (long file name systems)
SRM/UX file or directory name	literal	1 to 16 characters
volume specifier	literal	(see MASS STORAGE IS)

Semantics

To execute CHGRP, you must currently own the file or directory. For HFS files and directories, the owner identifier must be 18. SRM/UX users should obtain information about their owner identifier from their system administrator.

If you change the ownership with CHOWN, then you *cannot* subsequently use CHGRP to change the group identifier of the file.

If no directory path is specified, the current working directory is assumed. If no volume is specified, the current default volume is assumed.

If you are using a version of HP BASIC that supports wildcards, you can use them in file specifiers with CHGRP. You must first enable wildcard recognition using WILDCARDS. Refer to the keyword entry for WILDCARDS for details.

CHGRP

Major Objective: HP-UX Compatibility

This keyword is implemented primarily for compatibility with the HP-UX operating system. Group identifiers allow files and directories to be accessed by all users in the same group, while restricting access to users in all other groups. Therefore, you can use CHGRP to give group permissions to a specific HP-UX group. HP BASIC will no longer have group permissions on the file, but it will retain owner permissions (unless ownership is changed—such as with CHOWN).

For a list of group identifiers used on an HP-UX system, see your HP-UX system administrator. or look at the identifiers listed in the `/etc/group` file on the HP-UX system. This file could contain the following entry, which defines the relationship between the group named `workstation` and the group identifier 9.

```
workstation::9:basic,pws
```

If this group identifier is currently being used on an HP-UX system that is to share a disk with HP BASIC, then the HP-UX system administrator may need to change the `/etc/group` file so that HP BASIC is assigned this group identifier. Otherwise, all other HP-UX users with this group identifier will have the current group access permissions to *all* HP BASIC files and directories.

Note that the Series 200/300 HP BASIC and Pascal operating systems have the same group identifier of 9; however, Pascal has an owner identifier of 17.

For a list of group identifiers used on SRM/UX, see your system administrator or look at the identifiers listed in `/etc/srmdconf`.

CHOWN

Supported On	UX WS DOS
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

CHOWN modifies the owner identifier of an HFS or SRM/UX file or directory (for HP-UX compatibility).

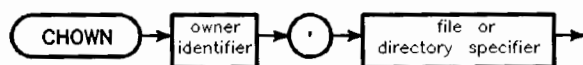
Example Statements

```
CHOWN Other_owner_id,"/DirPath/HFSfile"
```

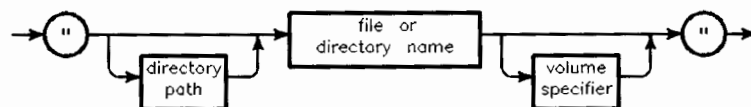
```
CHOWN 17,"?_*"
```



Syntax



literal form of HFS or SRM/UX file or directory specifier:



CHOWN

Item	Description	Range
owner identifier	numeric expression, rounded to an integer	0 through 32 767
file or directory specifier	string expression specifying a file on an HFS or SRM/UX volume	(see drawing)
directory path	literal	(see MASS STORAGE IS)
HFS directory or file name	literal	1 to 14 characters (see Glossary)
SRM/UX file or directory name	literal	1 to 16 characters
volume specifier	literal	(see MASS STORAGE IS)

Semantics

To execute CHOWN, you must currently own the file or directory. That is, the owner id of the file must match your user-id. HP BASIC/UX user-ids can be found in the file `/etc/passwd`. For HFS files and directories on HP BASIC/WS, the user-id is always 18. SRM/UX users should obtain information about owner identifiers from their system administrator or look at the owner identifiers listed in `/etc/srmdconf`.

If you change the ownership with CHOWN, then you *cannot* subsequently use CHOWN to change the owner identifier of the file or directory.

If no directory path is specified, the current working directory is assumed. If no volume is specified, the current default volume is assumed.

If you are using a version of HP BASIC that supports wildcards, you can use them in file specifiers with CHOWN. You must first enable wildcard recognition using WILDCARDS. Refer to the keyword entry for WILDCARDS for details.

Major Objective: HP-UX Compatibility

This keyword is implemented primarily for compatibility with the HP-UX operating system. Owner identifiers allow files and directories to have certain access permissions only available to the owner, while restricting access to all other users. Therefore, CHOWN can be used to give an HP-UX user the owner permissions of files and directories. The user, however, will still have group permissions of the file (unless the group identifier is changed—such as with CHGRP).

For a list of the owner identifiers used on an HP-UX system, see your HP-UX system administrator or look at the identifiers listed in the `/etc/passwd` file on the HP-UX system. It could contain the following entry, which defines the relationship between the owner named `basic` and the owner identifier 18:

```
basic:*:18:9:#BASIC workstation user:/WORKSTATIONS:/bin/false
```

If this owner identifier is currently being used on an HP-UX system that is to share a disk with HP BASIC, then the HP-UX system administrator will need to change the `/etc/passwd` file so that HP BASIC is assigned this owner identifier. Otherwise, any HP-UX user with this owner identifier will have the current owner access permissions to *all* HP BASIC files and directories.

Note that the Series 200/300 Pascal system has an owner identifier of 17; however, HP BASIC and Pascal operating systems have the same group identifier of 9.

C

CHR\$

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

CHR\$ converts a numeric expression into an ASCII character.

Example Statements

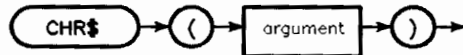
```
Lowercase$=CHR$(NUM(Uppercase$)+32)
```

```
A$[Marker;1]=CHR$(Digit+128)
```

```
Esc$=CHR$(27)
```

```
Kanji$=CHR$(129)&CHR$(64)
```

Syntax



Item	Description	Range
argument	numeric expression, rounded to an integer	0 through 255

Semantics

The low order byte of the 16-bit integer representation of the argument is used; the high order byte is ignored. A table of ASCII characters and their decimal equivalent values may be found in the back of this book.

Two-Byte Language Specifics

Certain localized versions of BASIC, such as Japanese localized BASIC, support two-byte characters. You can use CHR\$ to build two-byte characters byte-by-byte. For example, the two-byte Roman letter A is CHR\$(130)&CHR\$(96) (using the Japanese LANGUAGE binary). For more information about two-byte characters, refer to the globalization chapters of the *HP BASIC Porting and Globalization* manual.

C

CHRX

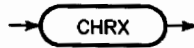
Supported On	UX WS DOS
Option Required	CRTX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

CHRX returns the number of columns (width) of a character cell (on bit-mapped alpha/graphics displays) or 0 (on displays with non-bit-mapped alpha displays).

Example Statements

```
CHRX
ALLOCATE INTEGER Char_cell(1:CHRX,1:CHRX)
```

Syntax



Semantics

Character cells are 20 (rows) by 10 (columns) for 1280 × 1024 resolution bit-mapped alpha displays, 16 (rows) by 8 (columns) for 1024 × 768 resolution bit-mapped alpha displays, 16 (rows) by 8 (columns) for 640 by 480 resolution bit-mapped displays, 15 (rows) by 12 (columns) for medium-resolution bit-mapped alpha displays, and 14 (rows) by 8 (columns) for DOS displays.

If the alpha display is not bit-mapped (that is, if the alpha is separate from the graphics raster, and is generated by character-generator-ROM hardware), then this function returns 0.

Two-Byte Language Specifics

Certain localized versions of HP BASIC, such as Japanese localized HP BASIC, support two-byte characters. Display systems operating in globalized (two-byte) mode use different character cell sizes depending upon the localized font. For more information about two-byte characters, refer to the globalization chapters of the *HP BASIC Porting and Globalization* manual.

C

CHRY

Supported On	UX WS DOS
Option Required	CRTX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

CHRY returns the number of rows (height) of a character cell (on bit-mapped alpha/graphics displays) or 0 (on displays with non-bit-mapped alpha displays).

Example Statements

```
CHRY
ALLOCATE INTEGER Char_cell(1:CHRY,1:CHRX)
```

Syntax



Semantics

Character cells are 20 (rows) by 10 (columns) for 1280 × 1024 resolution bit-mapped alpha displays, 16 (rows) by 8 (columns) for 1024 × 768 resolution bit-mapped alpha displays, 16 (rows) by 8 (columns) for 640 by 480 resolution bit-mapped displays, 15 (rows) by 12 (columns) for medium-resolution bit-mapped alpha displays, and 14 (rows) by 8 (columns) for DOS displays.

If the alpha display is not bit-mapped (that is, if the alpha is separate from the graphics raster, and is generated by character-generator-ROM hardware), then this function returns 0.

Two-Byte Language Specifics

Certain localized versions of HP BASIC, such as Japanese localized HP BASIC, support two-byte characters. Display systems operating in globalized (two-byte) mode use different character cell sizes depending upon the localized font. For more information about two-byte characters, refer to the globalization chapters of the *HP BASIC Porting and Globalization* manual.

C

CLEAR

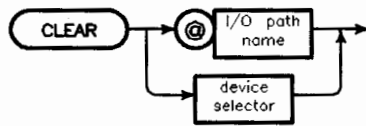
Supported On UX WS DOS IN
Option Required IO
Keyboard Executable Yes
Programmable Yes
In an IF ... THEN ... Yes

CLEAR clears the specified HP-IB or Data Communications interfaces.

Example Statements

```
CLEAR 7  
CLEAR Voltmeter  
CLEAR @Source
```

Syntax



Item	Description	Range
I/O path name	name assigned to a device or devices	any valid name (see ASSIGN)
device selector	numeric expression, rounded to an integer	(see Glossary)

Semantics

HP-IB Interfaces

CLEAR places all or only selected HP-IB devices into a pre-defined, device-dependent state. The computer *must* be the active controller to execute this statement. The bus messages sent are the same whether or not the computer is the system controller. When primary addresses are specified, the bus is reconfigured and the SDC (Selected Device Clear) message is sent to all devices which are addressed by the LAG message.

Summary of CLEAR Bus Actions

Interface Select Code Only	Primary Address Specified
ATN	ATN
DCL	MTA
	UNL
	LAG
	SDC

Data Communications Interfaces

CLEAR may also be directed to a Data Communications interface. The result is to clear the interface buffers; if the interface is suspended, a disconnect is also executed.

CLEAR ERROR

Supported On	UX WS DOS IN*
Option Required	None
Keyboard Executable	No
Programmable	Yes
In an IF ... THEN ...	Yes

CLEAR ERROR resets error indicators (ERRN, ERRM\$, ERRL, and ERRLN) to their power-up values.

Example Statements

```
CLEAR ERROR
IF Done THEN CLEAR ERROR
```

Syntax

CLEAR ERROR →

Semantics

CLEAR ERROR affects the following error indications:

- ERRN—subsequently returns 0
- ERRM\$—subsequently returns the null string
- ERRL—subsequently returns 0
- ERRLN—subsequently returns 0
- ERRDS—not affected

CLEAR LINE

Supported On	UX WS DOS
Option Required	CRTX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

CLEAR LINE clears the keyboard input line. It has the same effect as pressing **Shift-Clear line** (**CLR LN** on a 98203 keyboard).

Example Statements

```
CLEAR LINE
IF Flag THEN CLEAR LINE
```

Syntax

CLEAR LINE →

CLEAR SCREEN

Supported On	UX WS DOS IN
Option Required	CRTX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

CLEAR SCREEN clears the contents of the alpha display.

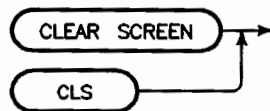
Example Statements

```
CLS
```

```
CLEAR SCREEN
```

```
IF Loop_count=1 THEN CLEAR SCREEN
```

Syntax



Semantics

CLEAR SCREEN clears the alpha display area and the associated memory. It has the same effect as executing `OUTPUT KBD;CHR$(255)&"K"`; or pressing the

`Clear display` (`CLR SCR`) key.

CLEAR WINDOW

Supported On	UX WS* DOS*
Option Required	RMBUX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

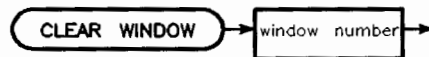
CLEAR WINDOW clears the contents of the specified window.

Example Statements

```
CLEAR WINDOW Fred
```

```
CLEAR WINDOW 604
```

Syntax



Item	Description	Range
window number	numeric expression, rounded to integer	600 through 699

Semantics

CLEAR WINDOW is only valid when running HP BASIC/UX under X Windows. The window number must correspond to a window created with the CREATE WINDOW statement, or root HP BASIC window (number 600). This statement then clears the specified window.

When not in a window system, this statement will cause an error. Note, there are three ways to clear the root HP BASIC window:

```
CLS
CLEAR SCREEN
CLEAR WINDOW 600
```


CLIP

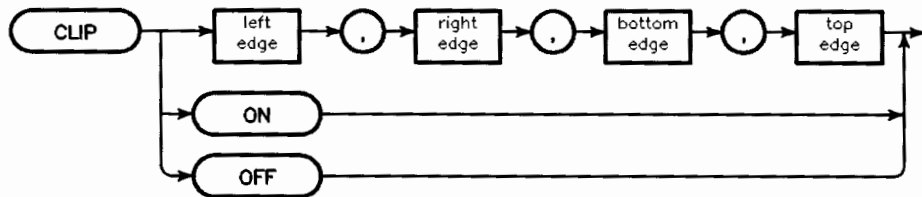
Supported On	UX WS DOS
Option Required	GRAPH
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

CLIP defines, enables, or disables the **soft clip limits** for subsequent graphics output.

Example Statements

```
CLIP Left,Right,Bottom,Top
CLIP ON
CLIP OFF
```

Syntax



Item	Description	Range
left edge	numeric expression in current units	—
right edge	numeric expression in current units	greater than left edge
bottom edge	numeric expression in current units	—
top edge	numeric expression in current units	greater than bottom edge

Semantics

Executing CLIP with numeric parameters allows the soft clip area to be set to the specified soft clip limits. If CLIP is not executed, the area most recently defined by either VIEWPORT or the PLOTTER IS statement is the clipping area. All plotted points, lines, or labels are clipped at this boundary.

The hard clip area is specified by the PLOTTER IS statement. The soft clip area is specified by the VIEWPORT and CLIP statements. CLIP ON sets the soft clip boundaries to the last specified CLIP or VIEWPORT boundaries, or to the hard clip boundaries if no CLIP or VIEWPORT has been executed. CLIP OFF sets the soft clip boundaries to the hard clip limits.

C

CLS

CLS is identical to CLEAR SCREEN.

C

CMD

See SEND.

C



CMPLX

Supported On	UX WS DOS
Option Required	COMPLEX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

CMPLX creates a complex number with the first argument representing the real part and the second argument representing the imaginary part. The arguments given may be **REAL**, **INTEGER**, or **COMPLEX** variables.

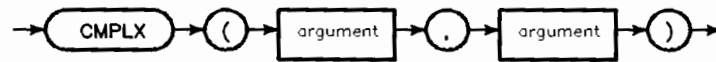
Example Statements

```
C=CMPLX(-2,1)
```

```
Result=CMPLX(-2,356,.0012)
```

```
Complex_value=CMPLX(Real_part,Imaginary_part)
```

Syntax



Item	Description/Default	Range Restrictions
argument	numeric expression	any valid INTEGER, REAL, or COMPLEX expression

Semantics

Arguments used by CMPLX are converted to two 8-byte (64-bit) floating-point values and handled accordingly. If arguments are **COMPLEX**, then only the real part of that **COMPLEX** argument is used.

COLOR

COLOR is a secondary keyword for the following primary keywords:

- AREA
- SET PEN
- PLOTTER IS

C

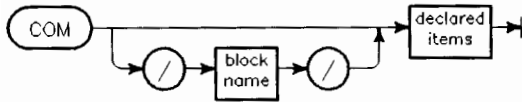
COM

Supported On	UX WS DOS IN*
Option Required	None
Keyboard Executable	No
Programmable	Yes
In an IF ... THEN ...	No

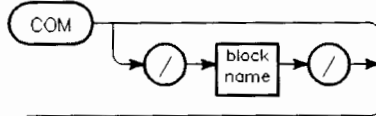
COM dimensions and reserves memory for variables in a special “common” memory area so more than one program **context** can access the variables.

Example Statements

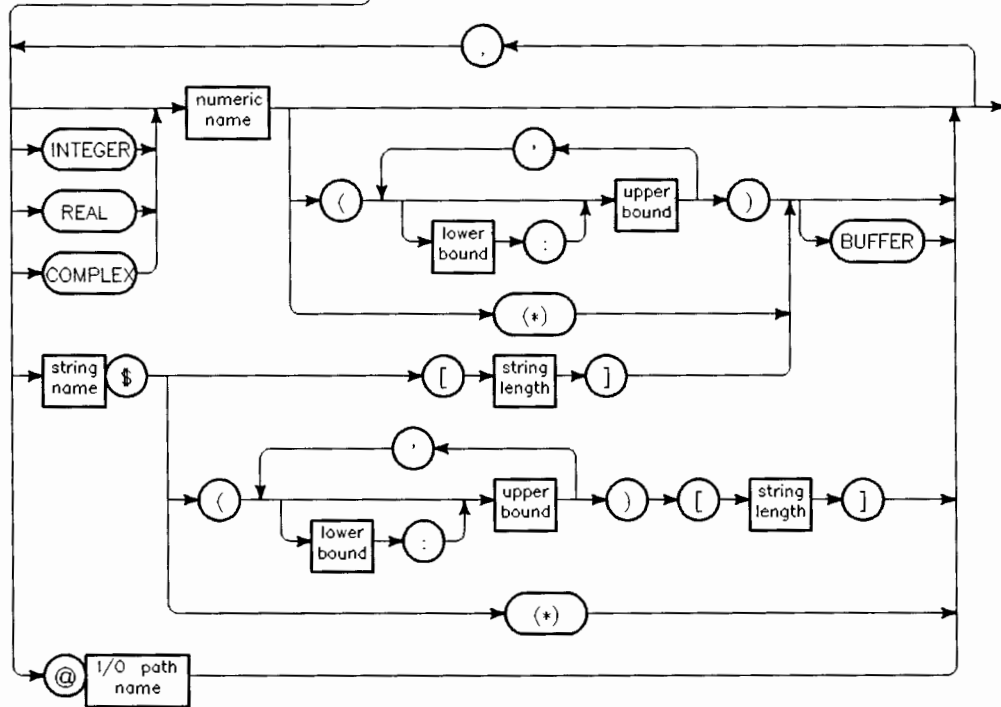
```
COM X,Y,Z
COM /Block/ Text$,@Path,INTEGER Points(*)
COM INTEGER I,J,REAL Array(-128:127)
COM Buffy$[1024] BUFFER
COM COMPLEX Complex_num
```



Expanded diagram:



C



COM

Item	Description	Range
block name	name identifying a labeled COM area	any valid name
numeric name	name of a numeric variable	any valid name
string name	name of a string variable	any valid name
lower bound	integer constant; Default = OPTION BASE value (0 or 1)	-32 767 through +32 767 (see "array" in Glossary)
upper bound	integer constant	-32 767 through +32 767 (see "array" in Glossary)
string length	integer constant	1 through 32 767
I/O path name	name assigned to a device, devices, mass storage file, or buffer	any valid name (see ASSIGN)

Semantics

Storage for COM is allocated at prerun time in an area of memory which is separate from the data storage used for program contexts. This reserved portion of memory remains allocated until SCRATCH A, SCRATCH BIN, or SCRATCH C is executed.

Changing the definition of the COM space is accomplished by a full program prerun. This can be done by:

- Pressing the **RUN** or **STEP** key when no program is running.
- Executing a RUN command when no program is running.
- Executing any GET or LOAD from a program.
- Executing a GET or LOAD command that tells program execution to begin (such as LOAD "File",1).

When COM allocation is performed at prerun, the new program's COM area is compared to the COM area currently in memory. When comparing the old and new areas, HP BASIC looks first at the types and structures declared in the COM statements. If the "text" indicates that there is no way the areas could match, then those areas are considered mismatched. If the declarations are consistent, but the shape of an array in memory does not match the

C-64 CALL - CYCLE

shape in a new COM declaration, HP BASIC takes the effect of REDIM into account. If the COM areas could be matched by a REDIM, they are considered to be in agreement. When this happens, the treatment of the arrays in memory depends upon the program state. If the COM matching occurred because of a programmed LOADSUB, the arrays in memory keep their current shape. If the COM matching occurred for any other reason (such as RUN or programmed LOAD), the arrays in memory are redimensioned to match the declarations. Any variable values are left intact. All other COM areas are rendered undefined, and their storage area is not recovered by HP BASIC. New COM variables are initialized at prerun: numeric variables to 0, string variables to the null string.

Each context may have as many COM statements as needed (within the limits stated below), and COM statements may be interspersed between other statements. If there is an OPTION BASE statement in the context, it must appear before COM statement. COM variables do not have to have the same names in different contexts. Formal parameters of subprograms are not allowed in COM statements. A COM mismatch between contexts causes an error.

The total number of COM elements is limited to a maximum memory usage of 16 777 215 bytes (or limited by the amount of available memory, whichever is less).

If a COM area requires more than one statement to describe its contents, COM statements defining that block may not be intermixed with COM statements defining other COM areas.

Numeric variables in a COM list can have their type specified as either REAL, INTEGER, or COMPLEX. Specifying a variable type implies that *all* variables which follow in the list are of the same type. The type remains in effect until another type is specified. String variables and I/O path names are considered a type of variable and change the specified type. Numeric variables are assumed to be REAL unless their type has been specified otherwise.

COM statements (blank or labeled) in different contexts which refer to an array or string must specify it to be of the same size and shape. The lowest-numbered COM statement containing an array or string name must explicitly specify the subscript bounds and/or string length. Subsequent COM statements can reference a string by name only or an array only by using an asterisk specifier (*).

COM

No array can have more than six dimensions. The lower bound value must be less than or equal to the upper bound value. The default lower bound is specified by the OPTION BASE statement.

Any LOADSUB which attempts to define or change COM areas while a program is running generates error 145.

C

Unlabeled or Blank COM

Blank COM does not contain a block name in its declaration. Blank COM (if it is used) must be created in a main context. The main program can contain any number of blank COM statements (limited only by available memory). Blank COM areas can be accessed by subprograms, if the COM statements in the subprograms agree in type and shape with the main program COM statements.

Labeled COM

Labeled COM contains a name for the COM area in its declaration. Memory is allocated for labeled COM at prerun time according to the lowest-numbered occurrence of the labeled COM statement. Each context which contains a labeled COM statement with the same label refers to the same labeled COM block.

Declaring Buffers

To declare COM variables to be buffers, each variable's name must be followed by the keyword BUFFER; the designation BUFFER applies only to the variable which it follows. String arrays cannot be declared to be buffers.

COMPILE

COMPILE compiles all or part of a program currently in memory for those versions of HP BASIC that support this command. (Not supported on HP BASIC/UX 700.)

Example Statements

```
COMPILE
```

```
COMPILE Sub1 TO Sub2:BEST
```

```
COMPILE #701;-Sub1,Sub9:BEST, MTP OFF
```

C 

COMPLEX

Supported On	UX WS DOS
Option Required	COMPLEX
Keyboard Executable	No
Programmable	Yes
In an IF ... THEN ...	No

COMPLEX declares complex variables and arrays and reserves storage for them. (For information about COMPLEX as a secondary keyword, see the ALLOCATE, COM, DEF FN, or SUB statements.)

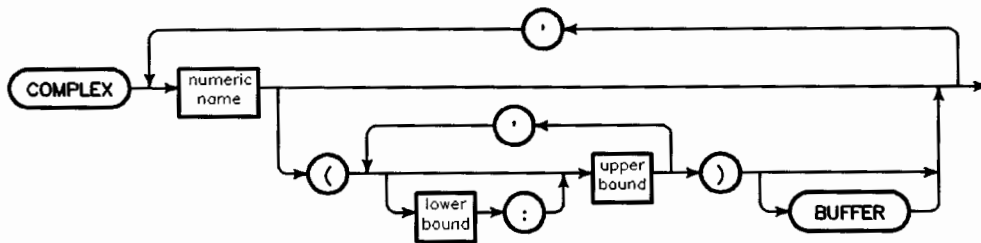
Example Statements

```
COMPLEX X,Y,Z
```

```
COMPLEX Array(-23:2,26)
```

```
COMPLEX A(512) BUFFER
```

Syntax



COMPLEX

Item	Description/Default	Range Restrictions
numeric name	name of a numeric variable	any valid name
lower bound	integer constant;Default = OPTION BASE value (0 or 1)	-32 767 through +32 767 (see "array" in Glossary)
upper bound	integer constant	-32 767 through +32 767 (see "array" in Glossary)

C**Semantics**

Each COMPLEX variable or array element consists of two floating-point values, one for the real part and one for the imaginary part of the COMPLEX number. Each complex value requires sixteen bytes of storage. The maximum number of subscripts in an array is six, and no dimension may have more than 32 767 elements.

The total number of COMPLEX elements is limited by the fact that the maximum memory usage for *all* variables—COMPLEX, INTEGER, REAL, and string—within any context is $2^{24}-1$, or 16 777 215, bytes (or limited by the amount of available memory, whichever is less).

Declaring Buffers

To declare COMPLEX variables to be buffers, each variable's name must be followed by the keyword BUFFER; the designation BUFFER applies only to the variable which it follows.

CONJG

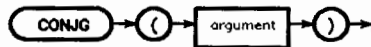
Supported On	UX WS DOS
Option Required	COMPLEX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

CONJG returns the complex conjugate of a COMPLEX number.

Example Statements

```
X=CONJG(Complex_expr)
Result=CONJG(CMPLX(2.1,-8))
```

Syntax



Item	Description/Default	Range Restrictions
argument	numeric expression	any valid INTEGER, REAL, or COMPLEX value

Semantics

The complex conjugate of a COMPLEX number CMPLX(X,Y) is CMPLX(X,-Y). That is, the imaginary part of the argument is negated. An INTEGER or REAL argument is returned unchanged.

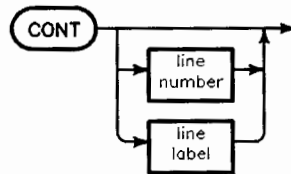
CONT

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	No
In an IF ... THEN ...	No

CONT resumes execution of a paused program at the specified line. If no line is specified, execution resumes at the next line that would have executed if the program had not PAUSED.

Example Statements

```
CONT
CONT 550
CONT Sort
```

Syntax

Item	Description	Range
line number	integer constant identifying a program line; Default = next program line	1 through 32 766 (1 through 2 147 483 646 for HP BASIC/UX 700)
line label	name identifying a program line	any valid name

CONT

Semantics

CONT can be executed by pressing **CONTINUE** (**f2** in the System menu of an ITF keyboard), or by executing a CONT command. Variables retain their current values whenever CONT executes. CONT causes the program to resume execution at the next statement which would have occurred unless a line is specified.

When a line label is specified, program execution resumes at the specified line, provided that the line is in either the main program or the current subprogram. If a line number is specified, program execution resumes at the specified line, provided that the line is in the current program context. If there is no line in the current context with the specified line number, program execution resumes at the next higher-numbered line. If the specified line label does not exist in the proper context, an error results.

CONTROL

Supported On	UX WS DOS
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

CONTROL sends control information an interface register or the internal table associated with an I/O path name. (CONTROL is also used in PASS CONTROL.)

Example Statements

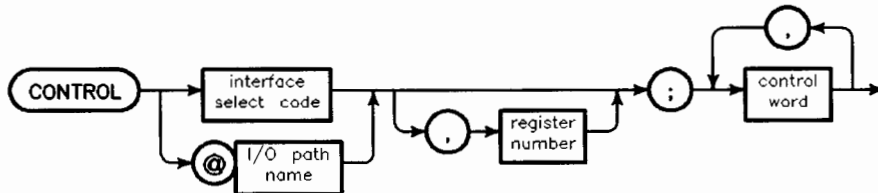
```
CONTROL @Rand_file,7;File_length ! Write to a file
```

```
CONTROL 1;Row,Column
```

```
CONTROL Interface,Register;Value ! Write to hardware interface
```

```
CONTROL @Serial,3;9600 ! Set serial interface baud rate
```

Syntax



CONTROL

Item	Description	Range
interface select code	numeric expression, rounded to an integer	1 through 32 (interface-dependent)
I/O path name	name assigned to a device, devices, mass storage file, buffer, or pipe	any valid name (see ASSIGN)
register number	numeric expression, rounded to an integer; Default = 0	interface-dependent
control word	numeric expression, rounded to an integer	-2^{31} through $2^{31}-1$ (interface-dependent)

C

Writing to File I/O Paths

I/O path names assigned to files have an association table that can be accessed as a set of registers.

CONTROL writes to this table, starting with the specified register and continuing in turn through the remaining registers until all control words are used. The number of control words must not exceed the number of registers available.

Register assignments can be found in the “Interface Registers” section at the back of this book.

Writing to Hardware Interfaces

Control words are written to the interface registers, starting with the specified register number, and continuing in turn through the remaining registers until all the control words are used. The number of control words must not exceed the number of registers available.

Register assignments can be found in the “Interface Registers” section at the back of this book.

There is a shorthand method available that permits you to assign values to several attributes without naming them individually in the CONTROL statement. You fill a string array with attribute names and a corresponding

C-74 CALL - CYCLE

CONTROL

string or numeric array with attribute values. Then, when you supply the array names to the CONTROL statement, the attribute named in each element of the attribute array will be assigned the corresponding value in the value array. Elements of the attribute array that contain nothing, or nothing but blanks, will be ignored. Only scalar attributes may be assigned values with this shorthand method.

C

CONVERT

See ASSIGN.

C

COPY

Supported On	UX WS DOS IN*
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

COPY copies individual files or entire disks. When an entire disk is copied, all old files on the destination disk are destroyed.

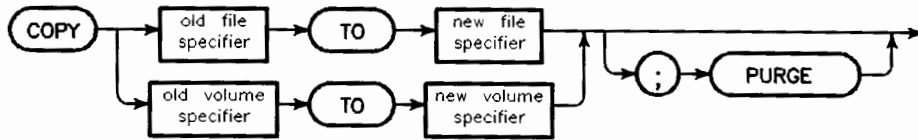
Example Statements

```

COPY "OLD_FILE" TO "New_file"
COPY "new" TO "archive";PURGE
COPY ":",700" TO ":",700,1"
COPY ":",4,1" TO ":",4,0"
COPY "/Dir_1/File_1" TO "Dir_3/File_1"
COPY Dir_path$&File$&Vol$ TO "File:,:700"
COPY "File:INTERNAL" TO "File:REMOTE 21,0"
COPY "DIR/*" TO "New_dir";PURGE
COPY "Dir/*" TO "New_dir"
COPY "Type_[a-z]" TO "Dir" ! WILDCARDS UX only
COPY "File?" TO "archive"
COPY "*" TO ":",700,1"

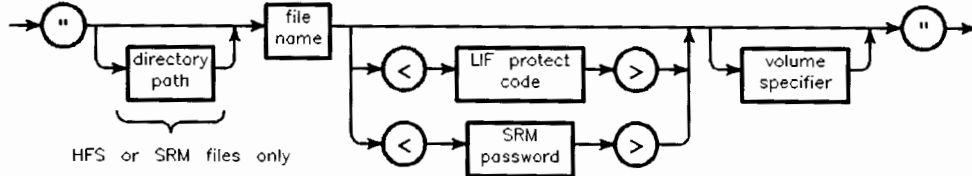
```

COPY

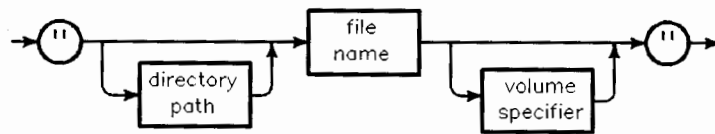


C

literal form of file specifier:



literal form of DFS file specifier:



Item	Description	Range
file specifier	string expression	(see drawing)
volume specifier	string expression	(see MASS STORAGE IS)
directory path	literal	(see MASS STORAGE IS)
file name	literal	depends on volume's format (see Glossary)
LIF protect code	literal; first two non-blank characters are significant	> not allowed
SRM password	literal; first 16 non-blank characters are significant	> not allowed
volume specifier	string expression	(see MASS STORAGE IS)

Semantics

The contents of the old file are copied into the new file, and a directory entry is created. A protect code (for LIF files) may be specified for the new file, to prevent accidental erasure, etc. COPY will not replace existing files unless you specify the PURGE option.

An error is returned if there is not enough room on the destination device, or if the new file name already exists in the destination directory and the PURGE option is not specified.

If the mass storage volume specifier (msvs) is omitted from a file specifier, the MASS STORAGE IS device is assumed.

If the directory path is also omitted, the MASS STORAGE IS directory is assumed.

Using Wildcards with COPY

If you are using a version of HP BASIC that supports wildcards, you can use them in file specifiers with COPY. You must first enable wildcard recognition using WILDCARDS. Refer to the keyword entry for WILDCARDS for more details.

You may use wildcards in both the source and destination of the COPY. If the wildcard specification for the source matches more than one file, then the destination must be a directory or a LIF volume specifier.

Note that BASIC handles the command

```
COPY "file_name" TO "dir_name"
```

in a different manner when wildcards are enabled than when they are disabled.

When wildcards are enabled, BASIC lets you to copy a file to a directory. It interprets the above command as make a copy of `file_name` and place that copy in a directory called `dir_name`.

When wildcards are disabled, BASIC interprets the above command as make a copy of `file_name` and place it in the *file* called `dir_name`. If a file or a directory already exists which uses the name `dir_name`, BASIC generates error 54, Duplicate file name.

COPY

Using the PURGE Option

The PURGE option allows the COPY command to replace existing files.

HP BASIC interprets the command `COPY "file1" TO "file2"; PURGE` as copy the file `file1` to `file2`, replacing `file2` if it exists.

C

HP BASIC interprets the command

```
COPY "file_name" TO "dir_name"; PURGE
```

in different ways depending on whether wildcards are enabled or disabled.

When wildcards are enabled, the preceding statement copies `file_name` into the directory `dir_name`. If a file with the name `file_name` already exists in that directory, COPY will replace it.

When wildcards are disabled, HP BASIC replaces the directory identified by `dir_name` with the file specified by `file_name`. This works only if `dir_name` is empty.

Copying an Entire LIF or HFS Volume

LIF and HFS volumes can be duplicated if the destination volume is as large as, or larger than, the source volume. COPY from a larger capacity volume to a smaller capacity volume is only possible when the amount of data on the larger will fit on the smaller. The directory and any files on the destination volume are destroyed. The directory size on the destination volume becomes the same size as that on the source media. When copying an entire volume, the volume specifiers must be unique. File names are not allowed. Disk-to-disk copy time is dependent on media type and interleave factors.

Also note that you will be prompted to continue when executing a volume copy from the keyboard, thus providing safe volume copying. There is no continue prompt when executing volume copy from a program.

HP BASIC/UX supports copying only of LIF volumes, not HFS volumes.

HFS Permissions

With HFS, COPY allows copying of individual files and volumes. HFS directories cannot be copied.

In order to COPY a file on an HFS volume, you need to have R (read) permission on the source file, as well as X (search) permission on the parent directory and all other superior directories. In addition, you will need W (write) and X (search) permission on the destination file's parent directory, as well as X (search) permission on all other superior directories.

HFS File Headers

When copying a file from LIF or SRM to HFS, a special header is added to the beginning of that file. This action is taken because that is the only way to "type" files (which would otherwise be "typeless"). When copying a file from HFS to LIF or SRM volumes, this file header is removed (since these volumes have typed files). Note that HP BASIC handles the file headers automatically and requires no special treatment in programs that use these files.

When copying a SYSTM file from LIF volumes to HFS volumes, it will be given a header and will remain a SYSTM file. However, it will not be bootable. Conversely, copying a bootable HP-UX file from HFS to LIF or SRM will result in an HP-UX file that is not bootable. (STORE SYSTEM will copy the current HP BASIC system from memory onto an HFS volume only in the root directory. STORE SYSTEM will error if the HFS directory is not the root directory (/). If the destination file is in the HFS volume's root directory, it will be a bootable system.)

SRM Passwords (not supported on HP BASIC/UX 700)

With SRM, COPY allows copying of individual files. SRM directories and volumes cannot be copied.

In order to COPY an SRM file, you need to have R (read) access capability on the file, on the parent directory, and on all other superior directories. You must also have W (write) access capability on the destination directory, as well as R access capability on all superior directories.

COPY

Although you may include a password in the new file specifier, the system ignores the password. If you wish to protect access to the new file, you must assign the password with PROTECT.

 **C**

COPYLINES

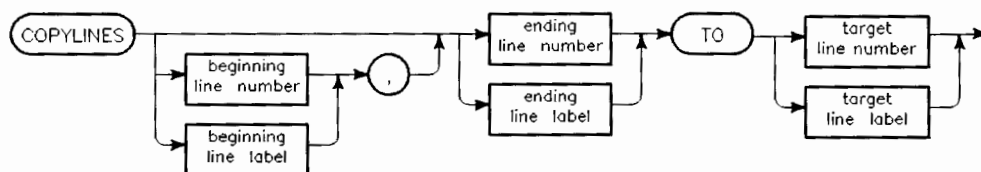
Supported On	UX WS DOS
Option Required	EDIT and PDEV
Keyboard Executable	Yes
Programmable	No
In an IF ... THEN ...	No

COPYLINES copies one or more contiguous program lines from one location to another while editing a program.

Example Statements

```
COPYLINES 1200 TO 3255
COPYLINES 10,120 TO 500
COPYLINES Label1,Label2 TO Label3
```

Syntax



COPYLINES

Item	Description	Range
beginning line number	integer constant identifying program line	1 to 32 766 (1 through 2 147 483 646 for HP BASIC/UX 700)
beginning line label	name of a program line	any valid name
ending line number	integer constant identifying program line	1 to 32 766 (1 through 2 147 483 646 for HP BASIC/UX 700)
ending line label	name of a program line	any valid name
target line number	integer constant identifying program line	1 to 32 766 (1 through 2 147 483 646 for HP BASIC/UX 700)
target line label	name of a program line	any valid name

Semantics

If the beginning line identifier is not specified, only one line is copied.

The target line identifier will be the line number of the first line of the copied program segment. Copied lines are renumbered if necessary. Any lines which are “pushed down” to make room for the copied lines are renumbered as necessary.

Line number references to the copied code are updated as they would be using REN, with these exceptions: line number references in lines not being copied remain linked to the source lines rather than being renumbered; references to non-existent lines are renumbered as if the lines existed.

If there are any DEF FN or SUB statements in the copied code, the target line number must be greater than any existing line number.

If you try to copy a program segment to a line number *contained* in the segment, an error will be reported and no copying will occur.

COPYLINES

If the starting line number does not exist, the next line is used. If the ending line number does not exist, the previous line is used. If a line label doesn't exist, an error occurs and no copying occurs.

If an error occurs *during* a COPYLINES (for example, a memory overflow), the copy is terminated and the program is left partially modified.

C

COS

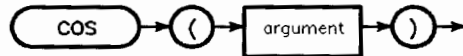
Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

COS returns the cosine of the specified angle.

Example Statements

```
Cosine=COS(Angle)
PRINT COS(X+45)
```

Syntax



Item	Description/Default	Range Restrictions
argument	numeric expression in current units of angle when INTEGER or REAL argument numeric expression in radians when COMPLEX argument	absolute values less than 1.708 312 772 2 E+10 deg. or 2.981 568 244 292 04 E+8 rad. for INTEGER and REAL arguments; see "Range Restriction Specifics" for COMPLEX arguments and underflow conditions



Semantics

The angle mode set by RAD or DEG determines whether the angle is interpreted in degrees or radians. The angle mode is radians unless you specify degrees using the DEG statement.

If the angle is REAL or INTEGER, the value returned is REAL. If the angle is COMPLEX, the value returned is COMPLEX. To compute the COS of a COMPLEX value, the COMPLEX binary must be loaded.

Range Restriction Specifics

The formula used for computing the COS of a COMPLEX argument is:

$$\text{CMPLX}(\text{COS}(\text{Real}) * \text{COSH}(\text{Imag}), -\text{SIN}(\text{Real}) * \text{SINH}(\text{Imag}))$$

where *Real* is the real part the COMPLEX argument and *Imag* is the imaginary part of the COMPLEX argument. Some values of a COMPLEX argument may cause errors in this computation. For example,

$$\text{COS}(\text{CMPLX}(0, \text{MAXREAL}))$$

will cause error 22 (error 21 in HP BASIC/UX 700) due to the $\text{COSH}(\text{Imag})$ calculation.

Note that any COMPLEX function whose definition includes a sine or cosine function will be evaluated in the radian mode regardless of the current angle mode (i.e. RAD or DEG).

The following range restrictions apply in HP BASIC/UX 700 when underflow mode ($\text{CONTROL } 32,7;\text{mode}$) is set to Error or Ignore.

COS

Range	Underflow Mode Error	Underflow Mode Ignore
Positive Maximum	+1.34217728000000E+008	+1.34217728000000E+008
Negative Minimum	-1.34217728000000E+008	-1.34217728000000E+008
Positive Minimum	+1.02907134889717E-076	+4.94065645841247E-324 ¹
Negative Maximum	-1.02907134889717E-076	-4.94065645841247E-324 ²

1 An underflow in Ignore mode results in a denormalized number that is less than the value for +MINREAL.

2 An underflow in Ignore mode results in a denormalized number that is greater than the value for -MINREAL.

COSH

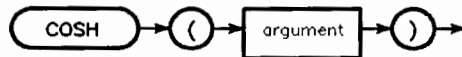
Supported On	UX WS DOS
Option Required	COMPLEX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

COSH returns the hyperbolic cosine of a numeric expression.

Example Statements

```
Result=COSH(10.3499)
PRINT "Hyperbolic Cosine = ";COSH(Expression)
```

Syntax



Item	Description/Default	Range Restrictions
argument	numeric expression	-710 through 710 for INTEGER or REAL arguments; see "Range Restriction Specifics" for COMPLEX arguments and underflow conditions

Semantics

If an INTEGER or REAL argument is given, this function returns a REAL value. If a COMPLEX argument is given, this function returns a COMPLEX value.

COSH

Range Restriction Specifics

The formula used for computing COSH is as follows:

$$(EXP(Argument)+EXP(-Argument))/2$$

where **Argument** is the argument of the COSH function.

Some arguments may cause errors in intermediate values computed during this computation. For example,

`COSH(MAXREAL)`

will cause error 22 (error 21 in HP BASIC/UX 700) due to the `EXP(MAXREAL)` computation.

The following range restrictions apply in HP BASIC/UX 700 when underflow mode (`CONTROL 32,7;mode`) is set to Error or Ignore.

Range	Underflow Mode Error	Underflow Mode Ignore
Positive Maximum	+7.10475860073944E+002	+7.10475860073944E+002
Negative Minimum	-7.10475860073944E+002	-7.10475860073944E+002
Positive Minimum	+2.10953732297368E-154	+4.94065645841247E-324 ¹
Negative Maximum	-2.10953732297368E-154	-4.94065645841247E-324 ²

1 An underflow in Ignore mode results in a denormalized number that is less than the value for +MINREAL.

2 An underflow in Ignore mode results in a denormalized number that is greater than the value for -MINREAL.

COUNT

COUNT is a secondary keyword for these keywords:

- CAT
- TRANSFER.

C

CREATE

Supported On	UX WS DOS* IN*
Option Required	HFS
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

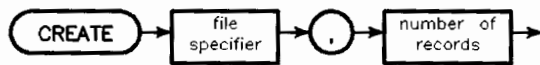
CREATE creates a DOS or HP-UX file. On DOS file systems, CREATE creates a DOS file; on all other file systems, CREATE creates an HP-UX file.

Example Statements

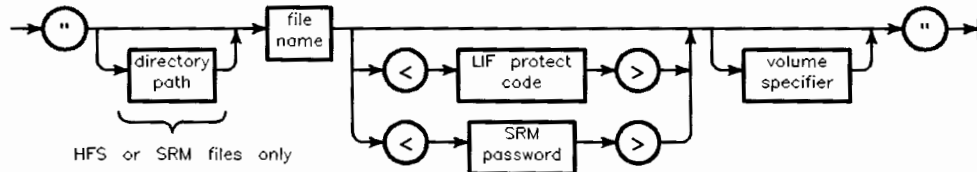
```
CREATE File_spec$,N_records
```

```
CREATE "My_file",12
```

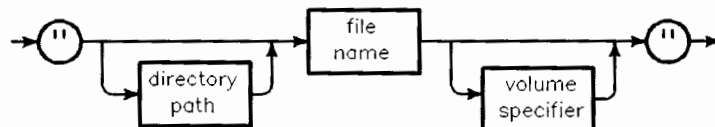
Syntax



literal form of file specifier:



literal form of DFS file specifier:



Item	Description	Range
file specifier	string expression	(see drawing)
directory path	literal	(see MASS STORAGE IS)
file name	literal	depends on volume's format (see Glossary)
LIF protect code	literal; first two non-blank characters are significant	> not allowed
SRM password	literal; first 16 non-blank characters are significant	> not allowed
volume specifier	literal	(see MASS STORAGE IS)
number of records	numeric expression, rounded to an integer	1 through $2^{31} - 1$

C

Semantics

CREATE creates a new file of type HP-UX on the default or specified volume or hierarchical directory. A corresponding directory entry is also made. The name of the newly created file must be unique within its directory. CREATE does not open the file; that is performed by ASSIGN. In the event of an error, no directory entry is made and the file is not created.

The number of records parameter specifies how many *logical* records are to be initially allocated to the file. The logical record size is always 1 for HP-UX files. On LIF volumes, the number of records allocated for the file is fixed; however, on HFS and SRM volumes, files are extensible. See the following section for details about extensible files.

The data representation used in the file depends on the FORMAT option used in the ASSIGN statement used to open the file. See ASSIGN for details.

CREATE

Extensible Files

Files created with CREATE are “extensible”. This means that the file system automatically allocates additional space for the file as new data is written to it. With HFS volumes, the initial size of the file is 0, but the file will automatically be extended as many bytes as necessary whenever an OUTPUT operation would otherwise overflow the file. On SRM volumes, the “number of records” parameter determines the “extent size” of the file (that is, the amount of space automatically appended to the file whenever it is extended). “Preallocating” an extensible file (initially creating a file of sufficient size) will improve the data transfer rate because the file system will not have to extend the file during data transfer operations.

LIF Protect Codes

A protect code is not allowed on an HP-UX file.

HFS Permissions

In order to create a file on an HFS volume, you need to have W (write) and X (search) permission of the immediately superior directory, as well as X (search) permission on all other superior directories.

When a file is created on an HFS volume, access permission bits are set to RW-RW-RW-. (You can modify them with PERMIT, if desired.) HP BASIC/UX permissions may be altered by the user’s `umask`. See the *HP-UX Reference*, `umask(1)` entry, for more information.

SRM Access Capabilities (not supported in HP BASIC/UX 700)

In order to CREATE an HP-UX file in an SRM directory, you need to have READ and WRITE capabilities on the immediately superior directory, as well as READ capabilities on all other superior directories.

When a file is created on an SRM volume, all access capabilities are public. Including an SRM password in the file specifier does not protect the file. You must use PROTECT to assign a password. You will not receive an error message for including a password, but a password in the CREATE statement is ignored.

HP BASIC/DOS Specifics

For the LIF and HFS (if present) file systems, **CREATE** works the same as for HP BASIC/WS. For the DFS file system, **CREATE** creates a *DOS* type file rather than an HP-UX file.

C

CREATE ASCII

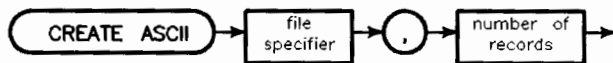
Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

CREATE ASCII creates a file using LIF ASCII format.

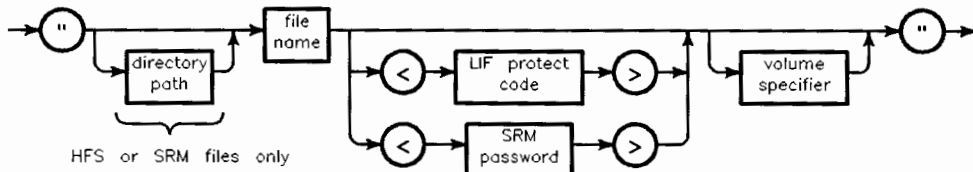
Example Statements

```
CREATE ASCII "TEXT",100
CREATE ASCII "/Dir1/Dir2/AsciiFile",25
CREATE ASCII Name$&":,700,1",Length
```

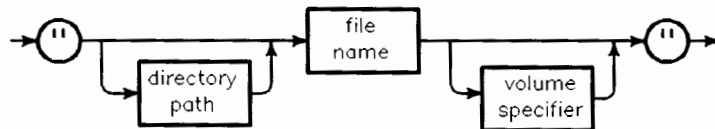
Syntax



literal form of file specifier:



literal form of DFS file specifier:



CREATE ASCII

Item	Description	Range
file specifier	string expression	(see drawing)
number of records	numeric expression, rounded to an integer	1 through $(2^{31} - 1)/256$
directory path	literal	(see MASS STORAGE IS)
file name	literal	depends on volume's format (see Glossary)
SRM password	literal; first 16 non-blank characters are significant	> not allowed
volume specifier	literal	(see MASS STORAGE IS)

C

Semantics

CREATE ASCII creates a new ASCII file and directory entry on the mass storage media. The name of the newly created ASCII file must be unique within its containing directory. CREATE ASCII does not open the new file; that is performed by the ASSIGN statement. In the event of an error, no directory entry is made and the file is not created.

The physical records of an ASCII file have a fixed length of 256 bytes; logical records have variable lengths, which are automatically determined when the OUTPUT, SAVE, or RE-SAVE statements are used.

Extensible Files

If the file is created on a volume that is *not* LIF, the file is “extensible”. This means that the file system automatically allocates additional space for the file as new data is written to it.

With HFS volumes, the initial size of the file is the size specified in the CREATE ASCII statement, but the file will automatically be extended as many bytes as necessary whenever an OUTPUT operation would otherwise overflow the file.

CREATE ASCII

On SRM volumes, the “number of records” parameter multiplied by the record size (256 for ASCII files) determines the “extent size” of the file (that is, the amount of space automatically appended to the file whenever it is extended).

“Preallocating” the file on non-LIF volumes (initially creating a file of sufficient size) will improve the data transfer rate with extensible files, because the file system will not have to extend the file during data transfer operations.

LIF Protect Codes

On a LIF disk, a protect code is not allowed on an ASCII file. Including a protect code in the CREATE ASCII statement will give an error.

HFS Permissions

In order to create a file on an HFS volume, you need to have W (write) and X (search) permissions on the immediately superior directory, as well as X (search) permissions on all other superior directories.

On HFS volumes, access permission bits are set to **RW-RW-RW-** when an ASCII file is created. (You can modify them with PERMIT, if desired.) In HP BASIC/UX, permissions may be altered by the users **umask**. See the *HP-UX Reference*, **umask(1)** entry, for more information.

DFS and HFS File Headers

On a DFS or HFS volume, the first 512 bytes of an ASCII file are used by the HP BASIC file system to describe the file’s type (this is the only way for HP BASIC to create a “typed” file on an HFS volume, since HFS files are otherwise “typeless”). This file header is handled automatically by HP BASIC, but it should be skipped when reading and writing the file with other HP-UX languages. See the “Porting and Sharing Files” chapter of *HP BASIC Porting and Globalization* for details.

SRM Access Capabilities (not supported in HP BASIC/UX 700)

In order to create an ASCII file in an SRM directory, you need to have R (read) and W (write) capabilities on the immediately superior directory, as well as R capability on all other superior directories.

When an ASCII file is created on an SRM volume, all access capabilities are public. Including a password in the file specifier does not protect the file. You must use PROTECT to assign passwords. You will not receive an error message for including a password, but SRM passwords in the CREATE ASCII statement are ignored.

C

CREATE BDAT

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

CREATE BDAT creates a file using LIF BDAT (Binary DATA) format.

Example Statements

```
CREATE BDAT "File",Records,Rec_size
```

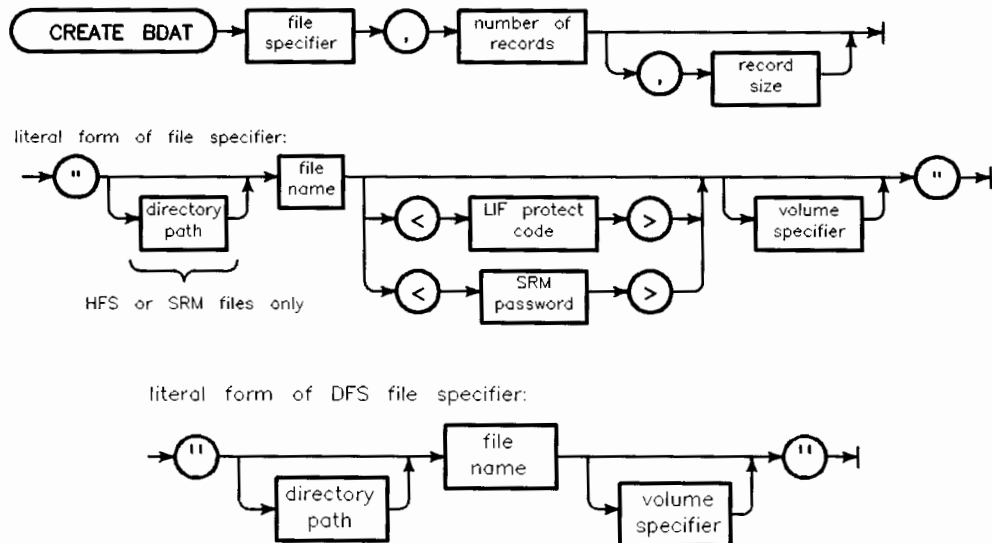
```
CREATE BDAT "George",48
```

```
CREATE BDAT "Protected<PC>",Length,128
```

```
CREATE BDAT Name$$Volume$,Bytes,1
```

```
CREATE BDAT "/Dir1/Dir2/BDATfile",25,128
```

```
CREATE BDAT "/Dir/File:REMOTE",10
```



CREATE BDAT

Item	Description	Range
file specifier	string expression	(see drawing)
number of records	numeric expression, rounded to an integer	1 through $(2^{31} - 769)/(\text{record size})$
record size	numeric expression, rounded to next even integer (except 1), which specifies bytes/record; Default = 256	1 through 65 534
directory path	literal	(see MASS STORAGE IS)
file name	literal	depends on volume's format (see Glossary)
LIF protect code	literal; first two non-blank characters are significant	> not allowed
SRM password	literal; first 16 non-blank characters are significant	> not allowed
volume specifier	string expression	(see MASS STORAGE IS)

C

Semantics

CREATE BDAT creates a new BDAT file and directory entry on the mass storage media. The name of the newly created BDAT file must be unique within its containing directory. CREATE BDAT does not open the file; that is performed by ASSIGN. In the event of an error, no directory entry is made and the file is not created.

A sector at the beginning of the file is reserved for system use. This sector cannot be directly accessed by HP BASIC programs. This sector is not present on SRM.

Extensible Files

If the file is *not* created on a LIF volume, it is "extensible". This means that the file system automatically allocates additional space for the file as new data is written to it.

CREATE BDAT

With HFS volumes, the initial size of the file is the size specified in the CREATE BDAT statement, but the file will automatically be extended as many bytes as necessary whenever an OUTPUT operation would otherwise overflow the file.

On SRM volumes, the “number of records” parameter multiplied by the record size determines the “extent size” of the file (that is, the amount of space automatically appended to the file whenever it is extended). “Preallocating” the file on an SRM volume (initially creating a file of sufficient size) will improve the data transfer rate with extensible files, because the file system will not have to extend the file during data transfer operations.

LIF Protect Codes

On LIF volumes, an optional protect code may be specified; the first two characters become the protect code of the file. (You can modify the protect code with PROTECT, if desired.)

HFS Permissions

In order to create a file on a DFS or HFS volume, you need to have W (write) and X (search) permission of the immediately superior directory, as well as X (search) permission on all other superior directories.

When a file is created on an HFS volume, access permission bits are set to **RW-RW-RW-**. You can modify the permissions with PERMIT. In HP BASIC/UX, permissions may be altered by the users **umask**. See the *HP-UX Reference*, **umask(1)** entry, for more information.

On HFS volumes, the first 512 bytes of a BDAT file are used by the HP BASIC file system to describe the file’s type (this is the only way for HP BASIC to create a “typed” file on an HFS volume, since HFS files are otherwise “typeless”). This file header is handled automatically by HP BASIC, but it should be skipped when reading and writing the file with other HP-UX languages. See the “Porting and Sharing Files” chapter of *HP BASIC Porting and Globalization* for details.

SRM Access Capabilities (not supported in HP BASIC/UX 700)

In order to create a file in an SRM directory, you need to have R (read) and W (write) capabilities on the immediately superior directory, as well as R capability on all other superior directories.

When a file is created on an SRM volume, all access capabilities are public. Including an SRM password in the file specifier does not protect the file. You must use PROTECT to assign a password. You will not receive an error message for including a password, but a password in the CREATE BDAT statement is ignored.

C

CREATE DIR

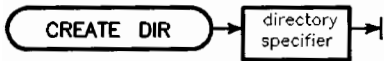
Supported On	UX WS DOS IN*
Option Required	SRM & DCOMM, or HFS
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

CREATE DIR creates a directory in either the current working directory or in the specified directory of an SRM or HFS volume.

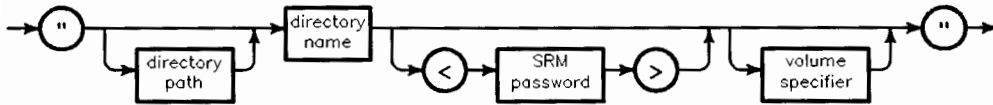
Example Statements

```
CREATE DIR "WORK_DIR"  
CREATE DIR "/Level1/Level2/New_dir"  
CREATE DIR "Level1/Level2/New_dir:REMOTE 21,3"  
CREATE DIR "Level1<SRM_RW_pass>/New_dir"  
CREATE DIR "Dir3/Dir4:,700"  
CREATE DIR "\DATA:DOS,C"
```

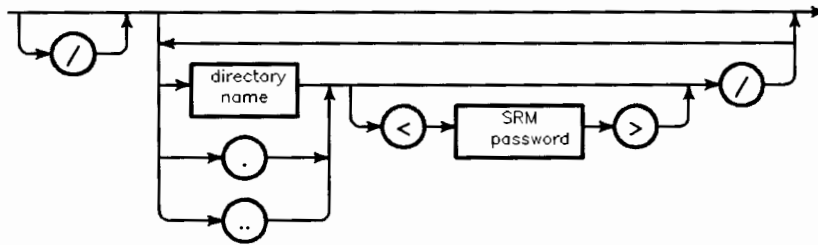
CREATE DIR



literal form of file specifier:



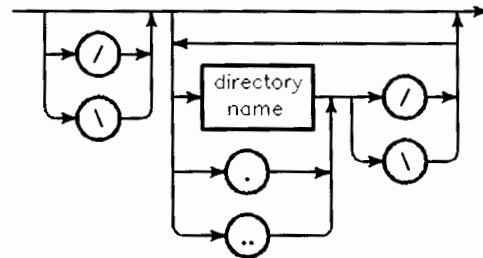
directory path:



literal form of directory specifier (DFS only):



directory path:



DFS

C

CREATE DIR

Item	Description	Range
directory specifier	string expression	(see drawing)
directory path	literal	(see drawing)
directory name	literal	depends on volume's format (14 characters for HFS; 255 characters for long file name systems; 16 characters for SRM; 8 + 3 characters for DFS; see Glossary for details)
SRM password	literal; first 16 non-blank characters are significant	> not allowed
volume specifier	literal	(see MASS STORAGE IS)

Semantics

CREATE DIR creates a directory and a corresponding directory entry in the current working directory or specified directory. The DIR file, or directory, keeps information about files and directories immediately subordinate to itself. The name of the newly created directory must be unique within its parent directory.

If no directory path is included in the specifier for the new directory, the new directory is created within the current working directory (the directory specified in the latest MASS STORAGE IS statement).

HFS Permissions

In order to create a directory on an HFS volume, you need to have W (write) and X (search) permission of the immediately superior directory, as well as X (search) permission on all other superior directories.

When a directory is created on an HFS volume, access permission bits are set to **RWXRWXRWX**. You can modify these permissions with PERMIT In

HP BASIC/UX, permissions may be altered by the users `umask`. See the *HP-UX Reference*, `umask(1)` entry, for more information.

As each directory or data file is created within an HFS directory, a 32-byte record identifying the addition is added to the DIR file. The length of this entry is variable for HFS long file name file systems.

SRM Access Capabilities (not supported in HP BASIC/UX 700)

In order to create a directory in an SRM directory, you need to have R (read) and W (write) capabilities on the immediately superior directory, as well as R (read) capabilities on all other superior directories.

When a directory is created on an SRM volume, all access capabilities are public. Including an SRM password in the directory specifier does not protect the file. You must use PROTECT to assign a password. You will not receive an error message for including a password, but a password in the CREATE DIR statement is ignored.

As each directory or data file is created within an SRM directory, a 24-byte record identifying the addition is added to the DIR file.

DFS Access Capabilities

In order to create a directory on a DFS volume, you need to have W (write) and X (search) permission of the immediately superior directory, as well as X (search) permission on all other superior directories.

When a directory is created on a DFS volume, access permission bits are set to RWXRWXRWX.



CREATE WINDOW

Supported On	UX WS* DOS*
Option Required	RMBUX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

CREATE WINDOW creates a window for alpha and graphics displays. An error is displayed on invalid parameters, or if the window already exists.

Example Statements

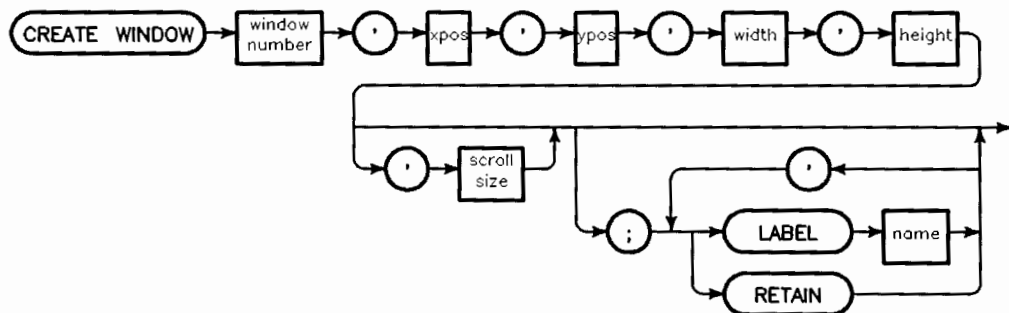
```
CREATE WINDOW 602,20,50,80*CHRX,24*CHRY,Scrollsize
```

```
CREATE WINDOW Plot,Xval,Yval,400,400
```

```
CREATE WINDOW 609,100,100,Xsize,Ysize,Scrollbuf; LABEL "Fred"
```

```
CREATE WINDOW Graph,400,300,100,100;RETAIN,LABEL "Test Results"
```

Syntax



Item	Description	Range
window number	numeric expression, rounded to integer	601 through 699
xpos	numeric expression, rounded to integer in pixel units	integer
ypos	numeric expression, rounded to integer in pixel units	integer
width	numeric expression, rounded to integer in pixel units	integer
height	numeric expression, rounded to integer in pixel units	integer
scroll size	numeric expression, rounded to integer specifies scroll buffer size DEFAULT=0 (units=lines)	range of integer, >=0 limited by available memory
name	string expression	-



Semantics

This statement is only valid when running under X Windows. When not in X Windows, this statement will cause an error. It creates the window specified by the window number with the given attributes.

The xpos and ypos parameters specify the location of the upper-left corner in pixel coordinates. The upper-left corner of the CRT is 0,0. If the xpos and ypos specified are greater than the size of the CRT, then the window is created off the screen and is not be visible until moved onto the screen.

The height parameter specifies the window height in pixels. To create a window with a specified number of alphanumeric rows, multiply the desired number of rows by the function CHRY (the pixel height of a character). The width parameter specifies the width of the window in pixels. Again, to convert alphanumeric columns to pixels simply multiply by the function CHRX.

The scroll size defines how many additional lines (rows) of text can be saved and scrolled within the specified window.

CREATE WINDOW

When LABEL <name> is specified, the window name appears in the output of the LIST WINDOW command in the window title bar (if the window manager supports title bars). The resulting title bar contains <name>:xxx where xxx is the window number attribute. The window name is also used as an identifier when the window is iconized. The window name attribute is not used to identify the window within HP BASIC programs. If LABEL <name> is not specified, then only the window number xxx appears in the title bar, and is used as the window name.

The RETAIN attribute specifies whether the raster image of the graphics in a window is saved in memory. The default is not to retain the image, and thus when the window is covered and uncovered, graphics can be lost. HP BASIC ensures that alpha information is always redrawn. The RETAIN attribute can only be specified at window create time. This attribute does have a significant penalty in terms of memory usage. For most monitors with 8 or less planes it requires one byte per pixel to save the image. Monitors with more planes will require more storage. Some new monochrome monitors can store 8 pixels per byte. Note that resizing a RETAINED window causes the window to be cleared, thus all data in the window is lost.

Control statements allow overlapping windows to move to the top of the stack, or be pushed to the bottom.

The CRT may be divided into several rectangular windows, each of which behaves like an independent CRT.

When a window is created, its contents are defined to be blank. If a window exists with the specified window number, an error message is returned.

Windows may be used for alpha, graphics, or both. When working within a window system the alpha and graphics planes are ALWAYS merged. The following statements work with window numbers:

```
ASSIGN @prt to 614
DUMP ALPHA 604
DUMP DEVICE IS 613      (only for dumping ALPHA)
DUMP GRAPHICS 605
OUTPUT 603 ...
PLOTTER IS 607,"WINDOW"
PRINTER IS 611
PRINTALL IS 612
```

C-110 CALL - CYCLE

CREATE WINDOW

DESTROY WINDOW, MOVE WINDOW, and CLEAR WINDOW statements affect the definitions of the windows.

C

CRT

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

CRT returns 1, the **device selector** of the CRT.

Example Statements

```
PRINTER IS CRT
```

```
ENTER CRT;Array$(*)
```

Syntax



CSIZE

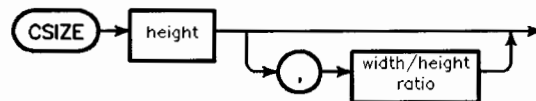
Supported On	UX WS DOS
Option Required	GRAPH
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

CSIZE sets the height and aspect ratio (width:height) of the character cell used by LABEL and SYMBOL.

Example Statements

```
CSIZE 10
CSIZE 5,0.6
CSIZE Height,Width/Height
```

Syntax



Item	Description	Range
height	numeric expression; Default = 5	—
width/height ratio	numeric expression; Default = 0.6	—

Semantics

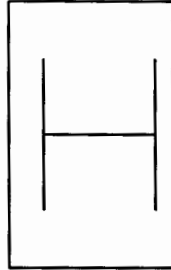
At power-on, RESET, and GINIT, the height is 5 graphic-display-units (GDUs), and the aspect ratio is 0.6 (width = 3 GDUs). A negative number for either parameter inverts the character along the associated dimension.

CSIZE

The drawing below shows the relation between the character cell and a character.

Character in a Character Cell

C



CSUB

This keyword stands for “Compiled SUBprogram”. CSUB statements are subprograms compiled in HP BASIC or another system language, and linked to BASIC by using a special CSUB preparation utility. They are loaded using the LOADSUB statement and can be deleted using the DELSUB statement. When viewed in BASIC’s edit mode, these subprograms look like SUB statements, except for the keyword CSUB (instead of SUB). They are invoked with CALL, just like normal SUB subprograms.

Because of their special nature, certain rules must be followed when editing a program containing CSUB statements. These lines will not be recognized if entered in BASIC (they must be created using a system compiler or with the COMPILER binary). Therefore, any operation which requires the line to be checked for proper syntax will fail. This includes such operations as GET, MOVE LINES, or re-storing the line by pressing the **Return** or **ENTER** keys. Operations which do not check syntax are allowed. This includes things like scrolling and renumbering.

Sometimes a CSUB will appear as multiple CSUB statements because of multiple entry points. In these cases, the group of statements cannot be broken; you cannot insert a comment line between the statements, delete a single statement in the group, or interfere with the order in any way. The only statements which can be entered directly after a CSUB are SUB and DEF FN. As always, these must be entered at the end of the program.

CSUM

See MAT.

C

CVT\$

Supported On	UX WS
Option Required	LANGUAGE
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

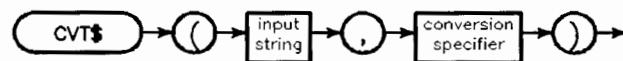
CVT\$ converts one **string expression** to another according to conversions defined by the LANGUAGE binary. It is useful for localized versions of HP BASIC that support certain languages, such as Japanese.

Example Statements

```
A$=CVT$(B$,"KATAKANA TO HIRAGANA")
```

```
A$=CVT$(B$,"ZENKAKU TO HANKAKU")
```

Syntax



Item	Description	Range
input string	string expression	any valid expression
conversion specifier	string expression	depends on LANGUAGE

Semantics

The CVT\$ function is used in certain localized versions of HP BASIC, such as Japanese localized HP BASIC. These local languages often use more than one alphabet. CVT\$ converts the input string character-by-character from one alphabet to another, according to the conversion specifier. The choices and default values available for conversion specifiers depend on the particular LANGUAGE binary you are using.

CVT\$

For a general discussion of globalization and localization, refer to *HP BASIC Porting and Globalization*. For LANGUAGE specific details, refer to *Using LanguageX with HP BASIC*, where *LanguageX* is your local language.

C

CYCLE

See OFF CYCLE and ON CYCLE.

C



D

DATA - DVAL\$

D

DATA

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	No
Programmable	Yes
In an IF ... THEN ...	No

DATA statements contain in-line data that is read by READ statements. (For information about DATA as a secondary keyword, see the SEND statement.)

D

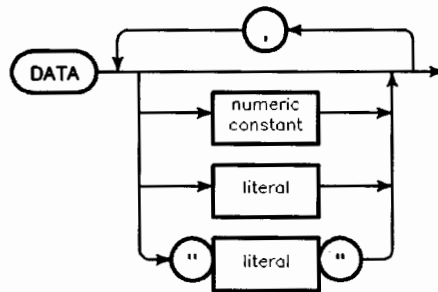
Example Statements

```
DATA 1,1.414,1.732,2
```

```
DATA word1,word2,word3
```

```
DATA"ex-point(!)","quote("")","comma(,)"
```

Syntax



Item	Description	Range
numeric constant	numeric quantity expressed using numerals, and optionally a sign, decimal point, or exponent notation	—
literal	string constant composed of characters from the keyboard, including those generated using the ANY CHAR key (f7) in the system menu of an ITF keyboard)	—

Semantics

A program or subprogram can contain any number of DATA statements at any location. When a program runs, the first item in the lowest numbered DATA statement is read by the first READ statement encountered. When a subprogram is called, the location of the next item to be read in the calling context is remembered in anticipation of returning from the subprogram. Within the subprogram, the first item read is the first item in the lowest numbered DATA statement within the subprogram. When program execution returns to the calling context, the READ operations pick up where they left off in the DATA items.

A numeric constant must be read into a variable which can store the value it represents. The computer cannot determine the intent of the programmer; although attempting to read a string value into a numeric variable will generate an error, numeric constants will be read into string variables with no complaint. In fact, the computer considers the contents of all DATA statements to be literals, and processes items to be read into numeric variables with a function similar to VAL. Error 32 results if the numeric data is not of the proper form (see VAL).

Unquoted literals must not contain quote marks (which delimit strings), commas (which delimit data items), or exclamation marks (which indicate the start of a comment). Leading and trailing blanks are deleted from unquoted literals. Enclosing a literal in double quotes enables you to include any punctuation you wish, including embedded double quotes, which are represented by a set of two adjacent double quotes.

```
DATA "Say ""Hello"" to him." ! Embedded quotes.
```

```
DATA "Danger, power ON!" ! Space, comma, and ! in the data.
```

DATE

Supported On	UX WS DOS
Option Required	CLOCK
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

DATE converts a formatted date string (DD MMM YYYY) into a numeric value (in seconds).

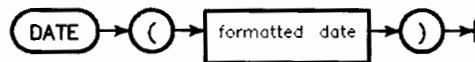
D

Example Statements

```
PRINT DATE("30 MAY 1987")
```

```
Days=(DATE(Day1$)-DATE(Day2$)) DIV 86400
```

Syntax



literal form of formatted date



Item	Description	Range
formatted date	string expression	(see drawing and text)
day	integer constant	1 through end-of-month
month	literal (lettercase ignored)	JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC
year	integer constant	1900 through 2079

Semantics

Using a value from the DATE function as the argument for SET TIMEDATE will set the clock to midnight on the date specified. Results from the DATE and TIME functions must be combined to set the date and time of day.

If the DATE function is used as an argument for SET TIMEDATE to set the clock, the date must be in the range: 1 Mar 1900 through 4 Aug 2079.

Specifying an invalid date, such as the thirty-first of February, will result in an error.

Leading blanks or non-numeric characters are ignored. ASCII spaces are recommended as delimiters between the day, month and year. However, any non-alphanumeric character, except the negative sign (minus sign), may be used as the delimiter.

D

DATE\$

Supported On	UX WS DOS
Option Required	CLOCK
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

DATE\$ formats a number of seconds into a string representing the formatted date (DD MMM YYYY).

D

Example Statements

```
PRINT DATE$(TIMEDATE)
Day1$=DATE$(Event1)
```

Syntax



Item	Description	Range
seconds	numeric expression	-4.623 683 256 E+13 through 4.653 426 335 039 9 E+13

Semantics

The date returned is in the form: DD MMM YYYY, where DD is the day of the month, MMM is the month mnemonic, and YYYY is the year.

The day is blank filled to two character positions. Single ASCII spaces delimit the day, month, and year.

The first letter of the month is capitalized and the rest are lowercase characters.

Years less than the year 0 are expressed as negative years.

D-6 DATA - DVAL\$

DEALLOCATE

Supported On	UX WS DOS
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

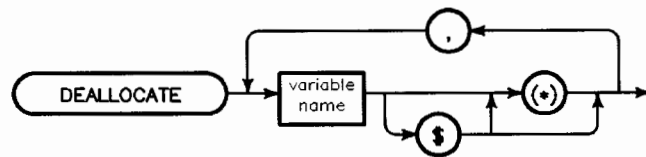
DEALLOCATE deallocates memory space reserved by the ALLOCATE statement.

Example Statements

```
DEALLOCATE A$,B$,C$
DEALLOCATE Text$(*)
DEALLOCATE Array(*)
```



Syntax



Item	Description	Range
variable name	name of an array or string variable	any valid name

Semantics

Memory space reserved by ALLOCATE exists in the same section of memory as that used by ON-event statements. Since entries in this area are “stacked” as they come in, space for variables which have been DEALLOCATED may not be available immediately. It will not be available until all the space “above it” is freed. This includes variables allocated after it, as well as ON-event

DEALLOCATE

entries. Exiting a subprogram automatically deallocates space for variables which were allocated in that subprogram.

Strings and arrays must be deallocated completely. Deallocation of an array is requested by the (*) specifier.

Attempting to DEALLOCATE a variable which is not allocated in the current context results in an error. When DEALLOCATE is executed from the keyboard, deallocation occurs within the current context.

D

DEF FN

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	No
Programmable	Yes
In an IF ... THEN ...	No

DEF FN indicates the beginning of a function subprogram. It also indicates whether the function is string or numeric and defines the formal parameter list.

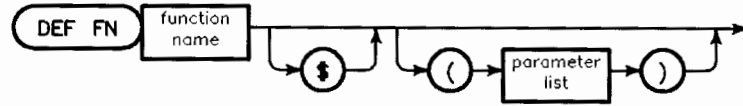
Example Statements

```
970 ! main program here.
980 END
990 !
1000 DEF FNNew$(String$)
1010 ! Additional statements
1020 RETURN Result$
1030 FNEND

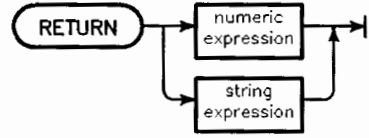
DEF FNXform(@Ptr,INTEGER A(*), OPTIONAL Text$)
DEF FNExtract(Buf$ BUFFER,Pointer)
```

D

DEF FN

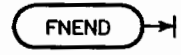


program segment

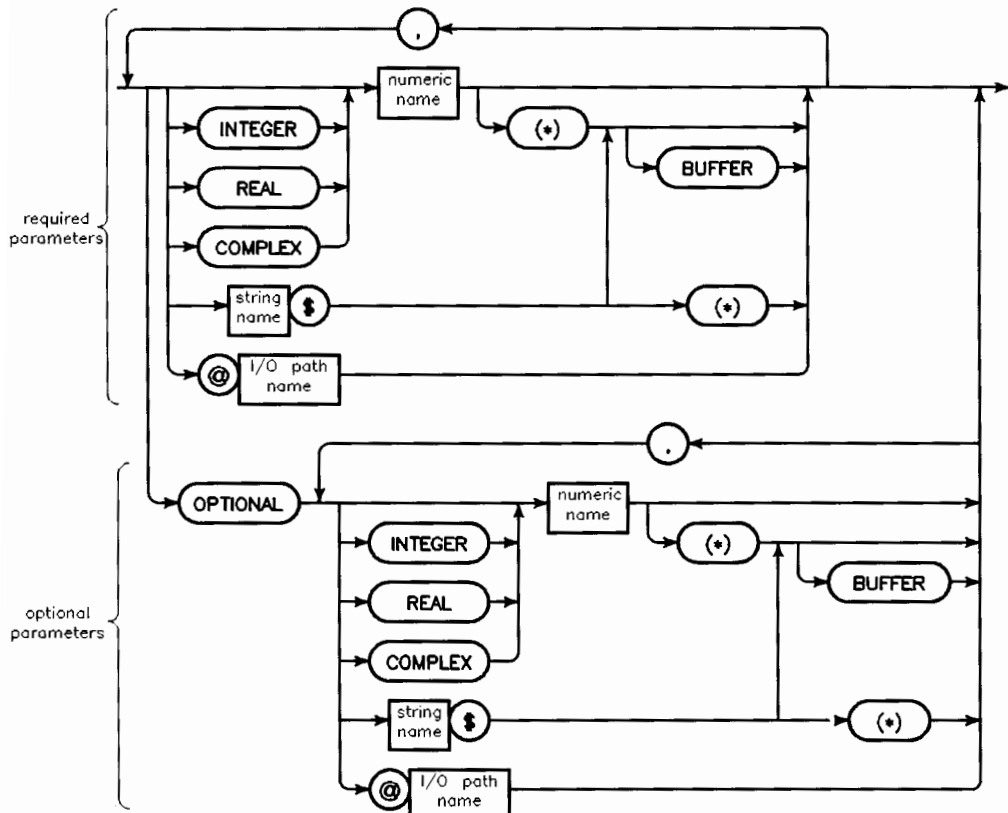


Note: A user-defined function may contain any number of RETURN statements.

program segment



D



D

Item	Description	Range
function name	name of the user-defined function	any valid name
numeric name	name of a numeric variable	any valid name
string name	name of a string variable	any valid name
I/O path name	name assigned to a device, devices, or mass storage file	any valid name (see ASSIGN)
program segment	any number of contiguous program lines not containing the beginning or end of a main program or subprogram	—

DEF FN

Semantics

User-defined functions must appear after the main program. The first line of the function must be a DEF FN statement. The last line must be an FNEND statement. Comments after the FNEND are considered to be part of the function.

Parameters to the left of the keyword OPTIONAL are required and must be supplied whenever the user-defined function is invoked (see FN). Parameters to the right of OPTIONAL are optional, and only need to be supplied if they are needed for a specific operation. Optional parameters are associated from left to right with any remaining pass parameters until the pass parameter list is exhausted. An error is generated if the function tries to use an optional parameter which did not have a value passed to it. The function NPAR can be used to determine the number of parameters supplied by the function call.

Variables in a function's formal parameter list may not be declared in COM or other declaratory statements within the function. A user-defined function may not contain any SUB statements or DEF FN statements. User-defined functions can be called recursively and may contain local variables. A unique labeled COM must be used if the local variables are to preserve their values between invocations of the user-defined function.

The RETURN statement is important in a user-defined function. If the program actually encounters an FNEND during execution (which can only happen if the RETURN is missing or misplaced), error 5 is generated. The expression in the RETURN statement must be numeric for numeric functions, and string for string functions. A string function is indicated by the dollar sign suffix on the function name. If RETURN specifies a numeric expression, the value returned by the function is always a real number, never an integer. RETURN *complex expression* yields a complex function result.

The purpose of a user-defined function is to compute a single value. While it is possible to alter variables passed by reference and variables in COM, this can produce undesirable side effects, and should be avoided. If more than one value needs to be passed back to the program, SUB subprograms should be used.

If you want to use a formal parameter as a BUFFER, it must be declared as a BUFFER in both the formal parameter list and the calling context.

DEG

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

DEG selects degrees as the current angle mode (unit of measure for angles).

Example Statements

DEG

Syntax



Semantics

Unless you set the angle mode to degrees, it is radians. HP BASIC sets the angle mode to radians when you do one of the following:

- start HP BASIC
- load or enter a new program
- execute SCRATCH, SCRATCH A, or SCRATCH C

Executing DEG sets the current angle mode to degrees. All functions which return an angle will return an angle in degrees. All operations with parameters representing angles will interpret the angle in degrees.

To set the angle mode to radians, use RAD.

A subprogram “inherits” the angle mode of the calling context. If the angle mode is changed in a subprogram, the mode of the calling context is restored when execution returns to the calling context.

DEL

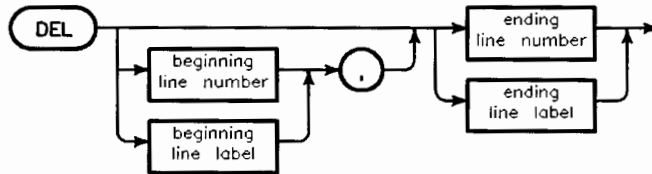
Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	No
In an IF ... THEN ...	No

DEL deletes one or more program lines from memory.

Example Statements

```
DEL 15
DEL Start,Last
DEL Sort,32000
```

Syntax



Item	Description	Range
beginning line number	integer constant identifying a program line	1 through 32 766 (1 through 2 147 483 646 for HP BASIC/UX 700)
beginning line label	name of a program line	any valid name
ending line number	integer constant identifying a program line	1 through 32 766 (1 through 2 147 483 646 for HP BASIC/UX 700)
ending line label	name of a program line	any valid name



D

Semantics

DEL cannot be executed while a program is running. If DEL is executed while a program is paused, HP BASIC changes to the stopped state.

When a line is specified by a line label, the computer uses the lowest numbered line which has the label. If the label does not exist, error 3 is generated. An attempt to delete a non-existent program line is ignored when the line is specified by a line number. An error results if the ending line number is less than the beginning line number. If only one line is specified, only that line is deleted.

When deleting SUB and FN subprograms, the range of lines specified must include the statements delimiting the beginning and ending of the subprogram (DEF FN and FNEND for user-defined function subprograms; SUB and SUBEND for SUB subprograms), as well as all comments following the delimiting statement for the end of the subprogram. Contiguous subprograms may be deleted in one operation.

DELAY

See ASSIGN, OFF DELAY, ON DELAY, PRINTALL IS, and PRINTER IS.

D

DELIM

See TRANSFER.

D



DELSUB

Supported On	UX WS DOS
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

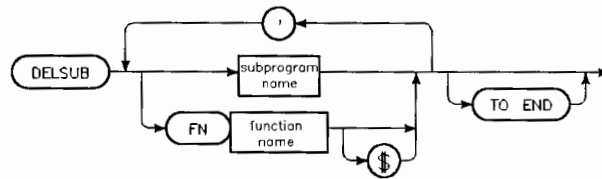
DELSUB deletes one or more subprograms or user-defined functions from memory.

D

Example Statements

```
DELSUB FNTrim$
DELSUB Mysub
DELSUB Process TO END
DELSUB Special1,Special3
```

Syntax



Item	Description	Range
subprogram name	name of a SUB or CSUB subprogram	any valid name
function name	name of a user-defined function	any valid name

Semantics

Subprograms being deleted do not need to be contiguous in memory. The order of the names in the deletion list does not have to agree with the order of the subprograms in memory. If there are subprograms with the same name, the one occurring first (lowest line number) is deleted.

The lines deleted begin with the line delimiting the beginning of the subprogram (SUB or DEF FN) and include the comments following the line delimiting the end of the subprogram (SUBEND or FNEND). If TO END is included, all subprograms following the specified subprogram are also deleted.

You cannot delete:

- Busy subprograms (ones being executed).
- Subprograms which are referenced by active ON-event CALL statements.

If an error occurs while attempting to delete a subprogram, the subprogram is not deleted, and neither are any subprograms listed to the right of that subprogram in the DELSUB statement.

D

DESTROY WINDOW

Supported On	UX WS*
Option Required	RMBUX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

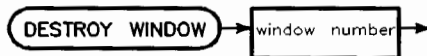
DESTROY WINDOW deletes a window created by HP BASIC/UX and removes its contents from the display. This statement can be entered in the HP BASIC/UX/WS; editor, but executes only in HP BASIC/UX in X.

D

Example Statements

```
DESTROY WINDOW 604
DESTROY WINDOW Fred
```

Syntax



Item	Description	Range
window number	numeric expression, rounded to integer	601 through 699

Semantics

This statement is only valid when running under X Windows. When not in X Windows, this statement will cause an error. It deletes the window specified by the window number. The specified window can only be a window created with the CREATE WINDOW statement. Thus the root HP BASIC window (number 600) cannot be deleted.

When a window is deleted, the contents of any windows it overlays are exposed.

DET

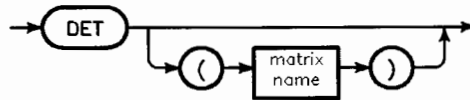
Supported On	UX WS DOS
Option Required	MAT
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

DET returns the determinant of a matrix.

Example Statements

```
Last_det=DET
PRINT DET(Matrix)
```

Syntax



Item	Description	Range
matrix name	name of a square, two-dimensional numeric array; Default = (see text)	any valid name

Semantics

If you do not specify a matrix, DET returns the determinant of the most recently inverted matrix. This value is not affected by context switching. If no matrix has been inverted since power-on, pre-run, SCRATCH or SCRATCH A, 0 is returned.

The determinant provides an indication of whether an inverse is valid. If the determinant of a matrix equals 0, then the matrix has no inverse. If the determinant is very small compared with the elements of its matrix, then the inverse may be invalid and should be checked.

DET

If the matrix is COMPLEX, the value returned is COMPLEX. Otherwise, the value returned is REAL.

 **D**

DICTIONARY IS

Supported On	UX WS
Option Required	INPUT
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

DICTIONARY IS specifies the file containing the language dictionaries. It is useful for localized versions of HP BASIC that support certain local languages, such as Japanese.

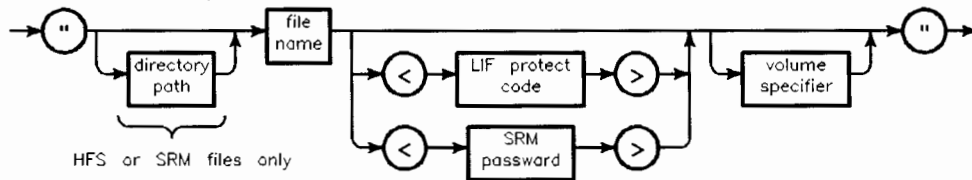
Example Statements

```
DICTIONARY IS "JPN_SYSDCT","SYSTEM"
DICTIONARY IS "JPN_USRDCT","USER"
DICTIONARY IS "", "USER" ! Closes USER dictionary
```

Syntax



literal form of file specifier:



Item	Description	Range
type	string expression	depends on INPUT

DICTIONARY IS

Semantics

Certain localized versions of HP BASIC, such as Japanese localized HP BASIC, use input methods that allow keyboard input translation. The translations are carried out by the INPUT binary according to the definitions in dictionary files. Before a word or phrase can be translated, the dictionaries must be specified using DICTONARY IS.

For a general discussion of globalization and localization, refer to the *HP BASIC Porting and Globalization* manual. For INPUT specific details, refer to *Using LanguageX with HP BASIC*, where *LanguageX* is your local language.

D

If you are using a version of HP BASIC that supports wildcards, you can use them in file specifiers with DICTONARY IS. You must first enable wildcard recognition using WILDCARDS. Refer to the keyword entry for WILDCARDS for details. Wildcard file specifiers used with DICTONARY IS must match one and only one file name.

If the file specifier does not include a complete path or volume specifier, the current MASS STORAGE IS volume and path are used.

DIGITIZE

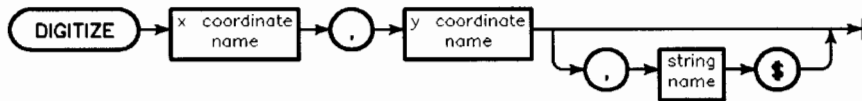
Supported On UX* WS DOS
 Option Required GRAPHX
 Keyboard Executable Yes
 Programmable Yes
 In an IF ... THEN ... Yes

DIGITIZE inputs the X and Y coordinates of a digitized point from the locator specified by GRAPHICS INPUT IS.

Example Statements

```
DIGITIZE Xpos,Ypos,Status$
IF Flag THEN DIGITIZE X,Y
```

Syntax



Item	Description	Range
x coordinate name	name of a numeric variable	any valid name
y coordinate name	name of a numeric variable	any valid name string
string name	name of a string variable	any valid name string

D

DIGITIZE

Semantics

The returned coordinates are in the unit-of-measure currently defined for the PLOTTER IS and GRAPHICS INPUT IS devices. The unit-of-measure may be default units or those defined by either the WINDOW or SHOW statement. If an INTEGER numeric variable is specified and the value entered is out of range, error 20 is reported.

If graphics input is from the keyboard, DIGITIZE is satisfied by pressing any of the following keys:

Return, **Enter**, **ENTER**, **EXECUTE**, **PAUSE**, **STEP**, **CONTINUE**, **ENTER**, **EXEC**, **PSE**, **STEP**, and **CONT**.

Note that if ON KBD is in effect while executing DIGITIZE when the keyboard or mouse or knob is the GRAPHICS INPUT IS device, the keys listed above will not be placed into KBD\$. Once the DIGITIZE is complete, these keys will be placed into KBD\$.

The optional string variable is used to input the device status of the GRAPHICS INPUT IS device. This status string contains eight bytes, defined as follows.

Byte	1	2	3	4	5	6	7	8
Meaning	Digitize Status	,	Point Significance	,	Tracking On/Off	,	Button Number	

Byte 1 Digitize status; If the locator device supports only single point digitizing, this byte is always a "1". If the locator device supports continuous digitizing, this byte is a "1" for all points in a stream of continuous points *except* the last point, which will be returned with a "0". The method of indicating the beginning and ending of a continuous point stream is device dependent. If the numeric value represented by this byte is used as the pen control value for a PLOT statement, continuous digitizing will be copied to the display device.

Bytes 2, 4, & 6 Commas; used as delimiters.

Byte 3 Significance of digitized point; “0” indicates that the point is outside the P1, P2 limits; “1” indicates that the point is outside the viewport, but inside the P1, P2 limits; “2” indicates that the point is inside the current viewport limits.

Byte 5 Tracking status; “0” indicates off, “1” indicates on.

Byte 7 and 8 The number of the buttons which are currently down. To interpret the ASCII number returned, change the number to its binary form and look at each bit. If the bit is “1”, the corresponding button is down. If the bit is “0”, the corresponding button is not down.

If the locator device (e.g., stylus or puck) goes out of proximity, a “button 7” is indicated in the “button number” bytes. Bytes 7 and 8 will be exactly “64” regardless of whether any actual buttons are being held down at the time. Proximity is reported only from HP-HIL locators; the HP 9111A always returns “00” in bytes 7 and 8. On a 35723A TouchScreen, going out of proximity (i.e., removing your finger from the screen) will trigger a digitize. Coming into proximity on a tablet with a button pressed will also trigger a digitize, even if the button was originally pressed while in proximity.

D

HP BASIC/UX Specifics

When running in X Windows:

- Only the HP-HIL devices recognized by the window system (i.e. those which control the window pointer can be used for graphics input.
- All HP-HIL devices (including tablets) can be accessed only through the KBD or ARROW KEYS digitizer specifier. TABLET is not a valid specifier in X Windows.
- Any HP-GL devices specified in a GRAPHICS INPUT IS will be locked to that window while DIGITIZE is being executed.

When running on a terminal:

- Only arrow keys can be used to provide input through the KBD select code.

DIM

Supported On	UX WS DOS IN*
Option Required	None
Keyboard Executable	No
Programmable	Yes
In an IF ... THEN ...	No

DIM dimensions and reserves memory for REAL numeric arrays, strings, and string arrays.

D

Example Statements

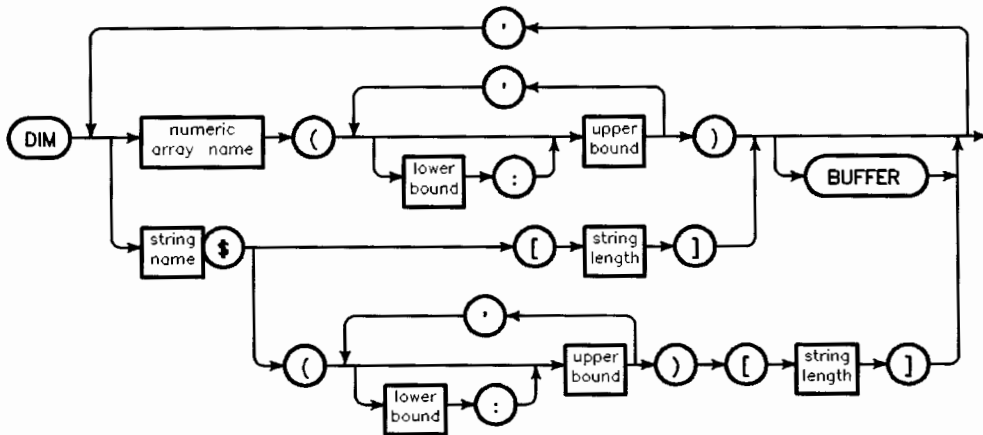
```
DIM String$[100],Name$(12)[32]
```

```
DIM Param(48,8,8,2,2,2)
```

```
DIM Array(-128:127,16)
```

```
DIM Buff$[512] BUFFER,Array(500) BUFFER
```

Syntax



Item	Description	Range
numeric array name	name of a numeric array	any valid name
string name	name of a string variable	any valid name
lower bound	integer constant; Default = OPTION BASE value (0 or 1)	-32 767 through + 32 767 (see "array" in Glossary)
upper bound	integer constant	-32 767 through +32 767 (see "array" in Glossary)
string length	integer constant	1 through 32 767



D

Semantics

A program can have any number of DIM statements. The same variable cannot be declared twice within a program (variables declared in a subprogram are distinct from those declared in a main program, except those declared in COM). The DIM statements can appear anywhere within a program, as long as they do not precede an OPTION BASE statement. Dimensioning occurs at pre-run or subprogram entry time. Dynamic run-time allocation of memory is provided by the ALLOCATE statement.

No array can have more than six dimensions. Each dimension can have a maximum of 32 767 elements.

The total number of variables is limited by the fact that the maximum memory usage for *all* variables—numeric and string—within any context is 16 777 215 bytes (or limited by the amount of available memory, whichever is less).

All numeric arrays declared in a DIM statement are REAL, and each element of type REAL requires 8 bytes of storage. A string requires one byte of storage per character, plus two bytes of overhead on Series 200/300/400 or four bytes on Series 700.

An undeclared array is given as many dimensions as it has subscripts in its lowest-numbered occurrence. Each dimension of an undeclared array has an upper bound of ten. Space for these elements is reserved whether you use them or not. Any time a lower bound is not specified, it defaults to the OPTION BASE value.

DIM

Declaring Buffers

To declare variables to be buffers, each variable's name must be followed by a keyword `BUFFER`; the designation `BUFFER` applies only to the variable which it follows.

String arrays *cannot* be declared to be buffers.

D

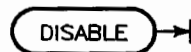
DISABLE

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

DISABLE disables all event-initiated branches currently defined, except ON END, ON ERROR, and ON TIMEOUT.

Example Statements

```
DISABLE
```

Syntax

Semantics

If an event occurs while the event-initiated branches are disabled, only the first occurrence of each event is logged; there is no record of how many of each type of event has occurred.

If event-initiated branches are enabled after being disabled, all logged events will initiate their respective branches if and when system priority permits. ON ERROR, ON END, and ON TIMEOUT branches are *not* disabled by DISABLE.

DISABLE EXT SIGNAL

Supported On	UX WS*
Option Required	RMBUX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

DISABLE EXT SIGNAL disables system-generated signals by causing them to be ignored by HP BASIC. This statement can be entered in the HP BASIC/UX/WS; editor, but executes only in HP BASIC/UX.

D

Example Statements

```
DISABLE EXT SIGNAL 4
```

```
DISABLE EXT SIGNAL Sigsys
```

Syntax



Item	Description	Range
signal number	numeric expression, rounded to integer	1 through 32 (see ON EXT SIGNAL)

Semantics

This statement causes the specified EXT SIGNAL to be ignored by HP BASIC. This does not allow an ON EXT SIGNAL to trigger, nor does it allow the default action to take place. Also, it does not cause the EXT SIGNAL action (default or user specified) to change.

Only supported system signals may be specified. See ON EXT SIGNAL for a list of valid signal numbers.

DISABLE INTR

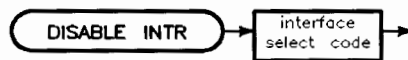
Supported On	UX WS DOS IN
Option Required	IO
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

DISABLE INTR disables interrupts from an interface by turning off the interrupt-generating mechanism on the interface.

Example Statements

```
DISABLE INTR 7
DISABLE INTR Isc
```

Syntax



D

DISP

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

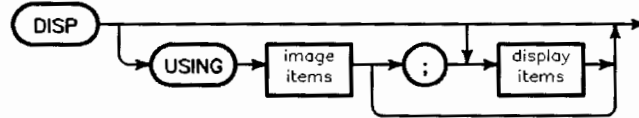
DISP prints the specified items on the display line. The display line is a single line near the bottom of the alphanumeric display.

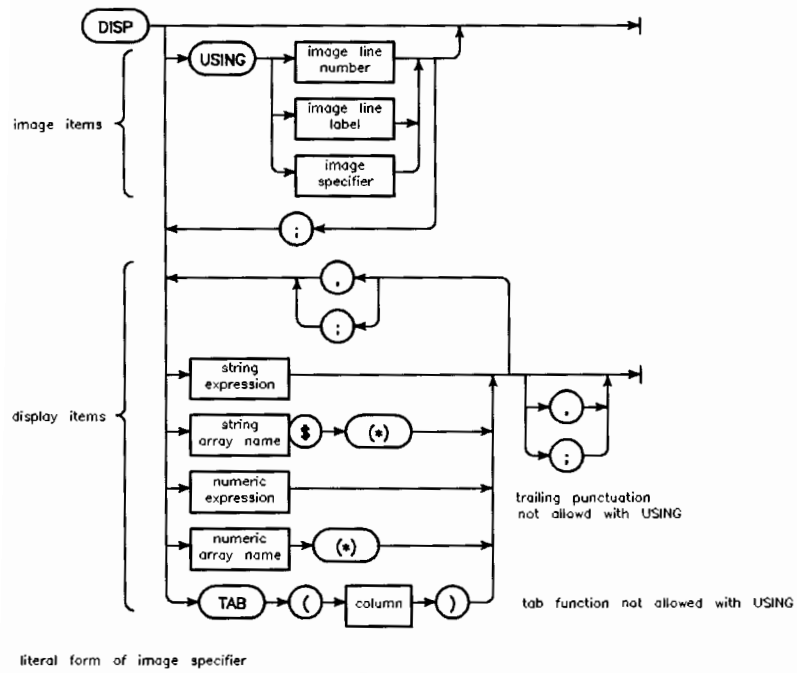
D

Example Statements

```
DISP Prompt$;  
DISP TAB(5),First,TAB(20),Second  
DISP  
DISP Name$,Id;Code  
DISP USING Form3;Item(1),Item(2)  
DISP USING "5Z.DD";Money
```

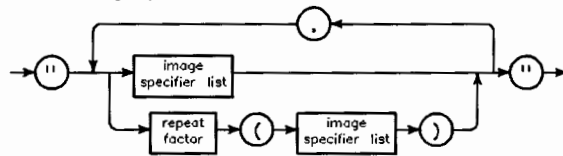
Syntax





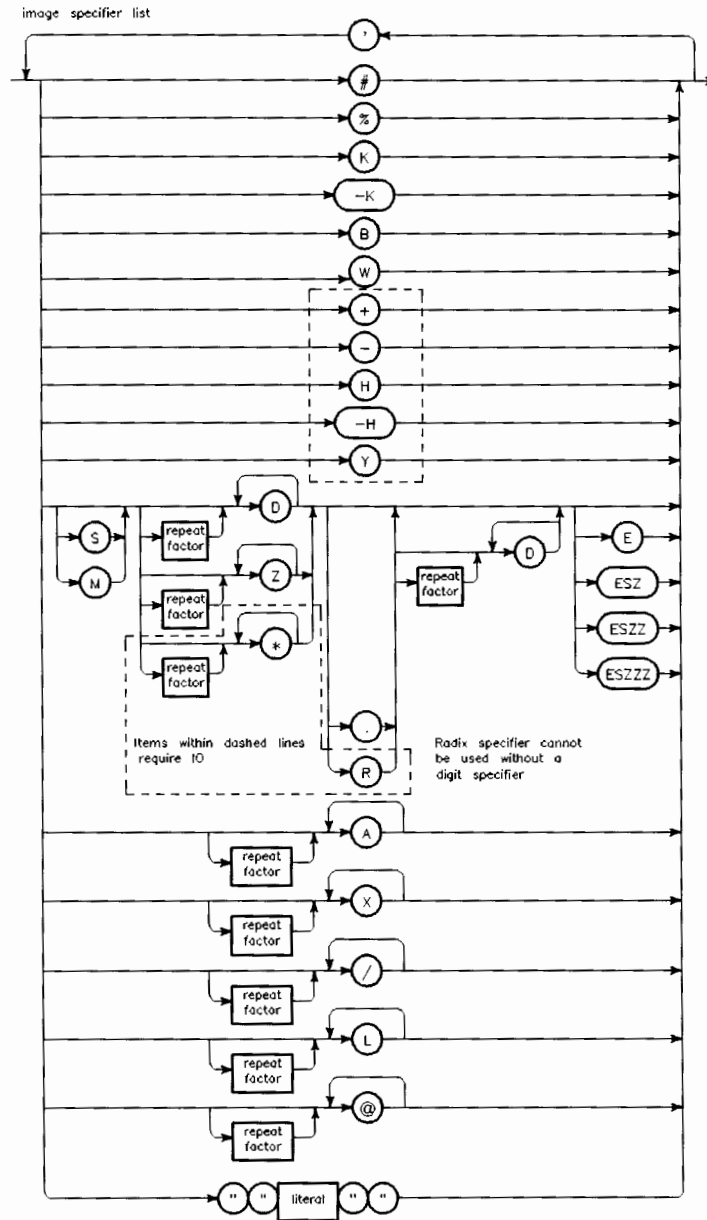
D

literal form of image specifier



DISP

D



Item	Description	Range
image line label	name identifying an IMAGE statement	any valid name
image line number	integer constant identifying an IMAGE statement	1 through 32 766 (1 through 2 147 483 646 for HP BASIC/UX 700)
image specifier	string expression	(see diagram)
string array name	name of a string array	any valid name
numeric array name	name of a numeric array	any valid name
column	numeric expression, rounded to an integer	1 through screenwidth
image specifier list	literal	(see diagram)
repeat factor	integer constant	1 through 32 767
literal	string constant composed of characters entered from the keyboard, including those generated using the ANY CHAR key	quote mark not allowed

D

Semantics

Standard Numeric Format

The standard numeric format depends on the value of the number being displayed. If the absolute value of the number is greater than or equal to $1E-4$ and less than $1E+6$, it is rounded to 12 digits and displayed in floating point notation. If it is not within these limits, it is displayed in scientific notation. The standard numeric format is used unless USING is selected, and may be specified by using K in an image specifier.

COMPLEX numbers are treated like two REAL numbers separated by a semicolon.

DISP

Automatic End-Of-Line Sequence

After the display list is exhausted, an End Of Line (EOL) sequence is sent to the display line, unless it is suppressed by trailing punctuation or a pound-sign image specifier.

Control Codes

Some ASCII control codes have a special effect in DISP statements:

Character	Keystroke	Name	Action
CHR\$(7)	CTRL-G	bell	Sound the beeper
CHR\$(8)	CTRL-H	backspace	Move the cursor back one character.
CHR\$(12)	CTRL-L	form-feed	Clear the display line.
CHR\$(13)	CTRL-M	carriage-return	Move the cursor to column 1. The next character sent to the display clears the display line, unless it is a carriage-return.

CRT Enhancements

There are several character enhancements (such as inverse and underlining) available on some CRTs. They are accessed through characters with decimal values above 127. For a list of the characters and their effects, see the "Display Enhancement Characters" table in "Useful Tables" at the back of this book.

Arrays

Entire arrays may be displayed using the asterisk specifier. Each element in an array is treated as a separate item by the DISP statement, as if the items were listed separately, separated by the punctuation following the array specifier. If no punctuation follows the array specifier, a comma is assumed. COMPLEX array elements are treated as if the real and imaginary parts are separated by a

semicolon. The array is output in row major order (rightmost subscript varies fastest).

Display Without USING

If DISP is used without USING, the punctuation following an item determines the width of the item's display field; a semicolon selects the compact field, and a comma selects the default display field. When the display item is an array with the asterisk array specifier, each array element is considered a separate display item. Any trailing punctuation will suppress the automatic EOL sequence, in addition to selecting the display field to be used for the display item preceding it.

The compact field is slightly different for numeric and string items. Numeric items are displayed with one trailing blank. String items are displayed with no leading or trailing blanks.

The default display field displays items with trailing blanks to fill to the beginning of the next 10-character field.

Numeric data is displayed with one leading blank if the number is positive, or with a minus sign if the number is negative, whether in compact or default field.

In the TAB function, a column parameter less than one is treated as one. A column parameter greater than the screen width (in characters) is treated as equal to the screen width.

Display With USING

When the computer executes a DISP USING statement, it reads the image specifier, acting on each field specifier (field specifiers are separated from each other by commas) as it is encountered. If nothing is required from the display items, the field specifier is acted upon without accessing the display list. When the field specifier requires characters, it accesses the next item in the display list, using the entire item. Each element in an array is considered a separate item.

The processing of image specifiers stops when a specifier is encountered that has no matching display item (and the specifier requires a display specifier). If

D

DISP

the image specifiers are exhausted before the display items, they are reused, starting at the beginning.

COMPLEX values require 2 REAL image specifiers (i.e. each COMPLEX value is treated like 2 REAL values).

If a numeric item requires more decimal places to the left of the decimal point than are provided by the field specifier, an error is generated. A minus sign takes a digit place if M or S is not used, and can generate unexpected overflows of the image field. If the number contains more digits to the right of the decimal point than specified, it is rounded to fit the specifier.

D

If a string is longer than the field specifier, it is truncated, and the rightmost characters are lost. If it is shorter than the specifier, trailing blanks are used to fill out the field.

Effects of the image specifiers on the DISP statement are shown in the following table:

Image Specifier	Meaning
K	Compact field. Displays a number or string in standard form with no leading or trailing blanks.
-K	Same as K.
H	Similar to K, except the number is displayed using the European number format (comma radix). (Requires IO)
-H	Same as H. (Requires IO)
S	Displays the number's sign (+ or -).
M	Displays the number's sign if negative, a blank if positive.
D	Digit specifier displays one digit character. A leading zero is replaced by a blank. If the number is negative and no sign image is specified, the minus sign will occupy a leading digit position. If a sign is displayed, it will "float" to the left of the left-most digit.
Z	Same as D, except that leading zeros are displayed.
*	Same as Z, except that asterisks are displayed instead of leading zeros. (Requires IO)
.	Displays a decimal-point radix specifier.
R	Displays a comma radix specifier (European radix). (Requires IO)
E	Displays an E, a sign, and a two-digit exponent.
ESZ	Displays an E, a sign, and a one-digit exponent.
ESZZ	Same as E.
ESZZZ	Displays an E, a sign, and a three-digit exponent.
A	Displays a string character. Trailing blanks are output if the number of characters specified is greater than the number available in the corresponding string. If the image specifier is exhausted before the corresponding string, the remaining characters are ignored. Use AA or 2A for two-byte globalization characters.

D

DISP

Image Specifier	Meaning
X	Displays a blank.
literal	Displays the characters contained in the literal.
B	Displays the character represented by one byte of data. This is similar to the CHR\$ function. The number is rounded to an INTEGER, and the least-significant byte is sent. If the number is greater than 32 767, then 255 is used; if the number is less than -32 768, then 0 is used.
W	Displays two characters represented by the two bytes of a 16-bit, two's-complement integer. The corresponding numeric item is rounded to an INTEGER. If it is greater than 32 767, then 32 767 is used; if it is less than -32 768, then -32 768 is used. The most-significant byte is sent first.
Y	Same as W. (Requires IO)
#	Suppresses the automatic output of an EOL (End-Of-Line) sequence following the last display item.
%	Ignored in DISP images.
+	Changes the automatic EOL sequence that normally follows the last display item to a single carriage-return. (Requires IO)
-	Changes the EOL automatic sequence that normally follows the last display item to a single line-feed. (Requires IO)
/	Sends a carriage-return and a line-feed to the display line.
L	Same as /.
@	Sends a form-feed to the display line.

D

DISPLAY FUNCTIONS

Supported On	UX* WS DOS IN
Option Required	CRTX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

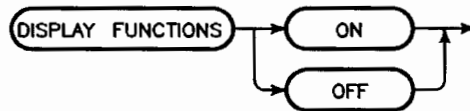
DISPLAY FUNCTIONS enables and disables the display functions mode. This mode causes control characters sent to the CRT to be displayed.

Example Statements

```

DISPLAY FUNCTIONS ON
DISPLAY FUNCTIONS OFF
IF No_ctrl_char THEN DISPLAY FUNCTIONS OFF
    
```

Syntax



Semantics

Except for the carriage-return character, all subsequent control characters sent to the display (while in the display functions mode) *do not* invoke their defined function, but are *only displayed*. The carriage-return is *both displayed and* causes the print position to move to the beginning of the next line (both CR and LF functions invoked).

Also available as CRT CONTROL register 4.

D

DISPLAY FUNCTIONS

HP BASIC/UX Specifics

To enable and disable the display function mode while running HP BASIC/UX in the X11 Window environment, use CRT Control Register 4. For example, the following command will allow you to turn on the display functions mode for HP BASIC/UX window number 601:

```
CONTROL 601,4;1
```

If you specify a font that does not have the control character you are printing, a space will be displayed instead.

D

DIV

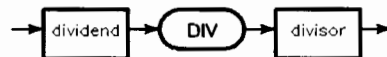
Supported On UX WS DOS IN
 Option Required None
 Keyboard Executable Yes
 Programmable Yes
 In an IF ... THEN ... Yes

DIV returns the integer portion of the quotient of the dividend and the divisor.

Example Statements

```
Quotient=Dividend DIV Divisor
PRINT "Hours =";Minutes DIV 60
```

Syntax



Item	Description	Range
dividend	numeric expression	—
divisor	numeric expression	not equal to 0

Semantics

DIV returns a REAL value unless both arguments are INTEGER. In the latter case, the returned value is INTEGER.

DIV *is not* defined for COMPLEX arguments.

See the discussion “Precision and Accuracy” in the section “Numeric Computation” of the *HP BASIC Programming Guide* for detailed information on the effects of the computer’s internal numeric representation.

DOT

Supported On	UX WS DOS
Option Required	MAT
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

DOT returns the inner (dot) product of two numeric vectors.

Example Statements

```
Res=DOT(Vec1,Vec2)
PRINT DOT(A,B)
```

Syntax



Item	Description	Range
vector name	name of a one-dimensional numeric array	any valid name

Semantics

The dot product is calculated by multiplying corresponding elements of the two vectors and then summing the products. The two vectors must be the same current size. If both vectors are **INTEGER**, the product will be an **INTEGER**. If either vector is **COMPLEX**, the product will be **COMPLEX**. Otherwise, the product will be of type **REAL**.

DRAW

Supported On	UX WS DOS IN
Option Required	GRAPH
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

DRAW draws a line from the pen's current position to the specified X and Y coordinate position using the current line type and pen number.

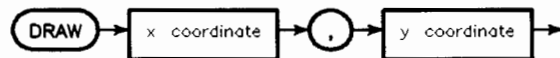
Example Statements

```
DRAW 10,90
```

```
DRAW Next_x,Next_y
```



Syntax



Item	Description	Range
x coordinate	numeric expression, in current units	
y coordinate	numeric expression, in current units	

Semantics

The X and Y coordinate information is interpreted according to the current unit-of-measure.

A DRAW to the current position generates a point. DRAW updates the logical pen position at the completion of the DRAW statement and leaves the pen down. The line is clipped at the current clipping boundary.

If none of the line is inside the current clipping limits, the pen is not moved, but the logical pen position is updated.

DRAW**Applicable Graphics Transformations**

	Scaling	PIVOT	CSIZE	LDIR	PDIR
Lines (generated by moves and draws)	X	X			[4]
Polygons and rectangles	X	X			X
Characters (generated by LABEL)			X	X	
Axes (generated by AXES and GRID)	X				
Location of labels	[1]	[3]		[2]	

D

¹The starting point for labels drawn after lines or axes is affected by scaling.

²The starting point for labels drawn after other labels is affected by LDIR.

³The starting point for labels drawn after lines or axes is affected by PIVOT.

⁴RPLOT and IPLOT are affected by PDIR.

DROUND

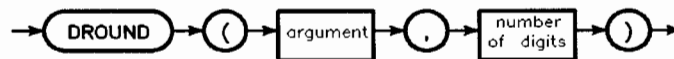
Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

DROUND rounds a numeric expression to the specified number of digits. If the specified number of digits is greater than 15, no rounding takes place. If the number of digits specified is less than 1, zero is returned.

Example Statements

```
Test_real=DROUND(True_real,12)
PRINT "Approx. Volts =";DROUND(Volts,3)
```

Syntax



Item	Description	Range
argument	numeric expression	—
number of digits	numeric expression, rounded to an integer	—

Semantics

COMPLEX numbers *are not* allowed as arguments to this function.

DUMP

Supported On	UX* WS DOS
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

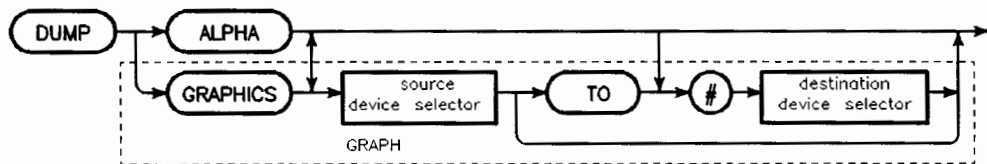
DUMP ALPHA copies the contents of the alphanumeric display to a printer.

DUMP GRAPHICS copies the contents of the graphics display to an output device.

Example Statements

```
DUMP ALPHA
DUMP ALPHA #701
DUMP ALPHA 602 ! HP BASIC/UX in X only
DUMP ALPHA 602 TO #604 ! HP BASIC/UX in X only
DUMP ALPHA 1 TO #701 ! HP BASIC/UX/WS only
DUMP GRAPHICS
DUMP GRAPHICS 602 ! HP BASIC/UX in X only
DUMP GRAPHICS #Device
DUMP GRAPHICS Color_source
DUMP GRAPHICS 28 TO #702
```

Syntax



Item	Description	Range
source device selector	numeric expression, rounded to an integer; Default = last CRT plotting device	(see Glossary)
destination device selector	numeric expression, rounded to an integer; Default = DUMP DEVICE IS device	external interfaces and windows only (see Glossary)

Semantics

DUMP ALPHA copies the contents of the alphanumeric display to an output device. With a bit-mapped alpha display, the alpha buffer is sent to the printer as alphanumeric characters.

DUMP GRAPHICS copies the entire contents of the CRT or window, which may contain bit-mapped alpha, to the current DUMP DEVICE IS device (usually a printer). Performing DUMP GRAPHICS to a device which does not support the HP Raster Interface Standard will produce unpredictable results. The HP 2631G, HP 9876, and the ThinkJet printers are among devices that support this standard. Windows do not support this standard. (See the *Configuration Reference* for a complete list of supported HP devices.)

If the destination device is not explicitly specified, it is assumed to be the current DUMP DEVICE IS device.

If EXPANDED is specified in the DUMP DEVICE IS statement, the source graphics image is doubled in both X and Y directions before being sent to the destination device. However, if both source and destination devices are explicitly specified, the image is sent without being expanded.

If a DUMP GRAPHICS operation is stopped by pressing the **Break** (**CLR I/O**) key, the printer may or may not terminate its graphics mode. Sending the printer up to 192 null characters [CHR\$(0)] can be used to terminate the graphics mode on a printer such as the HP 9876.

If the source has multiple planes of graphics memory associated with a pixel, an inclusive-OR is performed on all the bits corresponding to the pixel. This determines whether to print it as black or white.

D

DUMP

If a currently active CRT or window is explicitly specified as the source, the CRT's contents are dumped to the printer. However, if the specified CRT has not been "activated" (see following description), error 708 is reported.

Plotters are de-activated by power-up, GINIT, SCRATCH A, or **Reset**. A plotting device is activated when it is specified in a PLOTTER IS statement. In addition, the internal CRT or window is also (implicitly) activated by any of the following operations after de-activation: any pen movement; GCLEAR; GLOAD (to the current default destination); GSTORE (from the current default source); and DUMP GRAPHICS (from the current default source).

If a non-CRT source which is the current PLOTTER IS device is explicitly specified, the DUMP GRAPHICS is not performed; however, if a non-CRT source which is not the current PLOTTER IS device is explicitly specified, error 708 is reported.

On multi-plane bit-mapped display devices, which use a graphics write-enable mask, only the bits indicated by 1's will be OR'ed together and dumped.

HP BASIC/UX Specifics

DUMP GRAPHICS from a window dumps the raster image, which includes the displayed alpha text. DUMP ALPHA from a window dumps only the ASCII text contained in the window. There is no special case for non-square pixels (i.e. DUMP GRAPHICS with alpha on the display matches the image on the CRT). DUMP GRAPHICS on a terminal is not performed. DUMP GRAPHICS to a window is not permitted.

Both DUMP ALPHA and DUMP GRAPHICS are extended to support output to unnamed pipes. DUMP ALPHA supports output only to windows.

Displays with Non-Square Pixels (HP BASIC/WS Only)

For machines which have a display with non-square pixels (such as the HP 98542A and the HP 98543A), a non-expanded DUMP GRAPHICS will produce an image that matches the CRT or window *only* if no alpha appears in the graphics planes. Since most printers print square pixels, this routine treats graphics pixel pairs as single elements and prints one square for each pixel pair in the frame buffer. Because alpha works with individual pixels, and not with pixel pairs, mixed alpha and graphics will appear blurred on a DUMP

GRAPHICS non-expanded output. Using the EXPANDED option causes the vertical length (the height on the CRT or window) to be doubled as before, but dumps each separate pixel. In this mode, mixed alpha and graphics will appear the same on the dump as on the CRT or window.

Note

Some printers are not capable of printing 1024 graphics dots per line, so images dumped will be truncated to fit the printer.

D 

DUMP DEVICE IS

Supported On	UX* WS DOS
Option Required	GRAPH
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

DUMP DEVICE IS specifies which device receives the data when either DUMP ALPHA or DUMP GRAPHICS is executed without a device selector.

D

Example Statements

```
DUMP DEVICE IS 721
DUMP DEVICE IS Printer,EXPANDED
DUMP DEVICE IS 614 ! HP BASIC/UX in X only
DUMP DEVICE IS "plot.out" ! HP BASIC/UX/WS only
DUMP DEVICE IS "| conv | lp",EXPANDED ! HP BASIC/UX only
```

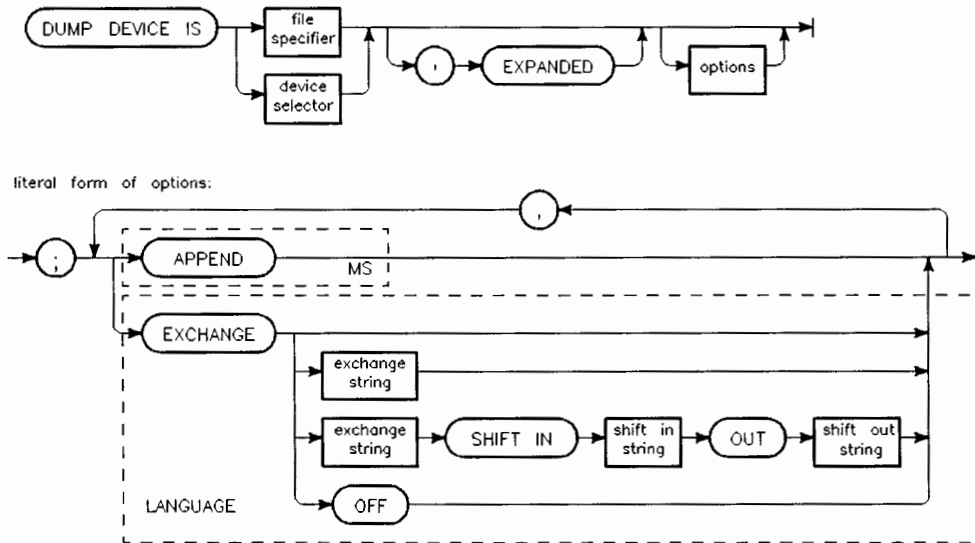
The following example is valid on HP BASIC/WS only. It requires the MS binary.

```
DUMP DEVICE IS 721;APPEND
```

The following examples require the LANGUAGE binary.

```
DUMP DEVICE IS 721;EXCHANGE "HP16"
DUMP DEVICE IS 701;EXCHANGE "JIS" SHIFT IN In$ OUT Out$
```

DUMP DEVICE IS



D

Item	Description	Range
file specifier	string expression	(See MASS STORAGE IS)
device selector	numeric expression, rounded to an integer; Default = 701	external interfaces or windows only (see Glossary)
exchange string	string expression	choices depend on LANGUAGE
shift in string	string expression	depends on printer used; six bytes maximum
shift out string	string expression	depends on printer used; six bytes maximum

DUMP DEVICE IS

Semantics

Doing a DUMP GRAPHICS to a printer which does not support the HP Raster Interface Standard will produce unpredictable results. The HP 9876 and the HP 2631G are among the devices or files which support the standard. (See the *Configuration Reference* for a complete list of supported HP devices or files.)

Specifying EXPANDED results in graphics dumps that are twice as big on each axis (except for displays with non-square pixels—see DUMP GRAPHICS for details) and turned sideways. This gives four dots on the printer for each dot on the display. The resulting picture does not fit on one page of an HP 9876 or HP 2631G printer.

DUMP DEVICE IS file

The file must be a BDAT or HP-UX file.

The DUMP DEVICE IS file statement positions the file pointer to the beginning of the file unless you specify the APPEND option. Thus, DUMP DEVICE IS overwrites existing files unless you specify APPEND.

The file is closed when another DUMP DEVICE IS statement is executed and at SCRATCH A.

You can read the file with ENTER if it is ASSIGNED with FORMAT ON.

An end-of-file error occurs when the end of a LIF file is reached.

If you are using a version of HP BASIC that supports wildcards, you can use them in file specifiers with DUMP DEVICE IS. You must first enable wildcard recognition using WILDCARDS. Refer to the keyword entry for WILDCARDS for details. Wildcard file specifiers used with DUMP DEVICE IS must match one and only one file name.

HP BASIC/UX Specifics

DUMP DEVICE IS supports output to windows or unnamed pipes.

HP BASIC/UX treats output to a pipe as it would output to a file. The pipe must be explicitly closed before any output becomes permanent (or takes place). Output to a spooled device will not be sent to the spooler until the

pipe has been closed. The closing of pipes can be achieved with a subsequent DUMP DEVICE IS, QUIT, or SCRATCH A command.

For example:

```
DUMP DEVICE IS "|expand|fold|sort|pr|lp -s"
```

No output takes place until another DUMP DEVICE IS statement is specified, a SCRATCH A command is executed, or HP BASIC is exited.

GRAPHICS data is in raw mode, therefore be sure to specify the "raw" mode option when piping to the printer spooler, for example:

```
DUMP DEVICE IS "| lp -oraw"
```

otherwise the printer hangs. Also, it is advisable to use the `-s` option of `lp` to suppress any messages to `stdout` (standard output).

Using EXCHANGE and SHIFT IN ... OUT (Requires LANGUAGE)

Some localized versions of HP BASIC, such as Japanese localized HP BASIC, support two-byte characters. The secondary keyword EXCHANGE allows you to automatically convert internal HP-15 character codes to the codes supported by your two-byte printer. The available choices and default values for the exchange string depend on the particular LANGUAGE localization binary that you are using. EXCHANGE affects DUMP ALPHA only. If you specify EXCHANGE without an exchange string, "HP-16" is assumed.

The secondary keywords SHIFT IN and OUT are useful with certain printers that use special control strings to turn two-byte printing on and off. HP BASIC automatically sends the specified shift in string before two-byte characters. HP BASIC also sends the specified shift out string before one-byte characters that follow two-byte characters.

Note SHIFT IN and SHIFT OUT cause Error 257 if used with HP-15 characters. Use EXCHANGE to convert HP-15 characters to your LANGUAGE two-byte characters.

Also note that when the LANGUAGE binary is loaded, HP-16 Code Conversion is the default mode for the DUMP DEVICE IS device.

DUMP DEVICE IS

For a general discussion of globalization and localization including printers, refer to *HP BASIC Porting and Globalization*. For LANGUAGE specific details, refer to *Using LanguageX with HP BASIC*, where *LanguageX* is your local language.

D

DVAL

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

DVAL converts a binary, octal, decimal, or hexadecimal character representation to a numeric value. The digits to be converted must be one-byte ASCII characters.

Example Statements

```
Number=DVAL(String$,Radix)
PRINT DVAL("FF5900",16)
```

Syntax



Item	Description	Range
string argument	string expression, containing digits valid for the specified base	(see tables)
radix	numeric expression, rounded to an integer	2, 8, 10, or 16

Semantics

The radix is a numeric expression that will be rounded to an integer and must evaluate to 2, 8, 10, or 16.

DVAL

The string expression must contain only the characters allowed for the particular number base indicated by the radix. ASCII spaces are not allowed. Only one-byte ASCII characters can be used as digits.

Binary strings are presumed to be in two's-complement form. If all 32 digits are specified and the leading digit is a 1, the returned value is negative.

Octal strings are presumed to be in the octal representation of two's-complement form. If all 11 digits are specified, and the leading digit is a 2 or a 3, the returned value is negative.

Decimal strings containing a leading minus sign will return a negative value.

Hex strings are presumed to be in the hex representation of the two's-complement binary form. The letters A through F may be specified in either uppercase or lowercase letters. If all 8 digits are specified and the leading digit is 8 through F, the returned value is negative.

Radix	Base	String Range	String Length
2	binary	0 through 11111111111111111111111111111111	1 to 32 characters
8	octal	0 through 3777777777	1 to 11 characters
10	decimal	-2 147 483 648 through 2 147 483 647	1 to 11 characters
16	hexadecimal	0 through FFFFFFFF	1 to 8 characters

Radix	Legal Characters	Comments
2	+,0,1	—
8	+,0,1,2,3,4,5,6,7	Range restricts the leading character. Sign, if used, must be a leading character.
10	+,-,0,1,2,3,4,5,6,7,8,9	Sign, if used, must be a leading character.
16	+,0,1,2,3,4,5,6,7,8,9, A,B,C,D,E,F,a,b,c,d,e,f	A/a = 10, B/b = 11, C/c = 12, D/d = 13, E/e = 14, F/f = 15

D

Two-Byte Language Specifics

Certain localized versions of HP BASIC, such as Japanese localized HP BASIC, support two-byte characters. DVAL *does not* allow two-byte characters. The string digits to be converted *must* be one-byte ASCII characters. For more information about two-byte characters, refer to the globalization chapters of *HP BASIC Porting and Globalization*.

DVAL\$

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

DVAL\$ converts a numeric value to a string of binary, octal, decimal, or hexadecimal digits. The resulting string contains digits that are one-byte ASCII characters.

Example Statements

```
String$=DVAL$(Number, Radix)
PRINT DVAL$(Count MOD 256, 2)
```

Syntax



Item	Description	Range
"32-bit" argument	numeric expression, rounded to an integer	-2^{31} through $2^{31} - 1$
radix	numeric expression, rounded to an integer	2, 8, 10, or 16

Semantics

The rounded argument must be a value that can be expressed (in binary) using 32 bits or less. The string digits returned are one-byte ASCII characters.

The radix must evaluate to be 2, 8, 10, or 16—representing binary, octal, decimal, or hexadecimal notation, respectively.

If the radix is 2, the returned string is in two's-complement form and contains 32 characters. If the numeric expression is negative, the leading digit will be 1. If the value is zero or positive, there will be leading zeros.

If the radix is 8, the returned string is the octal representation of the two's-complement binary form and contains 11 digits. Negative values return a leading digit of 2 or 3.

If the radix is 10, the returned string contains 11 characters. Leading zeros are added to the string if necessary. Negative values have a leading minus sign.

If the radix is 16, the returned string is the hexadecimal representation of the two's-complement binary form and contains 8 characters. Negative values return with the leading digit in the range 8 through F.



Radix	Base	Range of Returned String	String Length
2	binary	00000000000000000000000000000000 through 11111111111111111111111111111111	32 characters
8	octal	0000000000 through 3777777777	11 characters
10	decimal	-2 147 483 648 through 2 147 483 647	11 characters
16	hexadecimal	00000000 through FFFFFFFF	8 characters

E

ECHO - EXPANDED

E

ECHO

See SET ECHO.

E

EDGE

EDGE is a secondary keyword used to draw a border around the regions specified by these graphics keywords:

- IPLOT
- PLOT
- POLYGON
- RECTANGLE
- RPLOT
- SYMBOL

E

EDIT

Supported On	UX WS DOS IN*
Option Required	EDIT
Keyboard Executable	Yes
Programmable	No
In an IF ... THEN ...	No

EDIT activates the editor, letting you enter a new program or modify a program already in memory. EDIT also lets you edit typing-aid key definitions.

Example Statements

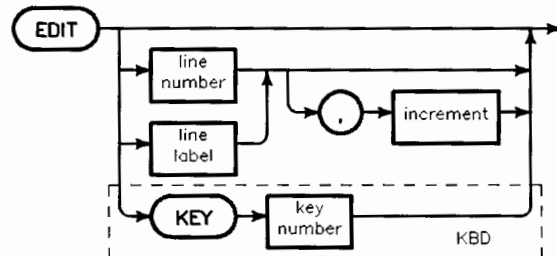
The following examples requires the EDIT binary.

```
EDIT  
EDIT Label2  
EDIT 1000,5
```

The following example is valid on HP BASIC/UX/WS/DOS only and requires the KBD binary in HP BASIC/WS/DOS.

```
EDIT KEY 5
```

Syntax



Item	Description	Range
line number	integer constant identifying program line; Default (see Semantics)	1 through 32 766 (1 through 2 147 483 646 for HP BASIC/UX 700)
line label	name of a program line	any valid name
increment	integer constant; Default = 10	1 through 32 766 (1 through 2 147 483 646 for HP BASIC/UX 700)
key number	integer constant	0 through 23

Semantics

The EDIT command allows you to scroll through a program in the computer by using the arrow keys, (Prev), (Next), or the knob. Lines may be added to the end of a program by going to the bottom of the program. A new line number will be provided automatically. Lines may be added between existing program lines by using the insert line key, and lines may be deleted by using the delete line key. Lines may be modified by typing the desired characters over the existing line, using the insert character and delete character keys as necessary. (ENTER), (EXECUTE) or (Return) are used to store the newly created or modified lines.

Edit mode is exited by pressing (CONTINUE), (CLR SCR), (Clear display), (PAUSE), (Stop), (RESET), (RUN), or (STEP) or by executing CAT, LIST (if PRINTER IS CRT), GET, or LOAD. In general any PRINT to the CRT (e.g., executing DISP) will exit you from the EDIT mode.

If the program was changed while paused, pressing (CONTINUE) will cause an error. Modifying a program moves it to the stopped state, making it impossible to continue.

EDIT

EDIT Without Parameters

If no program is currently in the computer, the edit mode is entered at line 10, and the line numbers are incremented by 10 as each new line is stored. If a program is in the computer, the line at which the editor enters the program is dependent upon recent history. If an error has paused program execution, the editor enters the program at the line flagged by the error message. Otherwise, the editor enters the program at the line most recently edited (or the beginning of the program after a LOAD operation).

EDIT With Parameters

If no program is in the computer, a line number (not a label) must be used to specify the beginning line for the program. The increment will determine the interval between line numbers. If a program is in the computer, any increment provided is not used until lines are added to the program. If the line specified is between two existing lines, the lowest-numbered line greater than the specified line is used. If a line label is used to specify a line, the lowest-numbered line with that label is used. If the label cannot be found, an error is generated.

EDIT KEY

To enter the EDIT KEY mode, type EDIT KEY, followed by the key number, and press **EXECUTE**, **ENTER**, or **Return**. Also, the desired softkey can be pressed after typing or pressing EDIT. When EDIT KEY mode is entered, the current key definition (if any) is displayed. You then edit the contents as if it were any other keyboard line. Non-ASCII keys may be included in the key definition by holding **CTRL** while pressing the desired key. Non-ASCII keystrokes are represented by an inverse-video "K" followed by another character associated with the key. The table *Second Byte of Non-ASCII Key Sequences* in the "Useful Tables" section of this manual has a list of the characters associated with the special keys.

Note

On the HP 98203A keyboard, many non-ASCII keys cannot be accessed by the method of holding **CTRL** while pressing the desired key. However, any of the non-ASCII keys can be entered into a softkey definition by pressing **ANY CHAR** 255, followed by the character associated with that non-ASCII key.

To accept the modified key definition, press **ENTER** or **Return**; to abort without changing the current definition, press **PAUSE**, **CLR SCR** or **Clear display**.

When a program is waiting for a response to an INPUT, LINPUT or ENTER, the typing aid definitions (defined with EDIT KEY) are in effect. When a program is running but not waiting for user input, the active ON KEY definitions supersede the typing aid definitions. Softkeys without ON KEY definitions retain their typing-aid function.

E

ELSE

See IF ... THEN.

E

ENABLE

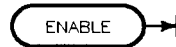
Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

ENABLE re-enables all event-initiated branches which were suspended by DISABLE. ON END, ON ERROR, and ON TIMEOUT are not affected by ENABLE and DISABLE.

Example Statements

ENABLE

Syntax



E

ENABLE EXT SIGNAL

Supported On	UX WS* DOS*
Option Required	RMBUX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

ENABLE EXT SIGNAL enables the specified system-generated signal which can cause end-of-statement branches or default actions. This statement can be entered in the HP BASIC/UX/WS editor, but executes only in HP BASIC/UX.

Example Statements

```
ENABLE EXT SIGNAL 4
ENABLE EXT SIGNAL Sigsys
```

Syntax



Item	Description	Range
signal number	numeric expression, rounded to integer	1 through 32 (see ON EXT SIGNAL)

Semantics

EXT SIGNALs default to enabled, and thus this statement is only needed if a DISABLE EXT SIGNAL statement has been executed. Note that the default action will take place unless an ON EXT SIGNAL statement is executed (see ON EXT SIGNAL).

Only supported system signals may be specified. See ON EXT SIGNAL for a list of valid signal numbers.

E-10 ECHO - EXPANDED

ENABLE INTR

Supported On	UX WS DOS IN
Option Required	IO
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

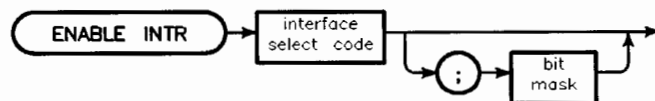
ENABLE INTR enables the specified interface to generate an interrupt which can cause event-initiated branches.

Example Statements

```
ENABLE INTR 7
```

```
ENABLE INTR Isc;Mask
```

Syntax



Item	Description	Range
interface select code	numeric expression, rounded to an integer	5, and 7 through 31
bit mask	numeric expression, rounded to an integer	-32 768 through +32 767

Semantics

If a bit mask is specified, its value is stored in the interface's interrupt-enable register. See the interface documentation for the correct bit mask value interpretation.

ENABLE INTR

If no bit mask is specified, the previous bit mask for the select code is restored. A bit mask of all zeros is used when there is no previous bit mask.

E

END

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	No
Programmable	Yes
In an IF ... THEN ...	No

END marks the end of the main program. For information about END as a secondary keyword, see OUTPUT and SEND

Example Statements

END

Syntax

E

Semantics

END must be the last statement (other than comments) of a main program. Only one END statement is allowed in a program. Program execution may also be terminated with a STOP statement, and multiple STOP statements are allowed. END terminates program execution, stops any event-initiated branches, and clears any unserved event-initiated branches. CONTINUE is not allowed after an END statement.

Subroutines used by the main program must be located before the END statement. Subprograms and user-defined functions must be located after the END statement.

END IF

See IF ... THEN.

E

END LOOP

See LOOP.

E



END SELECT

See SELECT ... CASE.

E

END WHILE

See WHILE.

E

ENTER

Supported On	UX WS DOS IN*
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

ENTER is used to input data from a device, file, string, buffer, window, or pipe, and assign the entered values to variables.

Example Statements

```
ENTER 705;Number,String$
```

```
ENTER Device;X;Y;Z
```

```
ENTER Command$;Parameter
```

```
ENTER @File;Array(*)
```

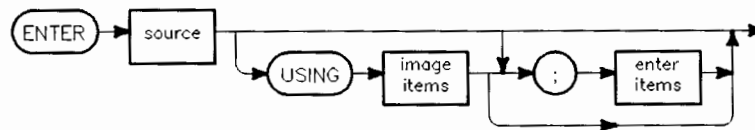
```
ENTER @Random,Record USING 20;Text$(Line)
```

```
ENTER @Source USING Fmt5;Item(1),Item(2),Item(3)
```

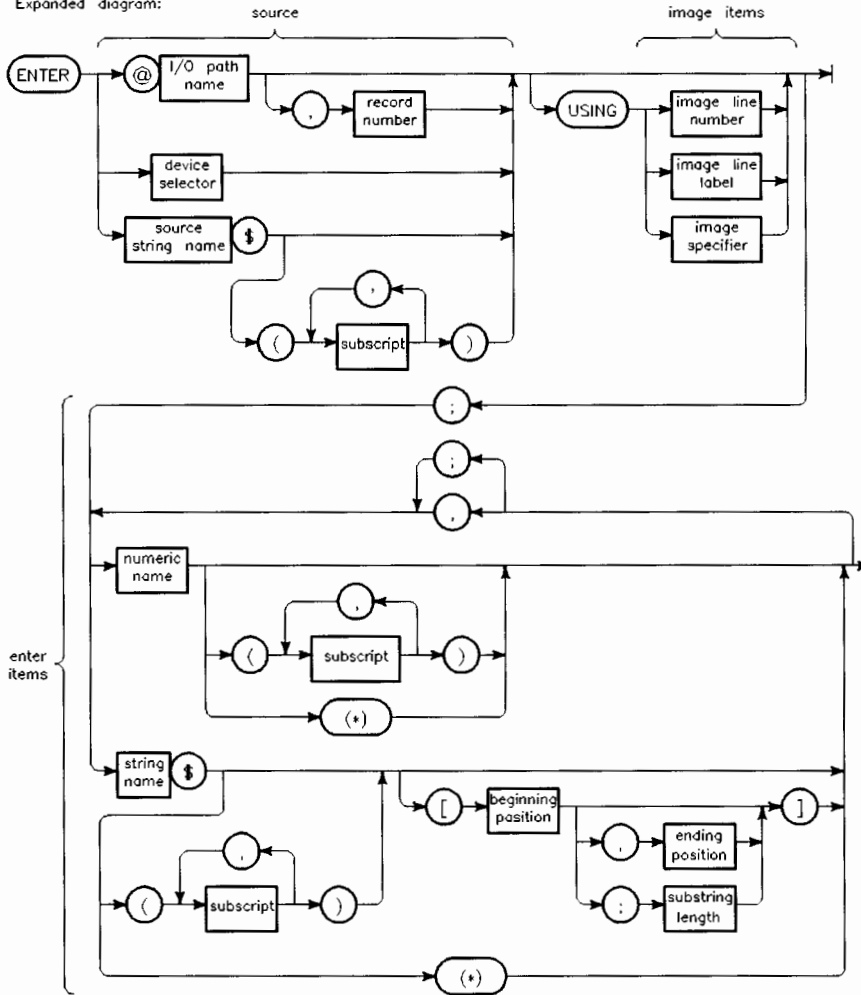
```
ENTER 12 USING "#,6A";A$[2;6]
```

E

Syntax



Expanded diagram:

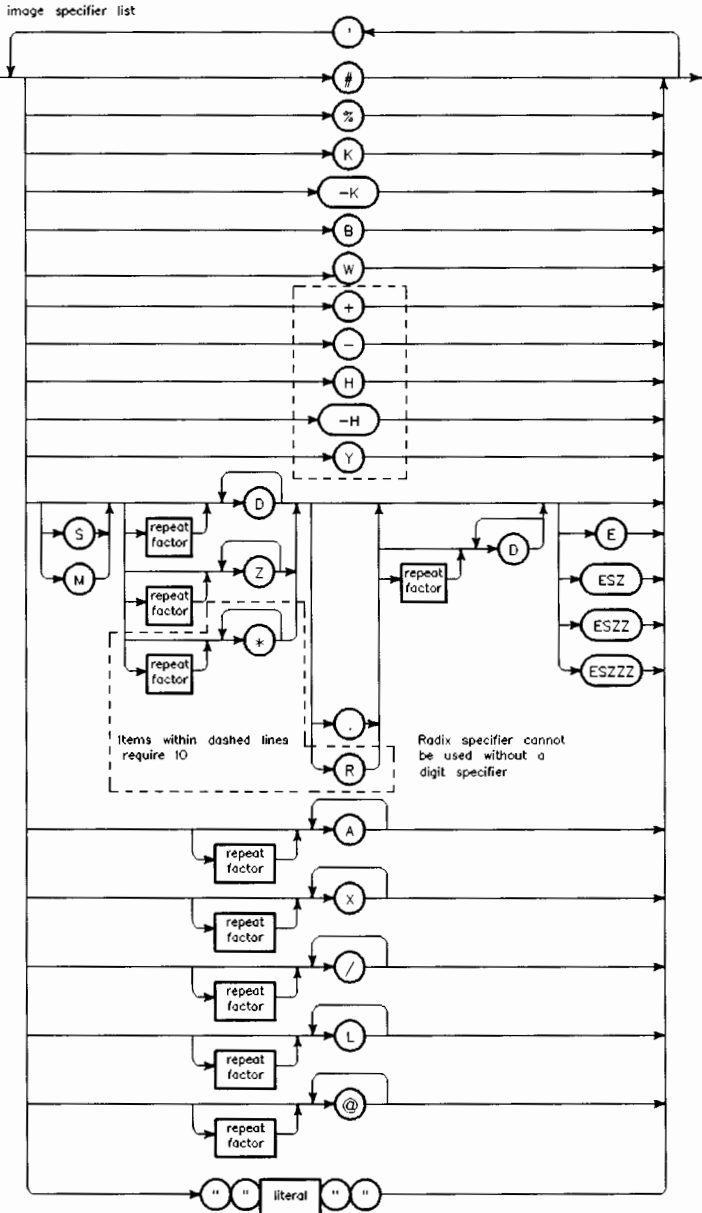


E

ENTER

Item	Description	Range
I/O path name	name assigned to a device(s), mass storage file, buffer, window, or pipe	any valid name (see ASSIGN)
record number	numeric expression, rounded to an integer	1 through $2^{31}-1$
device selector	numeric expression, rounded to an integer	(see Glossary)
source string name	name of a string variable	any valid name
subscript	numeric expression, rounded to an integer	-32 767 through +32 767 (see "array" in Glossary)
image line number	integer constant identifying an IMAGE statement	1 through 32 766 (1 through 2 147 483 646 for HP BASIC/UX 700)
image line label	name identifying an IMAGE statement	any valid name
image specifier	string expression	(see drawing)
numeric name	name of a numeric variable	any valid name
string name	name of a string variable	any valid name
beginning position	numeric expression, rounded to an integer	1 through 32 767 (see "substring" in Glossary)
ending position	numeric expression, rounded to an integer	0 through 32 767 (see "substring" in Glossary)
substring length	numeric expression, rounded to an integer	0 through 32 767 (see "substring" in Glossary)
image specifier list	literal	(see next drawing)
repeat factor	integer constant	1 through 32 767
literal	string constant composed of characters from the keyboard, including those generated using the ANY CHAR key	quote mark not allowed

E



E

ENTER

Semantics

The Number Builder

If the data being received is ASCII and the associated variable is numeric, a number builder is used to create a numeric quantity from the ASCII representation. The number builder ignores all leading non-numeric characters, ignores all blanks, and terminates on the first non-numeric character, or the first character received with EOI true. (Numeric characters are 0 through 9, +, -, decimal point, e, and E, in a meaningful numeric order.) If the number cannot be converted to the type of the associated variable, an error is generated. If more digits are received than can be stored in a variable of type REAL or COMPLEX, the rightmost digits are lost, but any exponent will be built correctly. Overflow occurs only if the exponent overflows. COMPLEX numbers are treated like two real numbers, the first representing the real part and the second representing the imaginary part. When an ENTER statement contains a COMPLEX variable, that variable is satisfied with two REAL values.

Arrays

Entire arrays may be entered by using the asterisk specifier. Each element in an array is treated as an item by the ENTER statement, as if the elements were listed separately. The array is filled in row major order (rightmost subscript varies fastest). COMPLEX arrays are treated as if they were REAL arrays with twice as many elements.

Files as Source

If an I/O path has been assigned to a file, the file may be read with ENTER statements. The file must be an ASCII, BDAT, DFS, or HP-UX file. The attributes specified in the ASSIGN statement are used only if the file is a BDAT, DOS, or HP-UX file. Data read from a LIF ASCII file (a file created using CREATE ASCII) is always in ASCII format (i.e., you *cannot* use ENTER..USING); however, you can enter the data into a string variable, and then use ENTER..USING from the string variable. Data read from a BDAT or HP-UX file is considered to be in internal representation with FORMAT OFF, and is read as ASCII characters with FORMAT ON.

E-22 ECHO - EXPANDED

Serial access is available for ASCII, BDAT, DOS, and HP-UX files. Random access is available for BDAT and HP-UX files. The file pointer is important to both serial and random access. The file pointer is set to the beginning of the file when the file is opened by an ASSIGN. The file pointer always points to the next byte available for ENTER operations.

Random access uses the record number parameter to read items from a specific location in a file. The record specified must be before the end-of-file pointer. The ENTER begins at the beginning of the specified record.

It is recommended that random and serial access to the same file not be mixed. Also, data should be entered into variables of the same type as those used to output it (e.g. string for string, REAL for REAL, etc.).

In order to read a file in an SRM directory, you need to have READ capability on the immediately superior directory, as well as READ capabilities on all other superior directories. If this capability is not public or if a password protecting this capability was not used at the time the file was assigned an I/O path name (with ASSIGN), an error is reported.

Devices as Source

An I/O path name or a device selector may be used to ENTER from a device. If a device selector is used, the default system attributes are used (see ASSIGN). If an I/O path name is used, the ASSIGN statement determines the attributes used. If multiple devices were specified in the ASSIGN, the ENTER sets the first device to be talker, and the rest to be listeners. You can improve performance for some interfaces on Series 300/400 computers by enabling io_burst, and on Series 700 computers by enabling ENTER buffering. See the *HP BASIC Interface Reference* for more information about improving performance.

If FORMAT ON is the current attribute, the items are read as ASCII. If FORMAT OFF is the current attribute, items are read from the device in the computer's internal format. Two bytes are read for each INTEGER, eight bytes for each REAL, and sixteen bytes for each COMPLEX value. Each string entered consists of a four byte header containing the length of the string, followed by the actual string characters. The string must contain an even number of characters; if the length is odd, an extra byte is entered to give alignment on the word boundary.

ENTER

CRT as Source

If the device selector is 1, the ENTER is from the CRT. The ENTER reads characters from the CRT, beginning at the current print position (print position may be modified by using TABXY in a PRINT statement.) The print position is updated as the ENTER progresses. After the last non-blank character in each line, a line-feed is sent with a simulated "EOI". After the last line is read, the print position is off the screen. If the print position is off screen when an ENTER is started, the off-screen text is first scrolled into the last line of the display.

Keyboard as Source

ENTER from device selector 2 may be used to read the keyboard. An entry can be terminated by pressing **ENTER**, **EXECUTE**, **Return**, **CONTINUE**, or **STEP**. Using **ENTER**, **EXECUTE**, **Return** or **STEP** causes a CR/LF to be appended to the entry. The **CONTINUE** key adds no characters to the entry and does not terminate the ENTER statement. If an ENTER is stepped into, it is stepped out of, even if the **CONTINUE** key is pressed. An HP-IB EOI may be simulated by pressing **CTRL E** before the character to be sent, if this feature has been enabled by an appropriate CONTROL statement to the keyboard (see the Control and Status Registers in the back of this book).

E

Strings as Source

If a string name is used as the source, the string is treated similarly to a file. However, there is no file pointer; each ENTER begins at the beginning of the string, and reads serially within the string.

Buffers as Source

When entering from an I/O path assigned to a buffer, data is removed from the buffer beginning at the location indicated by the buffer's empty pointer. As data is received, the current number-of-bytes register and empty pointer are adjusted accordingly. Encountering the fill pointer (buffer empty) produces an error unless a continuous inbound TRANSFER is filling the buffer. In this case, the ENTER will wait until more data is placed in the buffer.

Since devices are logically bound to buffers, an ENTER statement cannot intercept data while it is traveling between the device and the buffer. If an I/O path is currently being used in an outbound TRANSFER, and an ENTER statement uses it as a source, execution of the ENTER is deferred until the completion of the TRANSFER. An ENTER can be concurrent with an inbound TRANSFER only if the source is the I/O path assigned to the buffer.

An ENTER from a string variable that is also a buffer will not update the buffer's pointers and may return meaningless data.

Pipes as Source

If an I/O path has been assigned to a pipe, the pipe may be read with ENTER statements. The attributes specified in the ASSIGN statement are used. Data is considered to be in internal representation with FORMAT OFF, and is read as ASCII characters with FORMAT ON. (See "Devices as Source" for a description of these formats.) The pipe must be read serially. You can also use ENTER with pipes named in SRM/UX on HP BASIC/UX, and in HP BASIC/WS.

ENTER With USING

When the computer executes an ENTER USING statement, it reads the image specifier, acting on each field specifier (field specifiers are separated from each other by commas) as it is encountered. If no variable is required for the field specifier, the field specifier is acted upon without referencing the enter items. When the field specifier references a variable, bytes are entered and used to create a value for the next item in the enter list. Each element in an array is considered a separate item.

The processing of image specifiers stops when a specifier is encountered that has no matching enter item. If the image specifiers are exhausted before the enter items, the specifiers are reused, starting at the beginning of the specifier list.

Entry into a string variable always terminates when the dimensioned length of the string is reached. If more variables remain in the enter list when this happens, the next character received is associated with the next item in the list.

ENTER

When USING is specified, all data is interpreted as ASCII characters. FORMAT ON is always assumed with USING, regardless of any attempt to specify FORMAT OFF.

ENTER with USING cannot be used to enter data from LIF ASCII files (files created by CREATE ASCII. Instead, enter the item(s) into a string variable, then use ENTER with USING to enter the item(s) from the string variable. For example, use ENTER @File;String\$ then ENTER String\$ USING "5A,X,5DD"; Str2\$,Number.

Effects of the image specifiers on the ENTER statement are shown in the following table:

E

Image Specifier	Meaning
K	Freefield Entry. Numeric Entered characters are sent to the number builder. Leading non-numeric characters are ignored. All blanks are ignored. Trailing non-numeric characters and characters sent with EOI true are delimiters. Numeric characters include digits, decimal point, +, -, e, and E when their order is meaningful.
	String Entered characters are placed in the string. Carriage-return not immediately followed by line-feed is entered into the string. Entry to a string terminates on CR/LF, LF, a character received with EOI true, or when the dimensioned length of the string is reached.
-K	Like K except that LF is entered into a string, and thus CR/LF and LF do not terminate the entry.
H	Like K, except that the European number format is used. Thus, a comma is the radix indicator and a period is a terminator for a numeric item. (Requires IO)
-H	Same as -K for strings; same as H for numbers. (Requires IO)
S	Same action as D.
M	Same action as D.
D	Digit specifier demands a character. Non-numeric characters are accepted to fill the character count. Blanks are ignored, other non-numeric characters are delimiters.
Z	Same action as D.
*	Same action as D. (Requires IO)
.	Same action as D.
R	Like D, R demands a character. When R is used in a numeric image, it directs the number builder to use the European number format. Thus, a comma is the radix specifier and a period is a terminator for the numeric item. (Requires IO)
E	Same action as 4D.
ESZ	Same action as 3D.

E

ENTER

Image Specifier	Meaning
ESZZ	Same action as 4D.
ESZZZ	Same action as 5D.
A	Demands a string character. Any character received is placed in the string. Use AA or 2A for two-byte globalization characters.
X	Skips a character.
literal	Skips one character for each character in the literal.
B	Demands one byte. The byte becomes a numeric quantity.
W	Demands one 16-bit word, which is interpreted as a 16-bit, two's-complement integer. If either an I/O path name with the BYTE attribute or a device selector is used to access an 8-bit interface, two bytes will be entered; the most-significant byte is entered first. If an I/O path name with the BYTE attribute is used to access a 16-bit interface, the BYTE attribute is overridden and one word is entered in a single operation. If an I/O path name with the WORD attribute is used to access a 16-bit interface, one byte is entered and ignored when necessary to achieve alignment on a word boundary. If the source is a file, string variable, or buffer, the WORD attribute is ignored and all data are entered as bytes; however, one byte will be entered and ignored when necessary to achieve alignment on a word boundary.
Y	Like W, except that pad bytes are never entered to achieve word alignment. If an I/O path name with the BYTE is used to access a 16-bit interface, the BYTE attribute is not overridden (as with W specifier above). (Requires IO)
#	Statement is terminated when the last ENTER item is terminated. EOI and line-feed are item terminators, and early termination is not allowed.
%	Like #, except that an END indication (such as EOI or end-of-file) is an immediate statement terminator. Otherwise, no statement terminator is required. Early termination is allowed if the current item is satisfied.

Image Specifier	Meaning
+	Specifies that an END indication is required with the last character of the last item to terminate the ENTER statement. Line-feeds are not statement terminators. Line-feed is an item terminator unless that function is suppressed by -K or -H. (Requires IO)
-	Specifies that a line-feed terminator is required as the last character of the last item to terminate the statement. EOI is ignored, and other END indications, such as EOF or end-of-data, cause an error if encountered before the line-feed. (Requires IO)
/	Demands a new field; skips all characters to the next line-feed. EOI is ignored.
L	Ignored for ENTER.
@	Ignored for ENTER.

Note

Some localized versions of HP BASIC, such as Japanese localized HP BASIC, support two-byte characters. When using this localized language remember that the IMAGE, ENTER USING, OUTPUT USING, and PRINT USING statements define a one-byte ASCII character image with A. Use the image AA to designate a two-byte character.

For a general discussion of globalization and localization, refer to the *HP BASIC Porting and Globalization* manual. For LANGUAGE specific details, refer to *Using LanguageX With HP BASIC*, where *LanguageX* is your local language.

ENTER Statement Termination

A simple ENTER statement (one without USING) expects to give values to all the variables in the enter list and then receive a statement terminator. A statement terminator is an EOI, a line-feed received at the end of the last variable (or within 256 characters after the end of the last variable), an end-of-data indication, or an end-of-file. If a statement terminator is received before all the variables are satisfied, or no terminator is received within 256

ENTER

bytes after the last variable is satisfied, an error occurs. The terminator requirements can be altered by using images.

An ENTER statement with USING, but without a % or # image specifier, is different from a simple ENTER in one respect. EOI is not treated as a statement terminator unless it occurs on or after the last variable. Thus, EOI is treated like a line-feed and can be used to terminate entry into each variable.

An ENTER statement with USING that specifies a # image requires no statement terminator other than a satisfied enter list. EOI and line feed end the entry into individual variables. The ENTER statement terminates when the variable list has been satisfied.

An ENTER statement with USING that specifies a % image allows EOI as a statement terminator. Like the # specifier, no special terminator is required. Unlike the # specifier, if an EOI is received, it is treated as an immediate statement terminator. If the EOI occurs at a normal boundary between items, the ENTER statement terminates without error and leaves the value of any remaining variables unchanged.

When entering FORMAT ON text into string variables, care should be taken to avoid unexpected interactions between terminating on dimensioned string length and termination on line feeds in the text. It is recommended that the string variable be dimensioned at least two characters longer than the text if it will be terminated by a carriage return/line feed.

See the *HP BASIC Programming Guide*, "Entering Data" for more information.

EOL

See ASSIGN, PRINTALL IS, and PRINTER IS.

E

EOR

See OFF EOR, ON EOR, and TRANSFER.

E

EOT

See OFF EOT and ON EOT.

E

ERRDS

Supported On	UX WS DOS
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

ERRDS returns an INTEGER representing the device selector of the I/O resource involved in the most recent I/O error.

Example Statements

```
IF ERRDS=701 THEN GOSUB Print_error
IF ERRN=163 THEN Missing=ERRDS
```

E

Syntax



Semantics

The device selector will include a primary address if the interface addressed allows it (i.e. HP-IB). If the resource is a file, the device selector of the drive containing the file is returned. If the resource is not a device, 0 is returned. If no I/O error has occurred in a running program since power-up, SCRATCH A, or pre-run, 0 is returned.

If an error occurs in a TRANSFER statement without WAIT, the error number is recorded in the assignment table associated with the I/O path name assigned to the non-buffer end of the transfer instead of being reported immediately. It is not reported until the next reference to the I/O path name, and ERRDS will not be updated until this time.

ERRL

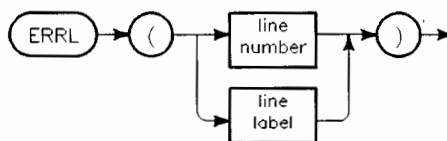
Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	No
Programmable	Yes
In an IF ... THEN ...	Yes

ERRL returns a value of 1 if the most recent error occurred in the specified line; otherwise, it returns 0.

Example Statements

```
IF ERRL(220) THEN Parse_error
IF NOT ERRL(Parameters) THEN Other
```

Syntax



Item	Description	Range
line number	integer constant	1 through 32 766 (1 through 2 147 483 646 for HP BASIC/UX 700)
line label	name of a program line	any valid name

ERRL

Semantics

The specified line must be in the same context as the ERL function, or an error will occur.

If an error occurs in a TRANSFER statement without WAIT, the error number is recorded in the assignment table associated with the non-buffer end of the transfer instead of being reported immediately. It is not reported until the next reference to the I/O path name, and ERL will not be updated until this time. Therefore, ERL will actually refer to the line containing the new reference to the I/O path name, not the line containing the TRANSFER statement that caused the error.

CLEAR ERROR resets ERL to 0.

Data Communications

This function returns 0 for all data communications errors.

E

ERRLN

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

ERRLN returns the number of the program line on which the most recent error occurred. If no error has occurred, this function returns a value of 0.

Example Statements

```
Bad_line=ERRLN
IF ERRLN=240 THEN GOSUB Fix_240
```

Syntax



Semantics

ERRLN will return 0 if no error has occurred since one of these events:

- power-on
- pre-run
- SCRATCH
- SCRATCH A
- CLEAR ERROR
- LOAD
- GET

If an error occurs in a TRANSFER without WAIT, the error number is recorded in the assignment table associated with the non-buffer end of the TRANSFER instead of being reported immediately. It is not reported until the next reference to the I/O path name, and ERRLN will not be updated until this time. Therefore, ERRLN will actually refer to the line containing the

ERRLN

new reference to the I/O path name, not the line containing the TRANSFER statement that caused the error.

Data Communications

This function returns 0 for all Data Communications errors (which occur while using the HP 98628 Datacomm Interface).

E

ERRM\$

Supported On	UX* WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

ERRM\$ returns the text of the error message associated with the most recent program execution error.

Example Statements

```
PRINT ERRM$
Em$=ERRM$
ENTER Em$;Error_num,Error_line
```



E

Syntax



Semantics

The line number and error number returned in the ERRM\$ string are the same as those used by ERRN and ERRL. This may give surprising results when a TRANSFER is in effect. For details on the interaction, see ERRL and ERRN.

ERRM\$ will return the null string if no error has occurred since one of these events:

- power-on
- pre-run
- SCRATCH
- SCRATCH A
- CLEAR ERROR
- LOAD
- GET

ERRM\$

HP BASIC/UX Specifics

Additional error messages specific to HP BASIC/UX are returned.

E

ERRN

Supported On	UX* WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

ERRN returns the number of the most recent program execution error. If no error has occurred, a value of 0 is returned.

Example Statements

```
IF ERRN=80 THEN Disc_out
DISP "Error Number = ";ERRN
```

Syntax



Semantics

CLEAR ERROR resets ERRN to 0.

If an error occurs in a TRANSFER statement without WAIT, the error number is recorded in the assignment table associated with the non-buffer end of the transfer instead of being reported immediately. It is not reported until the next reference to the I/O path name, and ERRN will not be updated until this time.

HP BASIC/UX Specifics

ERRN returns additional error values specific to HP BASIC/UX.

ERROR

See CAUSE ERROR, CLEAR ERROR, OFF ERROR and ON ERROR.

E

ERROR RETURN

Supported On	UX WS DOS
Option Required	None
Keyboard Executable	No
Programmable	Yes
In an IF ... THEN ...	Yes

ERROR RETURN returns program control to the line following the line which caused the most recent GOSUB. It is used with ON ERROR GOSUB to avoid retrying the line that caused the error.

Example Statements

```
ERROR RETURN
IF Dont_retry THEN ERROR RETURN
```

Syntax

ERROR RETURN →

Semantics

When this statement is executed, it causes program execution to resume at the line *following* the line that caused the most recent GOSUB (usually the line whose error initiated the most recent ON ERROR GOSUB branch). If you want to return to the line that *caused* the error, use RETURN.

If the error occurred in an END, SUBEND, or FN END statement, then execution returns to that statement since there is no following executable line. If the statement is used to return from a GOSUB, then it behaves as a RETURN.

ERROR SUBEXIT

Supported On	UX WS DOS
Option Required	None
Keyboard Executable	No
Programmable	Yes
In an IF ... THEN ...	Yes

ERROR SUBEXIT returns program control to the line following the line which invoked the subprogram.

Example Statements

```
ERROR SUBEXIT
IF Dont_retry THEN ERROR SUBEXIT
```

E

Syntax

ERROR SUBEXIT →

Semantics

When this statement is executed, it causes program execution to resume at the line *following* the line that caused the subprogram to be called (usually the line whose error initiated the most recent ON ERROR CALL branch). If you want to return to the line that *caused* the error, use SUBEXIT.

If the error occurred in an END, SUBEND, or FN END statement, then execution returns to that statement since there is no following executable line. If this statement is used from a CALL, then it behaves as a SUBEXIT.

EXCHANGE

See ASSIGN, DUMP DEVICE IS, PRINTALL IS, or PRINTER IS.

E

EXECUTE

Supported On	UX WS* DOS IN*
Option Required	n/a
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

EXECUTE allows access to the underlying operating system for executing commands and programs. This statement can be entered in the HP BASIC editor, but it executes only in HP BASIC/UX or HP BASIC/DOS.

Example Statements

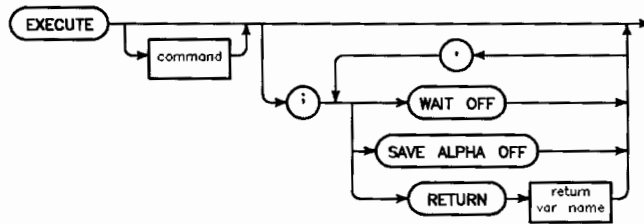
```
EXECUTE
```

```
EXECUTE ; SAVE ALPHA OFF, RETURN Success
```

```
EXECUTE "cat mydat|sed -e 's/real/longreal'|myfilt>foo";WAIT OFF
```

```
EXECUTE "DIR > C:\TMP\DIRLST"
```

Syntax



Item	Description	Range
command	string expression	-
return variable name	name of a numeric variable	any valid name

Semantics (HP BASIC/UX)

This statement suspends the operation of HP BASIC and transfers control to the operating system. If a command string is specified, then the operating system executes that command string. If the command string is omitted, then control is passed to the command specified in the user's SHELL environment variable (this is usually a shell). If the user has no SHELL environment variable, then control is passed to a Bourne shell (/bin/sh).

If the RETURN attribute is specified, then the return status from the command is returned in the associated variable. The return status consists of 16 bits of information defined as:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
return code					cd		terminating signal								

where:

terminating signal	is the signal causing process termination
cd	indicates whether a core dump resulted
return code	is the process exit code if the terminating signal field is 0.

Note that when a command is specified, a /bin/sh is used to control the execution of the command. This shell translates certain return codes from the command. Specifically, return codes indicating a signal has killed the process returns as $0x8000+0x100*signal\ number$, rather than the expected *signal number*. Thus a distinction cannot be made between a process terminated by SIGTERM and one which exited with return code 0x8f, since both would be received as 0x8f00.

If a simple command is executed (i.e., a single command and no pipes), then there is a workaround to this problem. The SHELL command `exec` can be inserted before the actual command to indicate that the shell should `exec` the command rather than forking a new process for it. The result of this is that without the shell around to translate the return code, the expected return code is received. For example, consider a "`ps -ef`" command. The statement:

EXECUTE

```
EXECUTE "ps -ef"; WAIT OFF,RETURN A
```

would set A to 0x8f00 if terminated by SIGTERM. If we wanted the return code to be the same as the process actually returned (without shell translation), we would use:

```
EXECUTE "exec ps -ef"; WAIT OFF,RETURN A
```

which sets A to 0x0f when terminated by SIGTERM. Note also that the most significant bit of the return status is weighted as -32768, thus the status is negative when this bit is set.

When running within a window system, the command is executed in the window which started HP BASIC. Note that this is not the standard HP BASIC window, as HP BASIC automatically spawns a new window for itself. All input and output from the EXECUTEd process takes place in this original window. HP BASIC spawns a new process from which to execute the command. During this time, the HP BASIC process waits for the command to complete. A new runlight state "Execute" indicates when HP BASIC is waiting for a system command to complete. HP BASIC continues to accept keys and echo them, but no keyboard commands are executed until the system call completes. The "Reset" key aborts the system call and returns HP BASIC to the idle state. Note that RESET sends SIGHUP to the partially completed command and all of its subprocesses, which causes them to die.

When this command is executed outside of a window system, HP BASIC first clears the screen and then spawns a new process to execute the command. At this point HP BASIC waits for the command to complete. HP BASIC relinquishes control of the keyboard so the user's command may access it. To return to HP BASIC the user must either wait for the process to complete, or kill it. To kill the process the user must use either SIGTERM or SIGKILL, or possibly "exit" for a shell. When the user process completes, HP BASIC first prompts the user before resuming. The prompt "PRESS RETURN TO CONTINUE:" appears at the bottom of the screen. This allows the user time to read any output from the command before HP BASIC clears the screen. The cursor and paging keys are not transmitted, and may be used to view text that has scrolled off the screen; other keys are ignored. After receiving the response, HP BASIC continues. It first clears the screen of the output from the command, and then repaints the alpha screen.

E

The WAIT OFF attribute disables the prompting after completion of the command. In this case HP BASIC immediately resumes operation. This attribute only affects operation outside a window system. If a command is not specified in the EXECUTE statement, then HP BASIC does not prompt before resumming control. It will continue as soon as the shell is exited.

The SAVE ALPHA OFF attribute only affects operation outside a window system. In this case, the screen is not cleared before executing the command, and it is not cleared and the alpha not repainted upon returning to HP BASIC. This option thus allows any graphics information to be saved. It should generally be used only when the command does not produce output to the CRT. Otherwise the commands output can cause scrolling of the alpha and graphics in an undesirable way. If the command does produce output, it should be redirected to a file, or discarded in /dev/null as follows:

```
EXECUTE "rmbclean >/dev/null 2>&1"; SAVE ALPHA OFF
```

The string "2>&1" causes the standard error output to also be discarded. Note that the WAIT prompting also writes text to the screen (and possibly cause scrolling). Thus this attribute should in general be used with the WAIT OFF attribute.

Semantics (HP BASIC/DOS)

This statement suspends the operation of HP BASIC and transfers control to a copy of COMMAND.COM. If a command string is specified, then COMMAND.COM executes that command string. If a command string is omitted, then COMMAND.COM accepts commands from the user. The user returns to HP BASIC by typing EXIT at the prompt.

If the SAVE ALPHA OFF attribute is specified, then the screen is not cleared before control is passed to COMMAND.COM, and it is not cleared and repainted upon returning to HP BASIC. This option allows any graphics information to be saved. It should generally be used only when the command does not produce output to the CRT. Otherwise, undesirable scrolling of the alpha and graphics may occur.

The WAIT OFF attribute disables prompting after completion of the command or when the user exits COMMAND.COM. HP BASIC resumes operation immediately after COMMAND.COM terminates.

EXECUTE

If the RETURN attribute is specified, then the return status from COMMAND.COM is returned in the associated variable. Note that this indicates only if COMMAND.COM was successfully run. It does not indicate whether or not COMMAND.COM was able to successfully execute the command string.

If the command string is "BACKGROUND", then COMMAND.COM is not run as described above. Instead, HP BASIC is put into background mode and continues to run concurrently with DOS. The WAIT OFF and ALPHA OFF attributes are ignored, and the value returned by the RETURN attribute is always 1. See the *Installing and Using HP BASIC/DOS 6.2* manual for more detailed information on background mode.

E

EXIT IF

See LOOP.

E

EXOR

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

EXOR returns a 1 or a 0 based on the logical exclusive OR of its arguments.

Example Statements

```
Ok=First_pass EXOR Old_data
```

```
IF A EXOR Flag THEN Exit
```

E

Syntax



Semantics

A non-zero value (positive or negative) is treated as a logical 1; only a zero is treated as a logical 0.

The EXOR function is summarized in this table.

A	B	A EXOR B
0	0	0
0	1	1
1	0	1
1	1	0

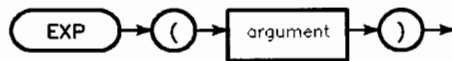
EXP

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

EXP raises e to the power of the argument. Internally, Napierian $e=2.718\ 281\ 828\ 459\ 05$.

Example Statements

```
Y=EXP(-X^2/2)
PRINT "e to the";Z;"=";EXP(Z)
```

Syntax

Item	Description/Default	Range Restrictions
argument	numeric expression	-708.396 418 532 264 through +709.782 712 893 383 8 for INTEGER and REAL arguments; see "Range Restriction Specifics" for COMPLEX arguments and underflow conditions

Semantics

If the argument is REAL or INTEGER, the value returned is REAL. If the argument is COMPLEX, the value returned is COMPLEX.

To compute the EXP of a COMPLEX value, the COMPLEX binary must be loaded.

EXP

Range Restriction Specifics

The formula used to compute the EXP of a COMPLEX argument is:

`CMPLX(EXP(Real_part)*COS(Imag_part),EXP(Real_part)*SIN(Imag_part))`

where `Real_part` is the real part of the COMPLEX argument and `Imag_part` is the imaginary part of the COMPLEX argument. Some values of a COMPLEX argument may cause errors in this computation. For example,

`EXP(CMPLX(710,0))`

will cause error 22 (error 21 in HP BASIC/UX 700) due to the `EXP(Real_part)` computation.

Note that any COMPLEX function whose definition includes a sine or cosine function will be evaluated in the radian mode regardless of the current angle mode (i.e. RAD or DEG).

E

The following range restrictions apply in HP BASIC/UX 700 when underflow mode (`CONTROL 32,7;mode`) is set to Error or Ignore.

Range	Underflow Mode Error	Underflow Mode Ignore
Positive Maximum	+7.09782712893384E+002	+7.09782712893384E+002
Negative Minimum	-7.08396418532264E+002	-7.44440071921381E+002
Positive Minimum	+2.10953732297368E-154	+4.94065645841247E-324 ¹
Negative Maximum	-2.10953732297368E-154	-4.94065645841247E-324 ²

1 An underflow in Ignore mode results in a denormalized number that is less than the value for +MINREAL.

2 An underflow in Ignore mode results in a denormalized number that is greater than the value for -MINREAL.

EXPANDED

See DUMP DEVICE IS.

E

F

FBYTE - FRENCH

F

FBYTE

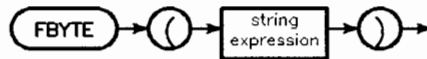
Supported On	UX WS
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

FBYTE returns 1 when the first byte of a string expression is a valid first byte in the **HP-15** character set. The HP-15 character set is used by versions of HP BASIC that support certain two-byte languages, such as Japanese.

Example Statements

```
IF FBYTE(A$) AND SBYTE(A$[2]) THEN Valid_Kanji
```

Syntax



F

Semantics

Certain localized versions of HP BASIC, such as Japanese localized HP BASIC, use two-byte characters. Together, FBYTE and SBYTE allow you to programmatically determine whether a character is one or two bytes long. Note that FBYTE only checks the first byte of the string expression. If FBYTE returns 1 (true), you must also test the second byte of the string using SBYTE to determine if the second byte is in the valid range for HP-15 characters.

For a general discussion of globalization and localization including two-byte characters, refer to *HP BASIC Porting and Globalization*. To determine the values returned by FBYTE for specific characters, refer to *Using LanguageX with HP BASIC*, where *LanguageX* is your local language.

FILL

FILL is a secondary keyword used to create shading with these graphics keywords:

- IPLOT
- PLOT
- POLYGON
- RECTANGLE
- RPLOT
- SYMBOL

F

FIND

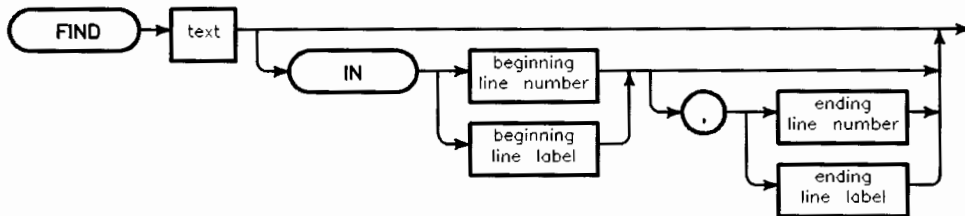
Supported On	UX WS DOS
Option Required	EDIT and PDEV
Keyboard Executable	Yes
Programmable	No
In an IF ... THEN ...	No

FIND lets you find a character sequence while editing a program.

Example Statements

```
FIND "SUB Printer"  
FIND "Cost=" IN 1550  
FIND "Target" IN Label1,Label2
```

Syntax



F

Item	Description	Range
text	literal	—
beginning line number	integer constant identifying program line	1 to 32 766 (1 through 2 147 483 646 for HP BASIC/UX 700)
beginning line label	name of a program line	any valid name
ending line number	integer constant identifying program line	1 to 32 766 (1 through 2 147 483 646 for HP BASIC/UX 700)
ending line label	name of a program line	any valid name



Semantics

This command causes a search through the program currently in memory. It compares the specified text to an internal “listing” of the program. Therefore, line numbers, keywords, variables, and constants can be found.

If an the specified text is found, the line containing it is displayed with the cursor under the first character of that occurrence. The line can be modified or deleted if desired.

If **ENTER**, **Return** or the delete line key is pressed, the search resumes with the next character. Alternately, the search is resumed without modifying the program when **CONTINUE** is pressed. Overlapping occurrences are not detected; e.g., if you were looking for “issi”, only one occurrence would be found in “Mississippi”.

If the beginning line number is given, the search begins at that line number. If the specified line number doesn’t exist, the next line that does exist is used. If the beginning line number is not specified, the search begins at the line currently being edited; or, (if you’re not in edit mode), with the first line of the program. If a specified label doesn’t exist, an error occurs.

The search continues through the last character of the Ending Line; or (if that was not specified) the end of the program. If you specify an Ending Line

F

FIND

Number that does not exist, the highest numbered line which occurs before that line number is used.

If there were no occurrences found, the cursor is left at the end of the first line searched. If one or more occurrences were found, the cursor is left at the end of the line containing the last occurrence.

A FIND command is canceled by entering a line after changing its line number. Other keys which will cancel a FIND are **EXECUTE**, **CLR I/O**, **Break**, **▲**, **▼**, or **INS LN**. Any of the keys which cancel EDIT mode will also cancel a FIND (with the exception of **CONTINUE**).

FIND is not allowed while a program is running; however, it may be executed while a program is paused. The program is continuable if it has not been altered by pressing **ENTER**, **Return**, **EXECUTE** or **DEL LN**.

While in the FIND mode, keyboard execution is only possible with the **EXECUTE** key. Using **ENTER** or **Return** causes an error.

F

FN

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

FN transfers program execution to the specified user-defined function and may pass items to the function. The value returned by the function is used in place of the function call when evaluating the statement containing the function call.

Example Statements

```
PRINT X;FNChange(X)
```

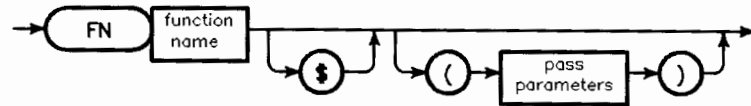
```
Final$=FNStrip$(First$)
```

```
Parameter=FNProcess(Reference,(Value),@Path)
```

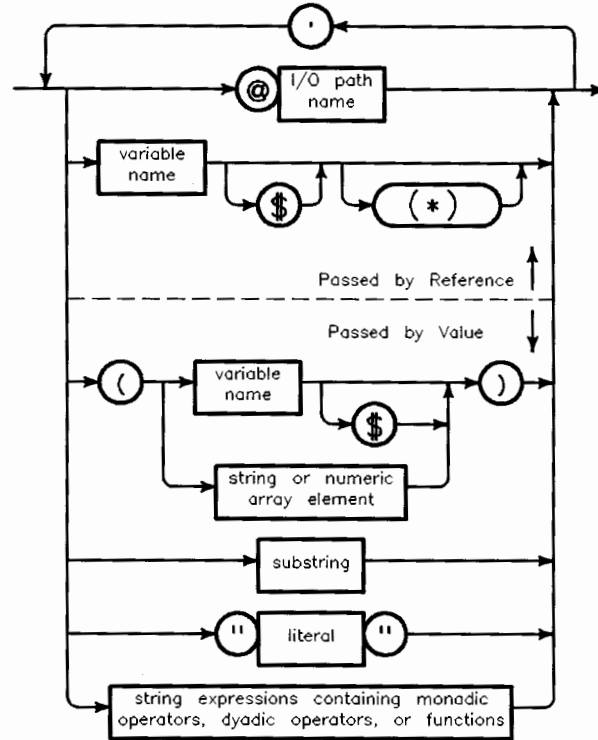
```
R=FNTrans(Item(Start+Offset),Lookup(*))
```

F

FN



pass parameters:



F

F-8 FBYTE - FRENCH

Item	Description	Range
function name	name of a user-defined function	any valid name
I/O path name	name assigned to a device, devices, or mass storage file	any valid name (see ASSIGN)
variable name	name of a numeric or string variable	any valid name
substring	string expression containing substring notation	(see Glossary)
literal	string constant composed of characters from the keyboard, including those generated using the ANY CHAR key	—
numeric constant	numeric quantity expressed using numerals, and optionally a sign, decimal point, or exponent notation	—

Semantics

A user-defined function may be invoked as part of a stored program line or as part of a statement executed from the keyboard. If you type the function name on the command line and then press **EXECUTE**, **ENTER**, or **Return**, **ENTER** or **Return**, the value returned by the function is displayed. The dollar sign suffix indicates that the returned value will be a string. User-defined functions are created with the DEF FN statement.

The pass parameters must be of the same type (numeric or string) as the corresponding parameters in the DEF FN statement. Numeric values passed by value are converted to the numeric type (REAL, INTEGER, or COMPLEX) of the corresponding formal parameter. Variables passed by reference must match the type of the corresponding parameter in the DEF FN statement exactly. An entire array may be passed by reference by using the asterisk specifier.

Invoking a user-defined function changes the program context. The functions may be invoked recursively.

If there is more than one user-defined function with the same name, the lowest numbered one is invoked by FN.

FNEND

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

FNEND is the last statement of a function subprogram. Control is actually transferred back to calling context by a RETURN statement. See DEF FN.

Example Statement

```
FNEND
```

F

FOR ... NEXT

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	No
Programmable	Yes
In an IF ... THEN ...	No

FOR ... NEXT defines a loop which is repeated until the loop counter passes a specified value. The step size may be positive or negative.

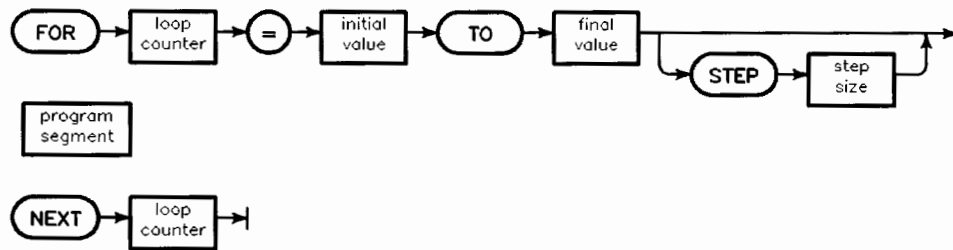
Example Statements

```

100 FOR I=4 TO 0 STEP -.1
110   PRINT I;SQR(I)
120 NEXT I

1220 INTEGER Point
1230 FOR Point=1 TO LEN(A$)
1240   CALL Convert(A$[Point;1])
1250 NEXT Point

```

Syntax

FOR ... NEXT

Item	Description	Range
loop counter	name of a numeric variable	any valid name
initial value	numeric expression	—
final value	numeric expression	—
step size	numeric expression; Default = 1	—
program segment	any number of contiguous program lines not containing the beginning or end of a main program or subprogram, but which may contain properly nested construct(s).	—

Semantics

The loop counter is set equal to the initial value when the loop is entered. Each time the corresponding NEXT statement is encountered, the step size (which defaults to 1) is added to the loop counter, and the new value is tested against the final value. If the final value has not been passed, the loop is executed again, beginning with the line immediately following the FOR statement. If the final value has been passed, program execution continues at the line following the NEXT statement. Note that the loop counter is not equal to the specified final value when the loop is exited.

The loop counter is also tested against the final value as soon as the values are assigned when the loop is first entered. If the loop counter has already passed the final value in the direction the step would be going, the loop is not executed at all. The loop may be exited arbitrarily (such as with a GOTO), in which case the loop counter has whatever value it had obtained at the time the loop was exited.

The initial, final and step size values are calculated when the loop is entered and are used while the loop is repeating. If you use a variable or expression for any of these values, you may change its value after entering the loop without affecting how many times the loop is repeated. However, changing the value of the loop counter itself can affect how many times the loop is repeated.

The loop counter variable is allowed in expressions that determine the initial, final, or step size values. The previous value of the loop counter is not changed until after the initial, final, and step size values are calculated.

Note

Avoid using fractional values in a FOR ... NEXT statement. Remember that some REAL fractional numbers cannot be represented exactly by the computer. For example, if you use a step size of 0.1, the loop may execute a different number of times than you expect. Also, if the step size evaluates to 0, the loop may repeat infinitely. In either case no error message is given.

Refer to the "Numeric Computation" chapter of the *HP BASIC Programming Guide* for detailed information on the effects of the computer's internal numeric representation.

Nesting Constructs Properly

Each FOR statement is allowed one and only one matching NEXT statement. The NEXT statement must be in the same context as the FOR statement. FOR ... NEXT loops may be nested, and may be contained in other constructs, as long as the loops and constructs are properly nested and do not improperly overlap.

F

FORMAT

See ASSIGN.

F

FRACT

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

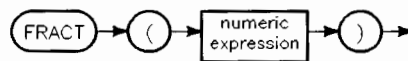
FRACT returns the “fractional part” of its argument. For REAL X,
 $X = \text{INT}(X) + \text{FRACT}(X)$.

Example Statements

```
PRINT FRACT(17/3)
```

```
Right_part=FRACT(Both_parts)
```

Syntax



Semantics

This function *does not* allow COMPLEX arguments.

F

FRAME

Supported On	UX WS DOS
Option Required	GRAPH
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

FRAME draws a frame around the current graphics clipping area using the current pen number and line type. After drawing the frame, the current pen position coincides with the lower left corner of the frame, and the pen is down.

Example Statement

```
FRAME
```

Syntax



F

FRENCH

See LEXICAL ORDER IS.

F



G

GCLEAR - GSTORE

G



GCLEAR

Supported On	UX WS DOS IN
Option Required	GRAPH
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

GCLEAR clears the graphics display or sends a command to an external plotter to advance the paper. With bit-mapped displays, the memory is cleared and the alpha is restored.

Example Statements

```
GCLEAR
```

Syntax



Multi-Plane Bit-Mapped Displays

The GCLEAR statement clears all planes designated as graphics planes with the current graphics write-mask. This includes any planes which are both alpha and graphics planes. See the "Multi-Plane Bit-Mapped Displays" section in the *HP BASIC Programming Guide* manual for information on enabling and displaying specific frame buffer planes.

Note

If any planes in the frame buffer are enabled by *both* the alpha mask and the graphics mask, the common planes, as well as the graphics planes, will be cleared. Then, the alpha data will be redisplayed in the common planes. This may cause text which was previously hidden or over-written by graphics to reappear.

GERMAN

See LEXICAL ORDER IS.

G



GESCAPE

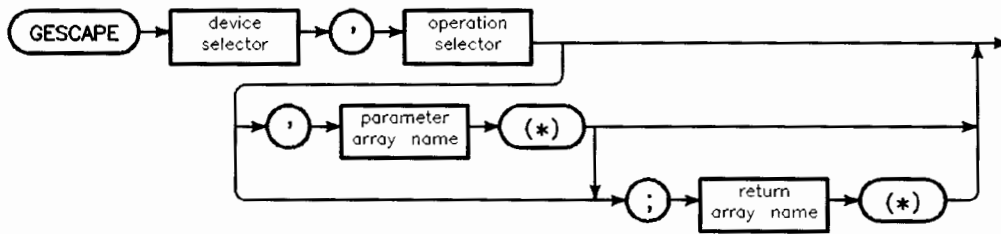
Supported On	UX WS DOS
Option Required	GRAPHX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

GESCAPE is used for communicating device-dependent graphics information. The type, size, and shape of the arrays must be appropriate for the requested operation.

Example Statements

```
GESCAPE Dev_select,operation
GESCAPE Dev_select,operation,array_in(*)
GESCAPE Dev_select,operation;array_out(*)
GESCAPE Dev_select,operation,array_in(*);array_out(*)
GESCAPE 604,10 ! HP BASIC/UX in X only
```

Syntax



Item	Description	Range
device selector	numeric expression, rounded to an integer	(see Glossary)
operation selector	numeric expression, rounded to an integer	(device dependent, see Semantics)
parameter array name	name of array which has a specific rank and size, containing parameters necessary for executing request	any valid name
return array name	name of array which has a specific rank and size into which the returned parameters are placed	any valid name



Semantics

Use the parameter array and return array to send data to the device and receive data from the device.

Note Operation selector 1 will accept either a REAL or an INTEGER array as its return or parameter array. All other operation selectors that require parameter or return arrays will accept only INTEGER arrays.

Color Map Information

The number of entries in the color map can be determined with a GESCAPE operation selector of 1. The return array must be one-dimensional with at least one element. If this operation selector is used on a system with a monochrome display (or an HP 98627A), error 733 will be reported.

The RGB values of the pens in the color map can be obtained through GESCAPE operation selector 2. The return array must be a two-dimensional three-column array with at least one row. The values returned are in the range of 0 to 1 and are multiples of 1/255 (one two-hundred fifty fifth) for color displays. The exception to this is the HP Model 236C computer, for which the values returned are in the range of 0 to 1 and are multiples of 1/15 (one fifteenth). The first row in the array always contains the values for PEN 0; if

G

GESCAPE

you want PEN 12, you must have at least thirteen rows in the array. Array filling occurs until either the array or the color map is exhausted.

The color map affects the entire display. Thus in a windowing environment, the color map is the same for all windows.

Determining Hard Clip Limits and GSTORE Array Size

The hard clip limits of the current plotting device can be obtained by executing a GESCAPE with operation selector 3. The return array must be a one-dimensional INTEGER array with at least four elements. Values will be returned in the smallest resolvable units for that device. For a CRT, the units are pixels.

Operation selector 3 also returns information useful for GSTORE and GLOAD files. The fifth and sixth elements returned give the two array dimensions to use (in conjunction with the ALLOCATE statement) to GSTORE the contents of the specified display. For example, on a HP 98544A display with all planes enabled for graphics, the dimensions returned would be 256 and 400—256 words for each of the 400 lines. That is, 1024 pixels wide, and four pixels' worth of information in each 16-bit word. This allows you to programmatically determine the size of the integer array to allocate for storing an image and thus avoid hardware-dependent code.

In HP BASIC/UX, all displays are stored as 2 pixels/16-bit word (except for monochrome, which are 16 pixels/16-bit word).

G

Drawing Mode Dominance

The normal drawing mode and the alternate drawing mode can be entered by using GESCAPE operation selectors 4 and 5, respectively.

For this discussion, the color of the area formed by the intersection of a newly plotted item and an existing item is the color X. In the normal drawing mode, X is the same color as the pen used to draw the newly plotted items. This is the color most recently set by PEN (for lines) or AREA (for area filling). Drawing in alternate mode with positive pen numbers causes the color-map entry number at each pixel to be inclusively-ORed with the pen value currently being drawn with. Drawing in alternate mode with negative pen numbers

G-6 GCLEAR - GSTORE

causes the color-map entry number at each pixel to be exclusively-ORed with the pen value currently being used to draw.

Drawing mode dominance affects the entire display. Thus in a windowing environment, all windows have the same drawing mode.

The Write Enable and Display-Enable Masks

If you have a multi-plane frame buffer and display, there are two user-definable masks which control certain aspects of graphical operations. They are:

- The **write-enable mask**. This mask is an integer whose bits, from the least-significant bit end, designate those frame buffer planes which will be affected by graphics operations. Bit values of 1 denote enabled planes (planes to be written to), and bit values of 0 denote disabled planes (planes which will not be written to). For example, if you have a four-plane frame buffer, and you set the write-enable mask to 3 (binary 0011), only values in frame buffer planes 1 and 2 will be modified by graphical operations.
- The **display-enable mask**. This mask is an integer whose bits, from the least-significant bit end, designate those frame buffer planes which are to be displayed. These bits may or may not indicate the same planes as the write-enable mask indicates. That is, you can write to some planes, and display others. Bit values of 1 denote planes which are to be displayed, and bit values of 0 denote planes which are not to be displayed. For example, if you have a four-plane frame buffer, and you set the display-enable mask to 5 (binary 0101), only values in frame buffer planes 1 and 3 will be displayed.

Note	Both the write-enable mask and the display-enable mask are initialized to all planes that exist in the machine at power up and SCRATCH A time.
-------------	--

Operation selector 6, which works with all CRTs, allows the user to obtain the current graphics write-enable and display-enable values. The first element of the return array contains the write-enable mask; the second represents the display-enable mask. The return array must be a one-dimensional integer array with at least one element. Array filling occurs until either the array or the masks are exhausted.

GESCAPE

Operation selector 7, which works only with multi-plane Series 300 CRTs, allows the user to set the graphics write-enable and display-enable values. The first element of the parameter array contains the write-enable mask; the second represents the display-enable mask. Again, the parameter array must be a one-dimensional integer array with one or more elements. If only one element exists, the write-enable mask is set as specified and the display-enable mask remains unchanged.

Legal values for both masks are:

- 0 through 15 for 4-plane systems,
- 0 through 63 for 6-plane systems,
- 0 through 255 for 8-plane systems.

The write- and display-enable masks affect the entire display. In a windowing environment, all windows are affected and have the same display mask values. The write-mask cannot be changed in X Windows, so all planes are always turned on.

Graphics Buffering (HP BASIC/UX Only)

In order to improve graphics performance, graphics buffering may be turned on with operation selector 10. Operation selector 11 will turn buffering off. This has the affect of storing graphics commands in a buffer until it is full, and then sending all of the commands in one output sequence. Because the buffer must fill up before it is sent to the display, it is possible that the output of the last few graphics commands which were executed do not appear on the display. It is advisable to flush the buffer (with operation selector 13) after each “picture” has been drawn to ensure that all the graphics commands have been sent to the display. It is NOT advisable to flush the buffer after every command, since this is the same as turning off buffering. It is also not advisable to turn buffering on while in interactive mode, since the output from any graphics commands will not appear on the display until the graphics buffer is full, or the graphics buffer is explicitly flushed. Operation selector 12 allows you to obtain the current buffering mode. The return array must be a one-dimensional integer array with at least one element.

G

G-8 GCLEAR - GSTORE

The default graphics buffering mode may be specified in the configuration file (`rmbrc`). HP BASIC/UX does not support graphics buffering for HPGL plotters.

Absolute Locator Hard Clip Limits

Operation selector 20 sets the hardclip limits for absolute HP-HIL locators. That is, it simulates, in software, the changing of the hardclip limits. These limits must be inside the largest X and largest Y, taken individually, for all absolute locators on the HP-HIL bus.

Operation selector 21 returns the current hardclip limits for absolute HP-HIL locators. These are the values used in GRAPHICS INPUT IS scaling.

Operation selector 21 is different than operation selector 22 in that 22 always returns the values “hardwired” into the device(s) on the HP-HIL bus, whereas the values returned by operation selector 21 may have come from operation selector 20 or from the device on the bus.

Operation selector 22 returns the hardware-defined hardclip limits of all absolute locators on the HP-HIL link.

For the three GESCAPE selectors above—20, 21, and 22—the parameter or return array must be a one dimensional integer array. Only the first two entries will be used for 20 and 21: X2 and Y2. No space is taken for the X1 and Y1 values, since the coordinates of P1 (the lower, left-hand corner) cannot be changed on HP-HIL absolute locators; X1 and Y1 will always be zeroes. For operation selector 22, entries will be made until the array is full or all devices on the bus have been covered. If more array entries exist after the devices are all represented, a -1 will be put in what would be the X coordinate entry of the next device to indicate the end of valid data. (Hardclip limits for these devices are limited to the range 0 through 32 767.)

Unlike other GESCAPES, selectors 20 through 22 do not require the device at the specified select code to be currently active. Indeed, to be effective, GESCAPE 2,20, which sets hard clip limits, must be done before doing the GRAPHICS INPUT IS KBD, "TABLET" statement. Operations 20 and 21 will give “DEVICE NOT PRESENT” errors if no tablet (or HP-HIL interface) exists, but 22 will return -1 for its first entry in that case. All will give a configuration error if the KBD binary is not present.

G

GESCAPE

Functions Available Through GESCAPE

Operation Selector	Return Array (R) or Parameter Array (P)
1	(R) A(0): Number of entries in the color map
2	(R) A(0,0): Pen 0 red color map value A(0,1): Pen 0 green color map value A(0,2): Pen 0 blue color map value : A(15,0): Pen 15 red color map value A(15,1): Pen 15 green color map value A(15,2): Pen 15 blue color map value
3	(R) A(0): X minimum hard clip value A(1): Y minimum hard clip value A(2): X maximum hard clip value A(3): Y maximum hard clip value A(4): Rows required for GSTORE integer array A(5): Columns required for GSTORE integer array
4	Set normal drawing mode
5	Set alternate drawing mode
6	(R) A(0): Current graphics write-enable mask value A(1): Current graphics display-enable mask value
7	(P) A(0): Graphics write-enable mask value to be set A(1): Graphics display-enable mask value to be set
10	Turn graphics buffering on.

G

Functions Available Through GESCAPE (continued)

Operation Selector	Return Array (R) or Parameter Array (P)
11	Turn graphics buffering off.
12	(R) A(0): Current buffering mode (0 = OFF; 1 = ON)
13	Flush graphics buffer.
20	(P) A(0): X maximum hard clip value to be set A(1): Y maximum hard clip value to be set
21	(R) A(0): Current X maximum hard clip value A(1): Current Y maximum hard clip value
22	(R) A(0): X maximum hard clip value for first absolute locator A(1): Y maximum hard clip value for first absolute locator A(2): X maximum hard clip value for second absolute locator A(3): Y maximum hard clip value for second absolute locator : A(n): A value of -1 indicates that there are no more absolute locators

G



GET

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

GET reads the specified file which contains a program saved in text format, and stores the file in memory. Typically, this file is created using SAVE or RE-SAVE.

Example Statements

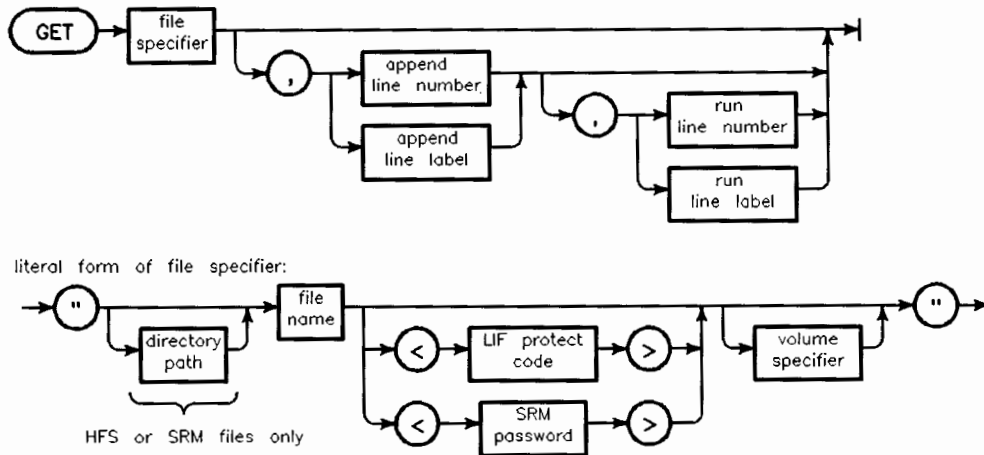
```
GET "George"
```

```
GET Progame$,Appndline,Runline
```

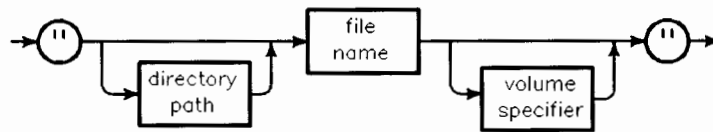
```
GET "FileName:REMOTE"
```

```
GET "/Dir1/Dir2/Dir3/File<SRM_READ_pass>"
```

Syntax



literal form of DFS file specifier:



Item	Description	Range
file specifier	string expression	(see drawing)
append line number	integer constant identifying a program line	1 through 32 766 (1 through 2 147 483 646 for HP BASIC/UX 700)
append line label	name of a program line	any valid name
run line number	integer constant identifying a program line	1 through 32 766 (1 through 2 147 483 646 for HP BASIC/UX 700)
run line label	name of a program line	any valid name
directory path	literal	(see MASS STORAGE IS)
file name	literal	depends on volume's format (see Glossary)
SRM password	literal; first 16 non-blank characters are significant	> not allowed
volume specifier	literal	(see MASS STORAGE IS)

Semantics

The file must be an ASCII, DFS, or HP-UX file that is created using SAVE or RE-SAVE. HP-UX files must contain text written in FORMAT ON representation.

When GET is executed, the first line in the specified file is read and checked for a valid line number. If no valid line number is found, the current program stays in memory and error 68 is reported. If the GET was attempted from a

GET

running program, the program remains active and the error 68 can be trapped with ON ERROR. If there is no ON ERROR in effect, the program pauses.

If there is a valid line number at the start of the first line in the file, the GET operation proceeds. Values for all variables except those in COM are lost and the current program is deleted from the append line to the end. If no append line is specified, the entire current program is deleted.

As the file is read, each line is checked for proper syntax. The syntax checking during GET is the same as if the lines were being typed from the keyboard, and any errors that would occur during keyboard entry will also occur during GET. Any lines which contain syntax errors are listed on the PRINTER IS device. Those erroneous lines which have valid line numbers are converted into comments and syntax is checked again. If the GET encounters a line longer than 256 characters, the operation is terminated and error 128 is reported. If any line caused any other syntax error, an error 68 is reported at the completion of the GET operation. This error is not trappable because the old program was deleted and the new one is not running yet.

If you create long program lines on a wide display and SAVE the program, then GET the program using a narrower display, GET may produce errors and convert the long lines to comments. This happens because GET can handle program lines of up to only twice the width of the current screen or X-Window. A commented line still contains all of the original text, but any part beyond two screenwidths is invisible, leaving the line intractable in that window. For this reason, you should limit line lengths to 160 characters or less whenever possible.

G

Any line in the main program or any subprogram may be used for the append location. If an append line number is specified, the lines from the file are renumbered by adding an offset to their line numbers. This offset is the difference between the append line number and the first line number in the file. This operation preserves the line-number intervals that exist in the file. When a line containing an error (or an invalid line number caused by renumbering) is printed on the PRINTER IS device, the line number shown is the one the line had in the file. Any programmed references to line numbers that would be renumbered by REN are also renumbered by GET. If no append line is specified, the lines from the file are entered without renumbering.

If a successful GET is executed from a program, execution resumes automatically after a prerun initialization. If no run line is specified, execution

G-14 GCLEAR - GSTORE

resumes at the lowest-numbered line in the program. If a run line is specified, execution resumes at the specified line. The specified run line must be a line in the main program segment.

If a successful GET is executed from the keyboard *and* a run line is specified, a prerun is performed and program execution begins automatically at the specified line. If GET is executed from the keyboard with no run line specified, RUN must be executed to start the program. GET is not allowed from the keyboard while a program is running.

If you are using a version of HP BASIC that supports wildcards, you can use them in file specifiers with GET. You must first enable wildcard recognition using WILDCARDS. Refer to the keyword entry for WILDCARDS for details. Wildcard file specifiers used with GET must match one, and only one, file name.

HFS Permissions

In order to GET a file on an HFS volume, you need to have R (read) permission on the file, as well as X (search) permission on the immediately superior directory and all other superior directories.

SRM Files (not supported in HP BASIC/UX 700)

In order to GET a file on an SRM volume, you need to have READ capability on the file and its immediately superior directory, as well as READ capabilities on all other superior directories. If this capability is not public or if a password protecting this capability is not given, an error is reported.

You may use GET with any ASCII, DFS, or HP-UX file whose data is in the format of a HP BASIC program (that is, having numbered lines). Although you may also use GET with ASCII files created on non-Series 200/300 SRM workstations (HP 9835, HP 9845, or Model 520), any line that is not valid HP BASIC syntax for Series 200/300 computers is stored as a commented (!) program line.

When used on SRM, GET is executed in shared mode, which means that several users can get one file at the same time. Attempts to get a locked file (see LOCK) result in Error 453. Additionally, you cannot get a file while it is being saved. The SAVE and RE-SAVE operations open the file in exclusive

G

GET

mode (shown as **LOCK** in a **CAT** listing) and enforce that status until the **SAVE** or **RE-SAVE** is complete. While in exclusive mode, the file is accessible only to the **SRM** workstation executing the **SAVE** or **RE-SAVE**.

G

GFONT IS

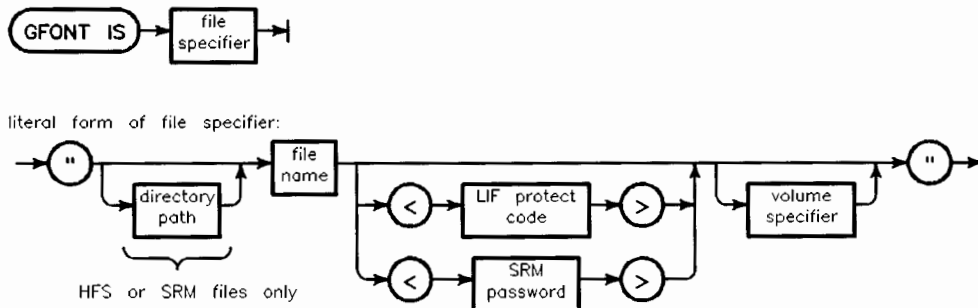
Supported On	UX WS
Option Required	LANGUAGE and GRAPH
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

GFONT IS specifies the file containing **graphics fonts** accessed by LABEL. It is useful in localized versions of HP BASIC that support certain languages, such as Japanese.

Example Statements

```
GFONT IS "JPN_VECTOR"
GFONT IS "JPN_V*"
```

Syntax



Semantics

Certain localized versions of HP BASIC, such as Japanese localized HP BASIC, require special files containing graphics fonts to display the characters used by LABEL. You do not need to use GFONT IS unless you use these special fonts. If you do need these special fonts, you must specify their location with GFONT IS before using LABEL. If you close the GFONT file, the default font defined in the GRAPH binary is used.



GFONT IS

For a general discussion of globalization and localization including graphics fonts, refer to the *HP BASIC Porting and Globalization* manual. For details concerning a particular font, refer to *Using LanguageX with HP BASIC*, where *LanguageX* is your local language.

If you are using a version of HP BASIC that supports wildcards, you can use them in file specifiers with GFONT IS. You must first enable wildcard recognition using WILDCARDS. Refer to the keyword entry for WILDCARDS for details. Wildcard file specifiers used with GFONT IS must match one and only one file name.

If the file specifier does not include a complete path or volume specifier, the current MASS STORAGE IS volume and path are used.

G

GINIT

Supported On	UX WS DOS
Option Required	GRAPH
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

GINIT establishes a set of default values for system variables affecting graphics operations.

Example Statements

```
GINIT
```

Syntax

Semantics

The following operations are performed when GINIT is executed:

```

AREA PEN 1
CLIP OFF
CSIZE 5,0.6
LDIR 0
LINE TYPE 1,5
LORG 1
MOVE 0,0
PDIR 0
PEN 1
PIVOT 0
GESCAPE CRT,4          PEN MODE NORMAL
VIEWPORT 0,RATIO*100,0,100
WINDOW 0,RATIO*100,0,100

```

G

GINIT

In addition, an active plotter or graphics input device is terminated. If the plotter is a file, the file is closed. After a GINIT and before a PLOTTER IS statement is executed, the following statements select a default plotter:

AXES	IDRAW	RECTANGLE
DRAW	IMOVE	RPLOT
DUMP GRAPHICS	IPLOT	SET ECHO
FRAME	LABEL	SET PEN
GCLEAR	MOVE	SYMBOL
GLOAD	PLOT	
GRID	POLYGON	
GSTORE	POLYLINE	

G

GLOAD

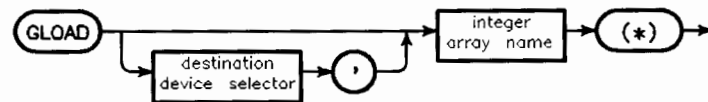
Supported On	UX* WS DOS
Option Required	GRAPH
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

GLOAD loads the contents of an INTEGER array into the graphics frame buffer.

Example Statements

```
GLOAD Picture(*)
IF Flag THEN GLOAD Array(*)
GLOAD 28, Hp98627(*)
```

Syntax



Item	Description	Range
destination device selector	numeric expression, rounded to an integer; Default = last CRT plotter	(see Glossary)
integer array name	name of an INTEGER array.	any valid name

G

GLOAD

Semantics

A frame buffer is an area of memory which contains the digital representation of a raster image. A monochromatic image has a frame buffer one bit deep. The Model 236 color display has a four-bit frame buffer which allows sixteen colors. The HP 98627A external color interface has a three-bit frame buffer which allows eight colors. The HP 98543A and HP 98545A display boards have 4 planes, allowing 16 colors, and the HP 98700 has 4 or 8 planes, allowing 16 or 256 colors, respectively. The HP 98547A and HP 98549A display boards have 6 planes, allowing 64 colors. The HP 98550A and HP 98720 display boards have 8 planes, allowing 256 colors. The HP Model 362/382 internal display interfaces have 8 planes, allowing 256 colors.

If a destination device is not explicitly specified, the array's contents are loaded into the current PLOTTER IS device (if it is a frame buffer) or into the last frame buffer device specified by a PLOTTER IS statement.

GLOAD operates on active plotting devices. A plotting device is active when it is specified in a PLOTTER IS statement. In addition, the internal CRT is also activated by any of the following operations: any pen movement; GCLEAR; GLOAD to the current default destination; GSTORE from the current default source; DUMP GRAPHICS from the current default source; and SET PEN. Plotters are de-activated by power-up, GINIT, SCRATCH A or **RESET**.

The array's contents are loaded into the specified frame buffer if a currently active frame buffer (CRT) is explicitly specified as the destination. However, if the specified frame buffer is not activated, error 708 occurs.

G

The GLOAD is not performed if a non-frame buffer destination which is the current PLOTTER IS device is explicitly specified. However, if a non-frame buffer destination which is *not* the current PLOTTER IS device is specified, error 708 occurs.

Pixel Representation

A pixel is a picture element. Each pixel on a monochromatic display is represented by one bit in memory; a binary 1 represents a pixel that is on, while a binary 0 represents a pixel which is off. Each INTEGER array element represents 16 pixels on a monochromatic display.

G-22 GCLEAR - GSTORE

GLOAD

Pixels on color and gray scale displays have different representation. The Model 236 color display requires four bits to represent each pixel. The optional color monitor (HP 98627) requires three bits to represent each pixel.

The number of pixels on the horizontal and vertical axes and the number of INTEGER array elements necessary to represent the entire display is shown in the following table for each model and display.

G



GLOAD

Model	Horizontal Size	Vertical Size	HP BASIC/WS INTEGER Elements	HP BASIC/UX INTEGER Elements
1-plane systems:				
216 (HP 9816) (monochromatic)	400	300	7500	n/a
220 (HP 9920) (monochromatic)				
(HP 98204A)	400	300	7500	n/a
(HP 98204B)	512	390	12 480	n/a
226 (HP 9826) (monochromatic)	400	300	7500	n/a
236 (HP 9836) (monochromatic)	512	390	12 480	n/a
98546 (monochromatic)	512	390	12 480	12 480
237 (HP 9837) (bit-mapped, monochromatic)	1024	768	49 152	49 152
98542 (medium-resolution bit-mapped, monochromatic)	1024	400	25 600	12 800
98544 (high-resolution, bit-mapped, monochromatic)	1024	768	49 152	49 152
98548 (high-resolution, bit-mapped, monochromatic)	1280	1024	163 840	81 920
3-plane systems:				
98627A (external color)	512	512	49 152	n/a

G

Model	Horizontal Size	Vertical Size	HP BASIC/WS INTEGER Elements	HP BASIC/UX INTEGER Elements
4-plane systems:				
236 (HP 9836C) (color)	512	390	49 920	n/a
98543 (medium-resolution, bit-mapped, color)	1024	400	102 400	102 400
98545 (high-resolution, bit-mapped, color)	1024	768	196 608	393 216
6-plane systems:				
98547 (high-resolution, bit-mapped, color)	1024	768	393 216	393 216
98549 (high-resolution, bit-mapped, color)	1024	768	393 216	393 216
8-plane systems:				
98700 (high-resolution, bit-mapped, color)	1024	768	393 216	393 216
98550A (high-resolution, bit-mapped, color)	1280	1024	655 360	655 360
98720A	1280	1024	655 360	655 360
362/382 (color or gray scale)	640	480	153 600	153 600
	1024	768	393 216	393 216
	1280	1024	655 360	655 360

The declared array size can be larger or smaller than the graphics memory size; the operation stops when either graphics memory or the array is exhausted.

Since any one dimension of an array cannot be more than 32 767 elements, for an array to be large enough to hold the entire graphics representation, the array may have to be multi-dimensional. For example,

INTEGER Screen(1:390,1:64,1:2) *for Model 236 Color*
 INTEGER Screen(1:512,1:32,1:3) *for HP 98627A Color*

GLOAD

Storage Format

The pixel representation on a monochromatic display is stored sequentially in the array using GSTORE.

The pixel representation for color displays is stored in different formats using GSTORE.

Model 236 color display: Consecutive pairs of 16-bit words are used, regardless of the array structure. P in the diagram is the 4-bit representation of the pixel.

Word 1				Word2			
P5	P1	P6	P2	P7	P3	P8	P4

HP 98627A color display: Each word contains the blue, green or red representation for 16 pixels. P in the diagram is the 1-bit color representation of the pixel.

Word	Pixel						Color
1	P1	P2	P3	P4	...	P16	BLUE
2	P1	P2	P3	P4	...	P16	GREEN
3	P1	P2	P3	P4	...	P16	RED
4	P17	P18	P19	P20	...	P32	BLUE
5	P17	P18	P19	P20	...	P32	GREEN
6	P17	P18	P19	P20	...	P32	RED
etc.							

G

Storage Format on Multi-Plane Bit-Mapped Displays

GLOAD loads information from an array into the **graphics planes** in the frame buffer. “Graphics planes” means those planes which have been write-enabled for graphics operations via power up, SCRATCH A, or GESCAPE. You can change the graphics write mask with GESCAPE.

In the following paragraphs, reference is made to the “highest graphics plane.” The “highest graphics plane” is that plane in the frame buffer whose corresponding bit in the graphics write-enable mask has the highest number. For example, the highest graphics plane with a write mask of binary 1000 is 4. Also note that although bits in a byte are numbered from 0 through 7 (right to left), planes in the frame buffer are numbered 1 through 8.

If the highest graphics plane currently enabled is 1 (or none), act like there is 1. The storage format is:

Word1	P0	P1	P2	P3	...	P15
Word2	P16	P17	P18	P19	...	P31

If the highest graphics plane currently enabled is between 2 and 4, inclusive, act like there are 4. The storage format is the same as the Model 236C format, described above.

If the highest graphics plane currently enabled is between 5 and 8, inclusive, act like there are 8. The storage format is:

Word	Each bit in most/significant byte	Each bit in least/significant byte
Word 1	P0	P1
Word 2	P2	P3

Images should be GLOADed on the same display and with the same write-enable mask that was used when the image was GSTOREd. If these guidelines are not observed, the GLOADed image may bear no resemblance to the GSTOREd image.

GLOAD

To determine the number of elements needed in an integer array to hold an image, use the GESCAPE operation selector 3.

When using graphics and alpha write masks, you may prefer not to overlap the masks; that is, have any planes which are simultaneously indicated by both masks. If planes enabled for alpha overlap those enabled for graphics, some alpha information will be stored along with the graphics information.

You can conserve space if you are using fewer than the maximum number of planes. For example, on a 98700 with eight planes, if pens 0 through 15 *only* are being used, the graphics write mask could be set to 15 (binary 00001111) rather than the default of 255 (binary 11111111). In this way, only half the memory would be required to GLOAD the image. You can change the graphics write mask with GESCAPE.

Non-Square Pixel Displays (HP BASIC/WS Only)

With non-square pixel displays, GSTORE stores all pixels (e.g., all 1024×400 pixels), thus requiring over twice the amount of memory as with a Model 236C. This is to insure that any image GSTOREd appears exactly the same when GLOADED back into the frame buffer. Since alpha uses the non-square pixels as separate elements—not as pairs as in graphics—it is possible to have pixel pairs with different values in each pixel. If pixel *pairs* were stored, images with mixed alpha and graphics could appear blurred when reloaded.

HP BASIC/UX Specifics

Storage format for all multi-plane bit-mapped displays is byte/pixel, regardless of the number of planes or value of the graphics write mask. For example:

Word	Each bit in most/significant byte	Each bit in least/ significant byte
Word 1	P0	P1
Word 2	P2	P3

Storage format for monochrome (1-plane) bit-mapped displays is the same for HP BASIC/WS and HP BASIC/UX. For example:

G-28 GCLEAR - GSTORE

Word1	P0	P1	P2	P3	...	P15
-------	----	----	----	----	-----	-----

When HP BASIC runs in X Windows, the number of pixels on the horizontal and vertical axes, and the number of INTEGER array elements necessary to represent the entire display can vary from the default size 640X400. You can accommodate different window sizes by dynamically setting the GLOAD array size as shown in the following example:

```
INTEGER A(0:5)
GESCAPE CRT,3;A(*) ! Read some display parameters
ALLOCATE Screen(1:A(4),1:A(5))
GSTORE Screen(*) ! Save frame buffer into array
.
.
.
GLOAD Screen(*) ! Load the array back
```

G

GOSUB

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	No
Programmable	Yes
In an IF ... THEN ...	Yes

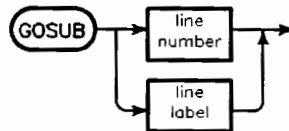
GOSUB transfers program execution to the subroutine at the specified line. The specified line must be in the current context. The current program line is remembered in anticipation of returning.

Example Statements

```
GOSUB 120
```

```
IF Numbers THEN GOSUB Process
```

Syntax

**G**

Item	Description	Range
line label	name of a program line	any valid name
line number	integer constant identifying a program line	1 through 32 766 (1 through 2 147 483 646 for HP BASIC/UX 700)

GOTO

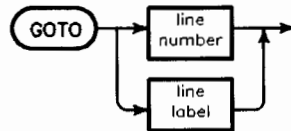
Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	No
Programmable	Yes
In an IF ... THEN ...	Yes

GOTO transfers program execution to the specified line. The specified line must be in the current context.

Example Statements

```
GOTO 550
GOTO Loop_start
IF Full THEN GOTO Exit
```

Syntax



Item	Description	Range
line label	name of a program line	any valid name
line number	integer constant identifying a program line	1 through 32 766 (1 through 2 147 483 646 for HP BASIC/UX 700)

G

GRAPHICS

Supported On	UX* WS DOS*
Option Required	GRAPH
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

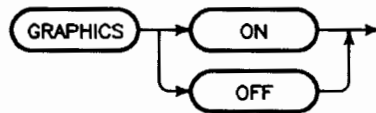
GRAPHICS turns the graphics display on or off without affecting the contents of the graphics memory.

Example Statements

```
GRAPHICS ON
```

```
IF Flag THEN GRAPHICS OFF
```

Syntax



Semantics

G

Multi-Plane Bit-Mapped Displays

If you do not understand the concept of write-enable masks or display-enable masks, see GCLEAR before reading the following paragraphs.

GRAPHICS ON/OFF applies only to the graphics display which also is the alpha display. For example, suppose your configuration consists of a display which has both alpha *and* graphics, and another display which has only graphics. In this case, there would be no way, with the GRAPHICS statement, to turn graphics on or off on the display which has graphics exclusively.

With default alpha and graphics write-masks, the GRAPHICS ON and GRAPHICS OFF statements have no effect on bit-mapped displays. If designated alpha and

graphics write masks do not overlap, then the statements will enable/disable graphics planes for displaying as with non-bit-mapped systems. When the write masks overlap, planes that are used *only* for graphics (not alpha) are enabled/disabled. For example, if the alpha write-enable mask is binary 1110 and the graphics write-enable mask is binary 0011, GRAPHICS ON and GRAPHICS OFF would only affect plane 1. Plane 2 is not affected because it is indicated by *both* the alpha and graphics write-enable masks, and planes 3 and 4 are not affected because they are not indicated by the graphics write-enable mask.

Note

Mixing ALPHA/GRAPHICS ON/OFF with explicit definition of the display-enable mask may cause the (ALPHA) and/or (GRAPHICS) keys to have unexpected results. The reason for this is that explicit setting of the display mask is, in a manner of speaking, working “behind the back” of the operating system. Thus, you could turn off graphics by modifying the display-enable mask, and the internal variables which keep track of (ALPHA) and (GRAPHICS) key presses would not—indeed, *could not*—have been updated. The reason these variables cannot be updated is that you can set the display mask to a state in which “alpha on” is only partially true; some alpha planes are on, and some aren’t. The same goes for graphics.

HP BASIC/UX Specifics

GRAPHICS ON/OFF has no effect in a windowing environment, since the write-masks are always set to enable all planes.

HP BASIC/DOS Specifics

GRAPHICS ON/OFF functions only on SEPARATE ALPHA mode, which is supported only for VGA and EGA displays.



GRAPHICS INPUT IS

Supported On	UX* WS DOS
Option Required	GRAPHX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

GRAPHICS INPUT IS defines the device to be used for subsequent DIGITIZE, READ LOCATOR, SET LOCATOR, and TRACK IS ... ON/OFF statements.

Example Statements

```
GRAPHICS INPUT IS KBD,"KBD"  
GRAPHICS INPUT IS KBD,"ARROW KEYS"  
GRAPHICS INPUT IS 706,"HPGL"  
GRAPHICS INPUT IS Ds,Hp$  
GRAPHICS INPUT IS KBD,"TABLET"
```

Syntax



G

Item	Description	Range
device selector	numeric expression, rounded to an integer	(see Glossary)
digitizer specifier	string expression	(see Semantics)

Semantics

The specified device is defined to be the graphics input device for subsequent graphics input statements (DIGITIZE, READ LOCATOR, SET LOCATOR, and TRACK ... IS ON). This input device becomes undefined when a power-up, **RESET**, GINIT, or SCRATCH A is executed. The default input device is KBD, "KBD".

The operating system attempts to use the current VIEWPORT and WINDOW (or SHOW) parameters for both the current PLOTTER IS device and the specified GRAPHICS INPUT IS device, so that the usable areas of the input and output devices correspond in a 1-to-1 mapping. If the aspect ratios of the input and output devices are different, the input device limits are truncated to match the output device's aspect ratio.

If the VIEWPORT statement specifies an area that does not exist on the input device, error 705 will be reported.

If you specify the keyboard device selector, there are two possibilities for the digitizer specifier. To specify relative pointing devices (e.g., the cursor keys, knob, or mouse), use "KBD" or "ARROW KEYS". For a port path to the Series 500, use the string "ARROW KEYS". To specify absolute pointing devices (e.g., HP-HIL tablets or the Touchscreen), use the string "TABLET". "HPGL" must be specified if the device selector is anything other than the keyboard select code.

When doing a DIGITIZE, the relative pointing devices move the graphics cursor. Otherwise, *in addition to moving the graphics cursor*, they perform their normal "alpha" functions: scrolling text on the screen, and moving the alpha cursor within the keyboard entry line.



HP-HIL Absolute Locators

This statement can specify HP-HIL absolute locators, which include graphics tablets as well as the Touchscreen. As with relative locators, all devices of this type are lumped together and processed as if they were a single device. This could lead to interference if two or more of these devices were connected to the HP-HIL bus. The intent is to support *one* active absolute locator on the HP-HIL bus, although careful use will allow more than one. In particular, the GESCAPE values of 20, 21, and 22 allow use of the HP-HIL Touchscreen on the



GRAPHICS INPUT IS

same bus as a Tablet, provided the stylus is removed from the Tablet when the Touchscreen is in use.

Absolute Locator Hard Clip Limits

You can set the position of P2—the upper right corner of the digitizing area—on HP-HIL tablets by using **GESCAPE** with operation selectors 20 through 22. This is conceptually similar to setting the P2 point with HPGL commands on HPGL tablets. See **GESCAPE** for further information.

HP BASIC/UX Specifics

When running in X Windows:

- Only the HP-HIL devices recognized by the window system (ie., those which control the window pointer) can be used for graphics input.
- All HP-HIL devices (including tablets) can be accessed only through the **KBD** or **ARROW KEYS** digitizer specifier. **TABLET** is not a valid specifier in X Windows.
- Any HP-GL devices specified in a **GRAPHICS INPUT IS** will be locked to that window while a statement which accesses the device (e.g., **DIGITIZE**) is being executed.

When running on a terminal:

- Only arrow keys can be used to provide input through the **KBD** select code.

G

GRID

Supported On	UX WS DOS
Option Required	GRAPH
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

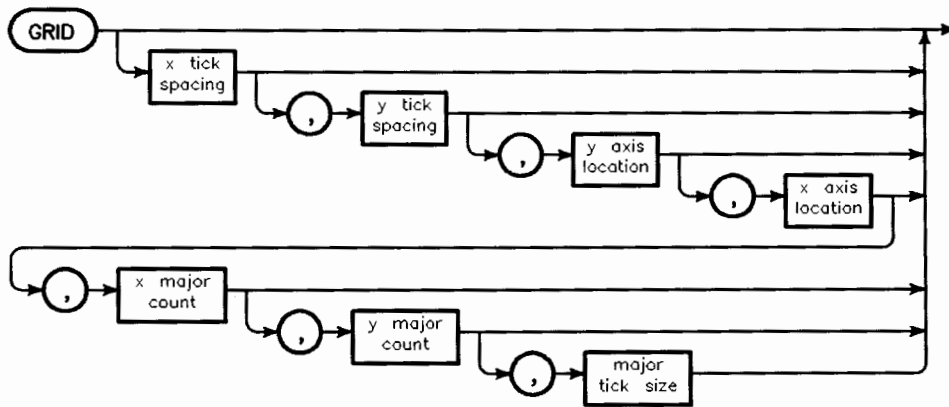
GRID draws a full grid pattern. The pen is left at the intersection of the X and Y axes.

Example Statements

```
GRID 10,10
```

```
GRID Xspace,Yspace,Xlocy,Ylocx,Xcount,Ycount,Major_size
```

Syntax



G

GRID

Item	Description	Range
x tick spacing	numeric expression in current units; Default = 0, no ticks	(see text)
y tick spacing	numeric expression in current units; Default = 0, no ticks	(see text)
y axis location	numeric expression specifying the location of the y axis in x-axis units; Default = 0	—
x axis location	numeric expression specifying the location of the x axis in y-axis units; Default = 0	—
x major count	numeric expression, rounded to an integer, specifying the number of tick intervals between major tick marks; Default = 1 (every tick is major)	1 through 32 767
y major count	numeric expression, rounded to an integer, specifying the number of tick intervals between major tick marks; Default = 1 (every tick is major)	1 through 32 767
major tick size	numeric expression in graphic display units; Default = 2	

G

Semantics

Grids are drawn with the current line type and pen number. Major tick marks are drawn as lines across the entire soft clipping area. A cross tick is drawn at the intersection of minor tick marks.

The X and Y tick spacing must not generate more than 32 768 grid marks in the clip area, or error 20 will be generated. Only the grid marks within the current clip area are drawn.

GRID

	Scaling	PIVOT	CSIZE	LDIR	PDIR
Lines (generated by moves and draws)	X	X			[4]
Polygons and rectangles	X	X			X
Characters (generated by LABEL)			X	X	
Axes (generated by AXES & GRID)	X				
Location of Labels	[1]	[3]		[2]	

¹The starting point for labels drawn after lines or axes is affected by scaling.

²The starting point for labels drawn after other labels is affected by LDIR.

³The starting point for labels drawn after lines or axes is affected by PIVOT.

⁴RPLOT and IPLOT are affected by PDIR.

G

GSEND

Supported On	UX WS DOS
Option Required	GRAPH
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

GSEND is used to send HPGL commands to the current PLOTTER IS device.

Example Statements

```
IF Hpgl_device THEN GSEND "IP;"
GSEND String$
```

Syntax



Item	Description	Range
HPGL command string	string expression	device-dependent

G

Semantics

This statement sends a string of characters to the current PLOTTER IS device, which may be a file or a plotter. The string is to contain Hewlett-Packard Graphics Language (HPGL) command(s). Note that HP BASIC does not check the syntax of these HPGL commands.

GSEND is most useful when the PLOTTER IS device is a file (it is not possible to OUTPUT an HPGL command to the file while it is the PLOTTER IS device).

GSEND

An error is reported if the current PLOTTER IS device is not an HPGL device or a file.

After GSEND sends the specified string, it will send a carriage return/line feed (as an EOL sequence). If your device does not recognize a carriage return/line feed as a terminator for an HPGL command, you must include the correct terminating sequence (normally a semicolon) as part of the HPGL command string you are sending.

Note that you *cannot* split HPGL commands over more than one GSEND statement, because of the carriage return/line feed sequence sent after each GSEND statement. The following example *will not work* because it splits the HPGL command over more than one GSEND statement. (Also, the command is not properly terminated.)

```
GSEND "P"  
GSEND "F"
```

The proper way to send this HPGL command is:

```
GSEND "PF;"
```

G

GSTORE

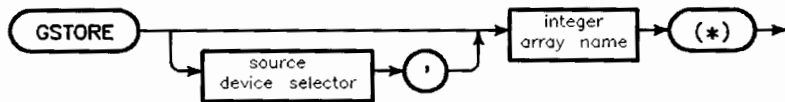
Supported On	UX WS DOS
Option Required	GRAPH
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

GSTORE stores the contents of the graphics frame buffer into an INTEGER array.

Example Statements

```
GSTORE Picture(*)
IF Final THEN GSTORE A(*)
GSTORE 28, Hp98627(*)
```

Syntax



G

Item	Description	Range
source device selector	numeric expression, rounded to an integer; Default = last CRT plotter	(see Glossary)
integer array name	name of an INTEGER array	any valid name

Semantics

A frame buffer is an area of memory which contains the digital representation of a raster image. A monochromatic image has a frame buffer of one bit deep. The Model 236 color display has a four-bit frame buffer which allows sixteen colors. The HP 98627A external color interface has a three-bit frame buffer which allows eight colors. The HP 98543A and HP 98545A display boards have 4 planes, allowing 16 colors, and the HP 98700 has 4 or 8 planes, allowing 16 or 256 colors, respectively. The HP 98547A and HP 98549A display boards have 6 planes, allowing 64 colors. The HP 98550A and HP 98720 displays have 8 planes, allowing 256 colors. The HP Model 362/382 internal display interfaces have 8 planes, allowing 256 colors.

If a source device is not explicitly specified, the array's contents are loaded from the current PLOTTER IS device (if it is a frame buffer) or from the last frame buffer device specified by a PLOTTER IS statement.

GSTORE operates on active plotting devices. A plotting device is active when it is specified in a PLOTTER IS statement. In addition, the internal CRT is also activated by any of the following operations: any pen movement; GCLEAR; GLOAD to the current default destination; GSTORE from the current default source; DUMP GRAPHICS from the current default source; and SET PEN. Plotters are de-activated by power-up, GINIT, SCRATCH A or **RESET**.

The frame buffer's contents are loaded into the specified array if a currently active frame buffer (CRT) is explicitly specified as the source. However, if the specified frame buffer is not activated, error 708 occurs.

The GSTORE is not performed if a non-frame buffer source which is the current PLOTTER IS device is explicitly specified. However, if a non-frame buffer source which is *not* the current PLOTTER IS device is specified, error 708 occurs.

Pixel Representation and Storage

See the GLOAD statement for details about pixel representation and storage formats.

G

H

HELP - HIL SEND

H

HELP - HIL SEND H-1

HELP

The HELP keyword is implemented for the HP BASIC Compiler and for HP BASIC Plus. See your Compiler or HP BASIC Plus documentation for details. (There is no compiler for the HP BASIC/UX 700.)

H

HILBUF\$

Supported On	UX WS DOS
Option Required	KBD
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

HILBUF\$ receives data sent by an HP-HIL device (e.g., Describe Records, Poll Records, etc.).

Example Statements

```
HILBUF$
Temp_buf$=HILBUF$
IF Read_buf THEN Buffer$=HILBUF$
```

Syntax



Semantics

This function receives data from HP-HIL devices which have had polling enabled by the ON HIL EXT statement or which have been sent a command by the HIL SEND statement. This data takes the form of 8-bit numbers (bytes) packed into a string. When HILBUF\$ is read, the internal buffer where it accumulates this data is cleared, ready to receive more data.

The format of the string returned by the HILBUF\$ function is as follows: lost packet count, followed by zero or more data packets. The lost packet count will normally be zero (the null character). If the internal buffer overflows (because it is not read), the lost packet count is the total number of packets lost (to a maximum count of 255 packets). Only whole packets are put into the buffer. The format of a packet is: packet length, device address, data list. For

H

HILBUF\$

example, sending an HIL SEND 4;RSC statement to an ID Module would create a packet of data similar to the following:

Packet Length	Device Address	data list								
11	4	16	4	180	65	151	176	3	15	65

where 11 is the packet length and 4 is the device address. The remaining characters make up the data list (which in this example is a product/exchange number and serial number). The first character of the packet is the **packet length**. The packet length tells you how many string characters are left in the packet (including this character). Packet lengths range from 3 to 19 characters. The second character in the string is the **device address**. This tells you the position of the device within the HP-HIL link. There can only be a total of 7 addresses in the HP-HIL link. The remaining characters in the packet make up the **data list**. This list contains information which is dependent on the HP-HIL device polled (ON HIL EXT) or on the HP-HIL device and the command sent (HIL SEND). For more information on packets read the chapter "HP-HIL Interface" found in the *HP BASIC Interface Reference*.

If the HIL SEND statement results in data being returned from the device, the data is put into HILBUF\$ even if HP-HIL interrupts are not enabled (i.e. ON HIL EXT is not currently active). Note that no interrupt is generated, even if HP-HIL interrupts are enabled (i.e. ON HIL EXT is currently active), for data placed in HILBUF\$ as a result of HIL SEND. However, care should be taken in this case, since executing ON HIL EXT clears HILBUF\$.

H

HIL SEND

Supported On	UX* WS DOS
Option Required	KBD
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

HIL SEND allows a selected subset of the HP-HIL Command Set to be transmitted to specific devices in the HP-HIL link.

Example Statements

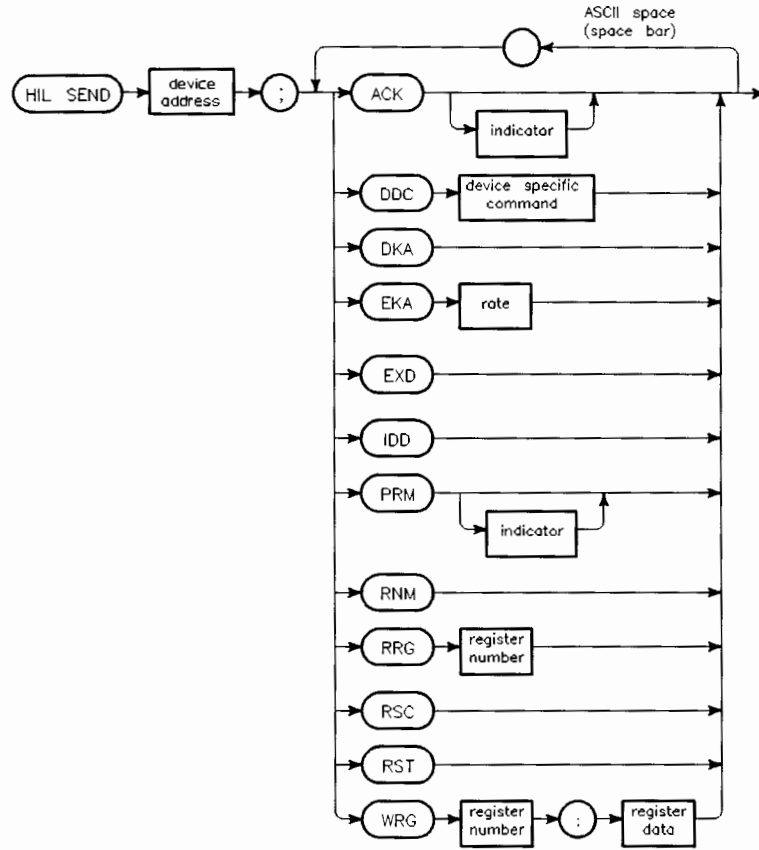
```
HIL SEND Dev_address;DKA PRM
```

```
HIL SEND 3;IDD
```

```
HIL SEND 7;ACK 6
```

H

HIL SEND



H

Item	Description/Default	Range Restrictions
device address	numeric expression representing the HP-HIL device's position in the HP-HIL link	1 through 7
rate	numeric expression indicating a keyswitch auto-repeat rate of 20 or 40 milliseconds	1 or 2
indicator	numeric expression representing which of several prompts/acknowledges on the device to use	1 through 7
device specific command	numeric expression whose meaning is device dependent	128 through 239
register number	numeric expression	0 through 127 (RRG); 0 through 255 (WRG)
register data	numeric expression	0 through 255

Semantics

HP-HIL commands must be sent to a specific HP-HIL device, they may not be sent to several devices at once.

The IDD (Identify and Describe) command can be sent to all HP-HIL devices. For all other commands, HP-HIL devices which can use the HIL SEND statement are those whose poll records are not being processed for another purpose by HP BASIC. These devices are grouped into three categories:

- Absolute positioning devices which are not the current GRAPHICS INPUT device. Examples of these devices are as follows: Touchscreen (HP 35723A), A-size Digitizer (HP 46087A), B-size Digitizer (HP 46088A).
- HP-HIL devices with Device ID's less than hexadecimal 60. Examples of these devices are as follows: Bar-code Reader (HP 92916A), ID Module (HP 46084A), Function Box (HP 46086A), Vectra Keyboard (HP 46030A).

H

HIL SEND

- True keyboards which *are not* relative pointing devices, such as the HP 46020A and HP 46021A. (Poll records from these devices are processed by the Keyboard controller, rather than by HP BASIC.)

The main HP-HIL devices which *cannot* use this function are:

- Relative pointing devices, such as the HP Mouse (HP 46060A) and Control Dial Box (HP 46085A). Since the HP 98203C keyboard has a knob on it, it is considered a relative pointing device and cannot be used with the HP-HIL Command Set.
- Current GRAPHICS INPUT devices.

If the HIL SEND statement results in data being returned from the device, the data is put into HILBUF\$ even if HP-HIL interrupts are not enabled (i.e. ON HIL EXT is not currently active). Note that no interrupt is generated, even if HP-HIL interrupts are enabled, for data placed in HILBUF\$ as a result of HIL SEND. However, care should be taken in this case, since executing ON HIL EXT clears HILBUF\$.

The system will report an error if an attempt is made to send an HP-HIL command to an HP-HIL device at an address which was not present at the last SCRATCH A or power-up, even if a device is now present at that address. The system will not report an error if a command is sent to an address which had a device present at power-up or SCRATCH A but is now empty.

The sections which follow cover the HP-HIL commands supported by HP BASIC. For a detailed description of these commands, read the "HP-HIL Command Reference" located in the "HP-HIL Appendix" of the *HP BASIC Interface Reference*.

ACK 1..7

These Acknowledge commands are used to provide an audible or visual stimulus to the user, perhaps indicating that the System is ready for a particular process to be performed. Usually Acknowledges 1 through 7 are paired with Prompt 1 through Prompt 7.

The Acknowledges supported by a device are indicated in the Describe Record.

H

H-8 HELP - HIL SEND

ACK

Acknowledge is intended to be a general-purpose stimulus to the user. This command is usually paired with Prompt. An HP-HIL device indicates support of Acknowledge in the Describe Record.

DDC 128..239

This is a range of 112 commands which have been reserved for use as “device-specific” commands. These commands are intended for use by devices with special requirements which the remainder of the HP-HIL protocol does not readily support.

DKA

This command is used to disable the “repeating keys” feature for the addressed HP-HIL device, reducing returned data to one report per keyswitch transition. Support of this command is not indicated in the Describe Record or Extended Describe Record. Examples of devices which support it are the: Function Box, Vectra Keyboard, ITF Keyboard. The default state for HP-HIL devices supporting this command is AutoRepeat disabled.

Note

The auto-repeat for DKA, EKA 1, and EKA 2 is different and independent of the keyboard auto-repeat which is controlled by keyboard CONTROL registers 3 and 4. The repeated arrow keys return a code which is not recognized by the keyboard driver; hence they have no effect.

EKA 1

EKA 1 is used to enable the “repeating key” feature in the addressed device (if the feature is supported). Support of this command is not indicated in the Describe Record or Extended Describe Record. Examples of devices which support it are the: Function Box, Vectra Keyboard, ITF Keyboard. This command will cause the HP-HIL device’s keys to repeat about every 40 milliseconds. Modifier keys (**Shift**, **CTRL**, **Extend char**, etc.) will not repeat. The cursor keys (**←**, **→**, **↑** and **↓**) on an ITF Keyboard will send repeated 02 codes after the initial Keycode.

H

HIL SEND

EKA 2

EKA 2 is used to enable the “repeating key” feature in the addressed device (if the feature is supported). Support of this command is not indicated in the Describe Record or Extended Describe Record. Examples of devices which support it are the: Function Box, Vectra Keyboard, ITF Keyboard. This command will cause the HP-HIL device’s keys to repeat about every 40 milliseconds. Modifier keys (**Shift**, **CTRL**, **Extend char**, etc.) will not repeat. The Cursor Keys (**←**, **→**, **▲** and **▼**) on an ITF Keyboard will send repeated 02 codes at a faster rate than EKA 1.

EXD

This command provides additional information concerning more advanced device features which may not be required for basic operation. Support of the Extended Describe command is indicated in the Describe Record Header.

IDD

Identify and Describe is used by the system to determine the type of HP-HIL devices in the HP-HIL link, as well as some general characteristics of these devices.

Sending an IDD to a relative pointing device, or to an absolute pointing device which is currently the GRAPHICS INPUT device, will result in an IDD record being reconstructed from the system’s internal configuration record. This pseudo-IDD record will be the actual IDD record stored by the system at power-up or SCRATCH A time, but no HP-HIL bus access is made (i.e. if the device has been removed, it will still show up here).

PRM 1..7

These Prompt commands are used to provide an audible or visual stimulus to the user, perhaps indicating that the System is ready for a particular type of input. Usually Prompts 1 through 7 are paired with Acknowledge 1 through Acknowledge 7.

The Prompts supported by a device are indicated in the Describe Record.

H

PRM

Prompt is intended to be a general-purpose stimulus to the user. This command is usually paired with Acknowledge. An HP-HIL device indicates support of Prompt in the Describe Record.

RNM

Report Name is used to request a string of up to 15 characters (8-bit ASCII) which aid in describing the device to the user. Devices indicate support of the Report Name command in the Extended Describe Record.

RRG

Read Register provides a means for interaction with more complex devices via HP-HIL, allowing for data transfers not generally supported by the HP-HIL devices. Device support for this command is indicated in the Extended Describe Record.

The numeric value listed after this HP-HIL command is the number of the register that is to be accessed. The range of valid register numbers is 0 to 127.

RSC

The Report Security Code command is used to extract a unique product/exchange number and serial number from the HP-HIL device. Support of the command is indicated in the Describe Record Header.

Information returned when executing this command can also be obtained using the `SYSTEM$("SERIAL NUMBER")` function. It should be noted that this function will only return the product/exchange number and serial number for the last HP 46084A ID Module in the HP-HIL link. If there are other devices in the HP-HIL link with security code information, they are ignored by the `SYSTEM$("SERIAL NUMBER")` function. This is not the case with the RSC command when it is executed with the HIL SEND statement, as it will allow you to select the device you want to report a security code.

H

HIL SEND

RST

Report Status is used to extract device-specific status information from devices configured on the HP-HIL link. Devices indicate support of the Report Status command in the Extended Describe Record.

WRG

Write Register provides a means of setting the contents of individual registers in HP-HIL devices supporting this feature. Device support for this command is indicated in the Extended Describe Record.

There are two types of Write Register Records: Write Register Type 1 and Write Register Type 2. HP BASIC looks at both of these Types as functionally the same (i.e. they both write a single byte to a single register).

The numeric value listed after this HP-HIL command is the number of the register that is to be accessed. The range of valid register numbers is 0 to 255. Range 0 to 127 selects Write Register Type 1 and range 128 to 255 selects Write Register Type 2. In either case, only one data item may be transmitted per command (i.e. this implementation limits the Type 2 data list to one item).

HP BASIC/UX Specifics

Bad register read/write errors are no longer reported. IDD, RNM, EXD, RST, and RSC may return a variable number of bytes in HILBUF\$. This number is determined by truncating all trailing null characters from the packet obtained by the device.

Devices to be addressed using HIL SEND must not have been opened by the X Windows server. These devices must also be connected to the local system since they cannot be accessed on a remote system. See the section "Opening Input Devices" in the chapter "System-Level Customization" found in the *Using the X Window System, Version 11* manual, for details on how to prevent the X Window server from opening specified HIL devices.

H

I

IDN - IVAL

I

IDN

See MAT.

IDRAW

Supported On	UX WS DOS
Option Required	GRAPH
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

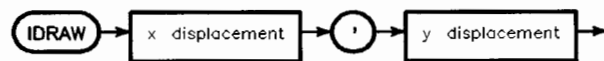
IDRAW draws a line from the current pen position to a position calculated by adding the X and Y displacements to the current pen position.

Example Statements

```
IDRAW X+50,0
```

```
IDRAW Delta_x,Delta_y
```

Syntax



Item	Description	Range
x displacement	numeric expression in current units	—
y displacement	numeric expression in current units	—

Semantics

The X and Y displacement information is interpreted according to the current unit-of-measure.

The line drawn by IDRAW is clipped at the current clipping boundary.

An IDRAW 0,0 generates a point. IDRAW updates the logical pen position at the completion of the IDRAW statement and leaves the pen down.

IDRAW

If none of the line is inside the current clipping limits, the pen is not moved, but the logical pen position is updated.

Applicable Graphics Transformations

	Scaling	PIVOT	CSIZE	LDIR	PDIR
Lines (generated by moves and draws)	X	X			[4]
Polygons and rectangles	X	X			X
Characters (generated by LABEL)			X	X	
Axes (generated by AXES & GRID)	X				
Location of Labels	[1]	[3]		[2]	

- [1]The starting point for labels drawn after lines or axes is affected by scaling.
[2]The starting point for labels drawn after other labels is affected by LDIR.
[3]The starting point for labels drawn after lines or axes is affected by PIVOT.
[4]RPLLOT and IPLOT are affected by PDIR.

IF ... THEN

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	No
Programmable	Yes
In an IF ... THEN ...	No

IF ... THEN provides conditional branching.

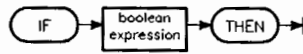
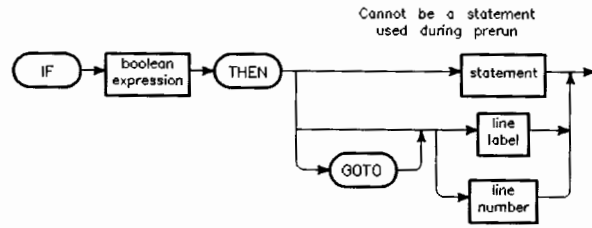
Example Statements

```
150 IF Flag THEN Next_file
160 IF Pointer<1 THEN Pointer=1

580 IF First_pass THEN
590   Flag=0
600   INPUT "Command?",Cmd$
610   IF LEN(Cmd$) THEN GOSUB Parse
620 END IF

1000 IF X<0 THEN
1010   BEEP
1020   DISP "Improper Argument"
1030 ELSE
1040   Root=SQR(X)
1050 END IF
```


IF ... THEN



program segment

END IF



program segment

ELSE

program segment

END IF

Item	Description	Range
boolean expression	numeric expression; evaluated as true if non-zero and false if zero	—
line label	name of a program line	any valid name
line number	integer constant identifying a program line	1 through 32 766 (1 through 2 147 483 646 for HP BASIC/UX 700)
statement	a programmable statement	(see following list)
program segment	any number of contiguous program lines not containing the beginning or end of a main program or subprogram.	—

Semantics

If the boolean expression evaluates to 0, it is considered false; if the evaluation is non-zero, it is considered true. Note that a boolean expression can be constructed with numeric or string expressions separated by relational operators, as well as with a numeric expression.

Single Line IF ... THEN

If the conditional statement is a GOTO, execution is transferred to the specified line. The specified line must exist in the current context. A line number or line label by itself is considered an implied GOTO. For any other statement, the statement is executed, then program execution resumes at the line following the IF ... THEN statement. If the tested condition is false, program execution resumes at the line following the IF ... THEN statement, and the conditional statement is not executed.

IF ... THEN

Prohibited Statements

The following statements must be identified at prerun time or are not executed during normal program flow. Therefore, they are not allowed as the statement in a single line IF ... THEN construct.

CASE	END	IF	REM
CASE ELSE	END IF	IMAGE	REPEAT
COM	END LOOP	INTEGER	SELECT
COMPLEX	END SELECT	LOOP	SUB
DATA	END WHILE	NEXT	SUBEND
DEF FN	EXIT IF	OPTION BASE	UNTIL
DIM	FNEND	REAL	WHILE
ELSE	FOR		

When ELSE is specified, only one of the program segments will be executed. When the condition is true, the segment between IF ... THEN and ELSE is executed. When the condition is false, the segment between ELSE and END IF is executed. In either case, when the construct is exited, program execution continues with the statement after the END IF.

Branching into an IF ... THEN construct (such as with a GOTO) results in a branch to the program line following the END IF when the ELSE statement is executed.

The prohibited statements listed above are allowed in multiple-line IF ... THEN constructs. However, these statements are not executed conditionally. The exceptions are other IF ... THEN statements or constructs such as FOR ... NEXT, REPEAT ... UNTIL, etc. These are executed conditionally, but need to be properly nested. To be properly nested, the entire construct must be contained in one program segment.

IMAG

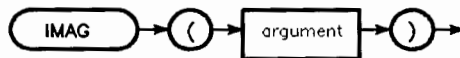
Supported On	UX WS DOS
Option Required	COMPLEX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

IMAG returns the imaginary part of a COMPLEX number.

Example Statements

```
X=IMAG(Complex_expr)
Y=IMAG(Real_expr)
Z=IMAG(Integer_expr)
Result=IMAG(CMPLX(2.1,-8))
```

Syntax



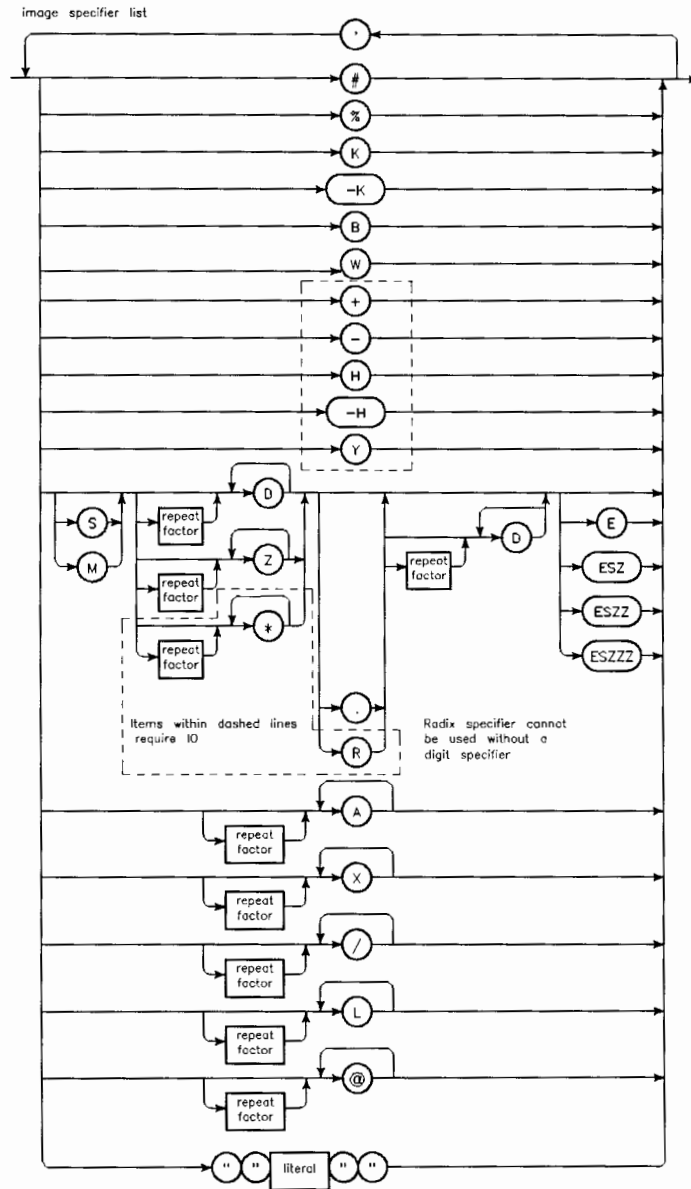
Item	Description/Default	Range Restrictions
argument	numeric expression	any valid INTEGER, REAL, or COMPLEX value

Semantics

If the argument is not a COMPLEX value, the result is 0.

Item	Description	Range
IMAGE statement items	literal	(see drawing)
repeat factor	integer constant	1 through 32 767
literal	string composed of characters from the keyboard, including those generated using the ANY CHAR key.	quote mark not allowed

IMAGE



I-12 IDN - IVAL

Note

Some localized versions of HP BASIC, such as Japanese localized HP BASIC, support two-byte characters. When using this localized language remember that the IMAGE, ENTER USING, OUTPUT USING, and PRINT USING statements define a one-byte ASCII character image with A. Use the image AA to designate a two-byte character.

For a general discussion of globalization and localization, refer to the *HP BASIC Porting and Globalization* manual. For LANGUAGE specific details, refer to *Using LanguageX With HP BASIC*, where *LanguageX* is your local language.



IMOVE

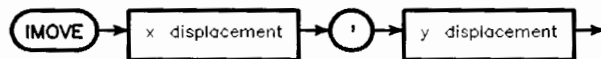
Supported On	UX WS DOS
Option Required	GRAPH
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

IMOVE lifts and moves the graphics pen from the current pen position to a position calculated by adding the specified X and Y displacements to the current pen position.

Example Statements

```
IMOVE X+50,0
IMOVE Delta_x,Delta_y
```

Syntax



Item	Description	Range
x displacement	numeric expression in current units	—
y displacement	numeric expression in current units	—

Semantics

IMOVE updates the logical position of the graphics pen, by adding the X and Y displacements to the current logical pen position. The pen is raised before it moves and remains up after the move. The X and Y displacements are interpreted according to the current unit-of-measure.

IMOVE

If both current physical pen position and specified pen position are outside current clip limits, no physical pen movement is made; however, the logical pen is moved the specified displacement.

Applicable Graphics Transformations

	Scaling	PIVOT	CSIZE	LDIR	PDIR
Lines (generated by moves and draws)	X	X			[4]
Polygons and rectangles	X	X			X
Characters (generated by LABEL)			X	X	
Axes (generated by AXES & GRID)	X				
Location of Labels	[1]	[3]		[2]	

¹The starting point for labels drawn after lines or axes is affected by scaling.

²The starting point for labels drawn after other labels is affected by LDIR.

³The starting point for labels drawn after lines or axes is affected by PIVOT.

⁴RPLOT and IPLOT are affected by PDIR.

INDENT

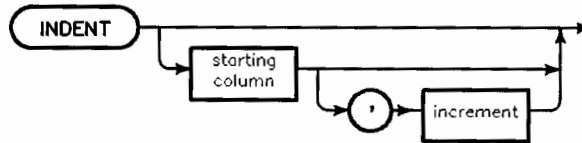
Supported On	UX WS DOS
Option Required	PDEV
Keyboard Executable	Yes
Programmable	No
In an IF ... THEN ...	No

INDENT indents program lines in the editor to reflect the program's structure and nesting.

Example Statements

```
INDENT
INDENT 8,4
```

Syntax



Item	Description	Range
starting column	integer constant; Default = 7	0 through Screen Width-8
increment	integer constant; Default = 2	0 through Screen Width-8

Semantics

The starting column specifies the column in which the first character of the first statement of each context appears. The increment specifies the number of spaces that the beginning of the lines move to the left or right when the nesting level of the program changes. Note that a line label may override the indentation computed for a particular line. The INDENT command does not move comments which start with an exclamation point, but it does move

INDENT

comments starting with REM. However, if a program line is moved to the right a comment after it may have to be moved to make room for it. In both of these cases (line labels and comments), the text moves only as far as is necessary; no extra blanks are generated.

Indenting a program may cause the length of some of its lines to become longer than the machine can list. This condition is indicated by the presence of an asterisk after the line numbers of the lines which are overlength. If this occurs, the program will run properly, STORE properly and LOAD properly. If the total length of a line exceeds 256 characters, you cannot do a SAVE, then a GET. Doing an INDENT with smaller values will alleviate this problem.

Indentation occurs after the following statements:

FOR	REPEAT
LOOP	WHILE
SUB	SELECT
IF ... THEN ¹	DEF FN

¹This is only true for IF..THEN statements where the THEN is followed by an end-of-line or an exclamation point.

The following statements cause a one-line indentation reversal; that is, indentation is reversed for these statements but re-indented immediately after them:

CASE	EXIT IF
CASE ELSE	FNEND
ELSE	SUBEND

Indentation is reversed before the following statements:

END IF	END WHILE
END LOOP	NEXT
END SELECT	UNTIL

INDENT

Indentation remains the same from line to line for all other statements.

Improperly matched nesting will cause improper indentation. Deeply nested constructs may cause indentation to exceed screen width-8. However, visible indentation is bounded by starting column and screen width-8. If a large Increment is used, indentation may attempt to go beyond screen width-8. This will not be allowed to occur, but an internal indentation counter is maintained, so construct-forming statements will have matching indentation.



INITIALIZE

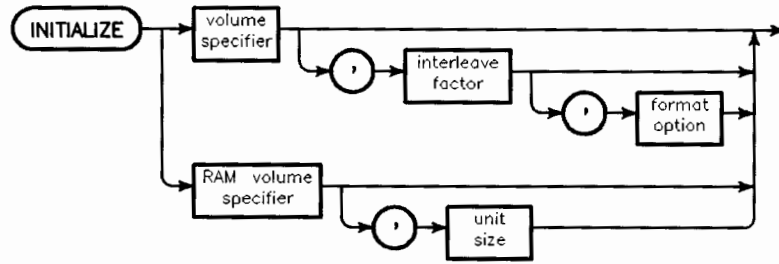
Supported On	UX* WS DOS* IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

INITIALIZE prepares mass storage media for use by the computer. When INITIALIZE is executed, any data on the media is lost. INITIALIZE may not be used to create HFS volumes; to format an HFS volume, use the DISC_UTIL program. Only an unmounted disk may be initialized LIF format in HP BASIC/UX.

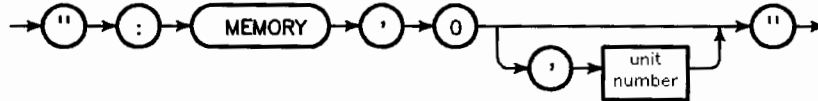
Example Statements

```
INITIALIZE ":INTERNAL" ! HP BASIC/WS only
INITIALIZE ":HP9133,702,0"
INITIALIZE Disc$,2
INITIALIZE Disc$,Interleave
INITIALIZE ":MEMORY,0,2",Sectors
INITIALIZE DISC$,Interleave,Format
```

INITIALIZE



literal form of RAM volume specifier:



Item	Description	Range
volume specifier	string expression	(see MASS STORAGE IS)
interleave factor	numeric expression, rounded to an integer; Default = device dependent (see table)	0 through 15
format option	numeric expression Default = 0	device dependent
RAM volume specifier	string expression	(see drawing)
RAM unit size	numeric expression, rounded to an integer; specifies number of 256-byte sectors; Default = 1056 (size of a 5 1/4 -inch or <i>single</i> -sided 3 1/2 -inch disk)	4 through 32 767 memory-dependent

Semantics

Any media used by the computer must be initialized before its *first* use. Initialization creates a new LIF directory, eliminating any access to old data. The media is partitioned into physical records. The quality of the media is checked during initialization. Defective tracks are “spared” (marked so that they will not be used subsequently).

Note that when executing INITIALIZE from the keyboard, HP BASIC prompts you to continue, thus ensuring safe initialization. HP BASIC does not prompt you to continue when executing INITIALIZE from a program.

Interleave Factor

The interleave factor establishes the distance (in physical sectors) between consecutively numbered sectors. The interleave factor is ignored if the mass storage device is not a disk. If you specify 0 for the interleave factor, the default for the device is used.

Device Type	Default Interleave
INTERNAL	1
CS80	[a]
HP 9121	2
HP 913X (floppy)	4
HP 913X (hard)	9
HP 9895	3
HP 8290X	4

^aCS80 disks use the current interleave as the default. If the disk is uninitialized, the interleave recommended for that disk is used. Factory-shipped interleave is 1 for the HP 7908, HP 7911, HP 7912 and HP 7914 disks. An uninitialized HP 9122 disk has a default interleave of 2.

INITIALIZE

Format Option

Some mass storage devices allow you to select the sector or volume size with which the disk is initialized. Omitting this parameter or specifying 0 initializes the disk to the default sizes. Refer to the disk drive manual for options available with your disk drive. For example, when initializing a single-sided flexible disk on the HP 9122 double-sided flexible disk drive, use a value of 4 (256-byte sectors, and 270K bytes total volume size).

Initializing EPROM (Requires EPROM)

In order to initialize an EPROM unit, it must be completely erased. The select code specified in the INITIALIZE statement must be the select code of the EPROM Programmer card currently connected to the EPROM memory card; if not, error 72 is reported.

The unit number must be one greater than the greatest unit number of any initialized EPROM unit currently in the system. For example, if the greatest unit number of an EPROM unit in the system is 3, then the unit to be initialized must be unit number 4.

INITIALIZE and HFS Volumes

Since INITIALIZE creates a LIF directory, it *cannot* alone be used to format an HFS disk; it will still, however, scan the volume for bad sectors. To format an HFS volume on the HP BASIC/WS, use the System Disk Utility (DISC_UTIL, which calls the "Mkhfs" compiled subprogram to place an HFS-format directory on the disk volume). See the "BASIC Utilities Library" chapter of *Installing and Maintaining HP BASIC/WS 6.2* or *Installing and Maintaining HP BASIC/UX* for instructions on using this utility.

On HP BASIC/UX, use the HP-UX command **newfs** command. See the *HP-UX Reference*, **newfs(1m)** entry.

INITIALIZE and SRM Volumes

Since INITIALIZE creates a LIF directory, it *cannot* be used with SRM (which uses the Structured Directory Format, SDF). An error will be reported if you attempt to initialize a REMOTE volume from a workstation.

Recovering MEMORY Volume Space

RAM disk memory can be reclaimed if no binaries have been loaded after initializing the memory volume. To recover this memory, you would execute a line similar to the following:

```
INITIALIZE ":,0,unit number",0
```

Initializing the volume to 0 sectors removes it from memory.

Memory volumes are allocated in a mark and release stack. What this means is, you get the memory back only when other subsequently created memory volumes have been reclaimed. You can re-initialize a removed memory volume in its original space provided the newly allocated space is no larger than the original space that was allocated. Otherwise, new space will be allocated for it.

HP BASIC/UX Specifics

Only an unmounted disk may be initialized, in LIF format.

HP BASIC/DOS Specifics

For LIF media in external HP-IB disk drives, INITIALIZE works the same as for Series 200/300.

INITIALIZE cannot be used to format LIF media in internal PC drives (use the LIFINIT utility). In internal drives, INITIALIZE formats an HPW (virtual-LIF) disk through select code 15.

INITIALIZE cannot be used to format a DFS disk (use the MS-DOS "FORMAT" command).

INMEM

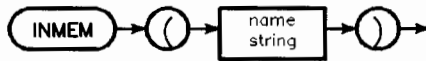
Supported On	UX WS DOS
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

INMEM checks for the presence of a user subprogram (SUB) or function (FN) in memory.

Example Statements

```
IF NOT INMEM("Mysub")THEN LOADSUB ALL FROM "MYSUBS"  
IF NOT INMEM("FNMyfunc$")THEN LOADSUB ALL FROM "MYFUNCS"
```

Syntax



Item	Description	Range
name string	name of string variable	any valid name

Semantics

This function works for subprograms (SUBs) and functions (FNs), both compiled and non-compiled. It is particularly useful when you want to conserve memory by programmatically loading and deleting subprograms.

INPUT

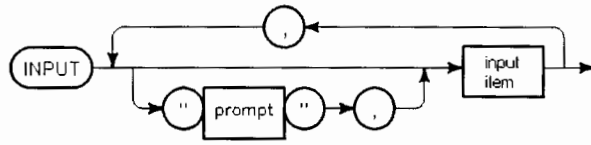
Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	No
Programmable	Yes
In an IF ... THEN ...	Yes

INPUT is used to assign keyboard input to program variables.

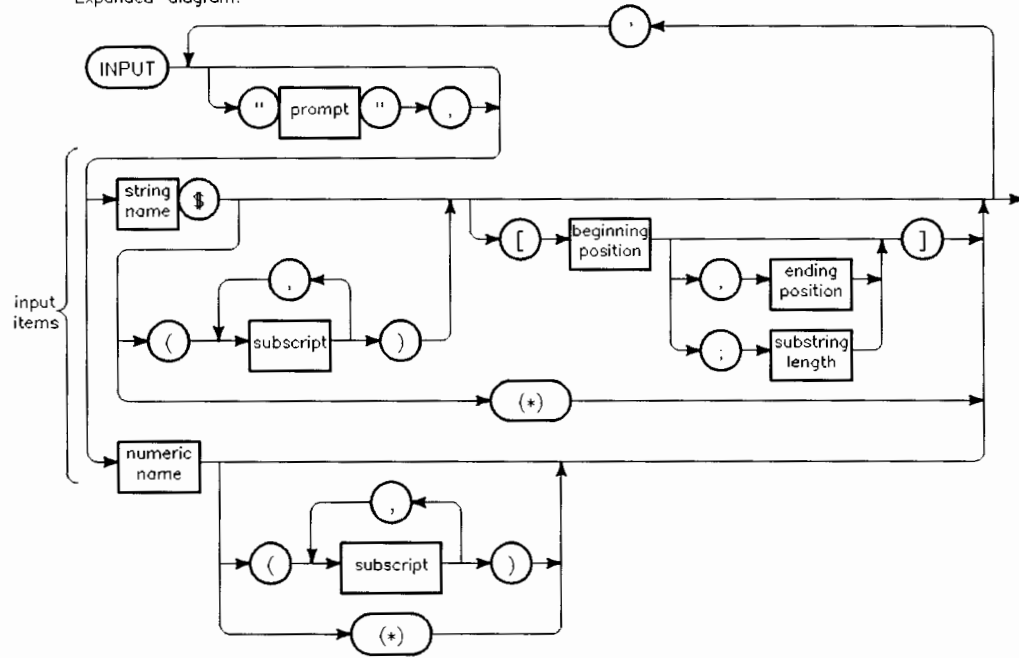
Example Statements

```
INPUT "Name?",N$,"ID Number?",Id
INPUT "Enter 3 numbers",V(1),V(2),V(3)
INPUT "",String$[1;10]
INPUT Array(*)
```

INPUT



Expanded diagram:



Item	Description/Default	Range Restrictions
prompt	a literal composed of characters from the keyboard, including those generated using the ANY CHAR key; Default = question mark	—
string name	name of a string variable	any valid name
subscript	numeric expression, rounded to an integer	-32 768 through +32 767 (see "array" in Glossary)
beginning position	numeric expression, rounded to an integer	1 through +32 767 (see "substring" in Glossary)
ending position	numeric expression, rounded to an integer	0 through +32 767 (see "substring" in Glossary)
substring length	numeric expression, rounded to an integer	0 through +32 767 (see "substring" in Glossary)
numeric name	name of a numeric variable	any valid name

Semantics

Values can be assigned through the keyboard for any numeric or string variable, substring, array, or array element.

A prompt, which is allowed for each item in the input list, appears on the display line. If the last DISP or DISP USING statement suppressed its EOL sequence, the prompt is appended to the current display line contents. If the last DISP or DISP USING did not suppress the EOL sequence, the prompt replaces the current display line contents.

Not specifying a prompt results in a question mark being used as the prompt. Specifying the null string for the prompt suppresses the question mark.

To respond to the prompt, the operator enters a number or a string. Leading and trailing blank characters are deleted. Unquoted strings *may not* contain commas or quotation marks. Placing quotes around an input string allows any character(s) to be used as input. If " is intended to be a character in a quoted string, use "". Note that when you are prompted to input a COMPLEX value,

INPUT

you must input two REAL values (one representing the real part and another representing the imaginary part) separated by a comma or a **Return** or **ENTER**. Multiple values can be entered individually or separated by commas. Press the **CONTINUE**, **Return**, **EXECUTE**, **ENTER** or **STEP** after typing the final data item. Two consecutive commas cause the corresponding variable to retain its original value. Terminating an input line with a comma retains the old values for all remaining variables in the list.

The assignment of a value to a variable in the INPUT list is done as soon as the terminator (comma or key) is encountered. Entering no data items and pressing **CONTINUE**, **ENTER**, **EXECUTE**, **Return**, or **STEP** retains the old values for all remaining variables in the list.

If you press **CONTINUE**, **ENTER**, **EXECUTE**, or **Return** to end the data input, program execution continues at the next program line. If **STEP** is pressed, the program execution continues at the next program line in single step mode. (If the INPUT was stepped into, it is stepped out of, even if **CONTINUE**, **ENTER**, **EXECUTE**, or **Return** is pressed.)

If too many values are supplied for an INPUT list, the extra values are ignored.

An entire array may be specified by the asterisk specifier. Inputs for the array are accepted in row major order (right-most subscript varies most rapidly).

Live keyboard operations are not allowed while an INPUT is awaiting data entry. **PAUSE** or **STOP** on an HP 46020 keyboard can be pressed so live keyboard operations can be performed. The INPUT statement is re-executed, beginning with the first item, when **CONTINUE** or **STEP** is pressed. All values for that particular INPUT statement must be re-entered.

Keyboard-initiated events are deactivated during an INPUT statement. Errors do not cause an ON ERROR branch. If an input response results in an error, re-entry begins with the variable which would have received the erroneous response.

INT

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

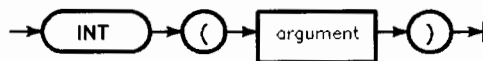
INT returns the greatest integer which is less than or equal to its argument. The result will be of the same numeric type (REAL or INTEGER) as the argument.

Example Statements

```
Whole=INT(Number)
```

```
PRINT "Integer portion =";INT(X)
```

Syntax



Semantics

COMPLEX arguments *are not* allowed with this function.

See the discussion "Precision and Accuracy" in the section "Numeric Computation" of the *HP BASIC Programming Guide* for detailed information on the effects of the computer's internal numeric representation.

INTEGER

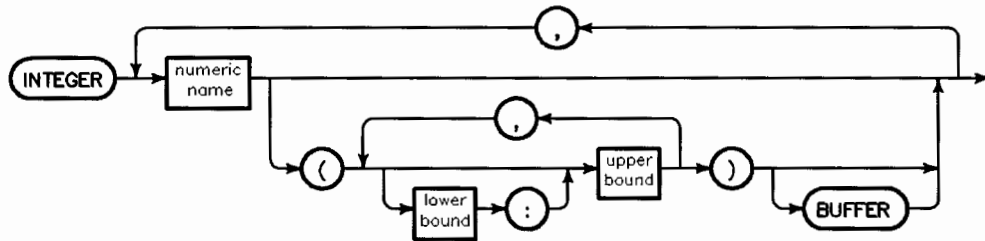
Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	No
Programmable	Yes
In an IF ... THEN ...	No

INTEGER declares integer variables, dimensions integer arrays, and allocates memory for the variables and arrays. For information about INTEGER as a secondary keyword, see ALLOCATE, COM, DEF FN, or SUB.

Example Statements

```
INTEGER I,J,K  
INTEGER Array(-128:255,4)  
INTEGER Buf(2000) BUFFER
```

Syntax



Item	Description	Range
numeric name	name of a numeric variable	any valid name
lower bound	integer constant; Default = OPTION BASE value (0 or 1)	-32 767 through +32 767 (see "array" in Glossary)
upper bound	integer constant	-32 767 through +32 767 (see "array" in Glossary)

Semantics

An INTEGER variable (or an element of an INTEGER array) uses two bytes of storage space. An INTEGER array can have a maximum of six dimensions. No single dimension can have more than 32 767 total elements.

The total number of INTEGER elements is limited by the fact that the maximum memory usage for *all* variables—numeric and string—within any context is 16 777 215 bytes (or limited by the amount of available memory, whichever is less).

Declaring Buffers

To declare INTEGER variables to be buffers, each variable's name must be followed by the keyword BUFFER; the designation BUFFER applies only to the variable which it follows.

INTENSITY

See AREA and SET PEN.



I-32 IDN - IVAL

INTERACTIVE

See RESUME INTERACTIVE and SUSPEND INTERACTIVE.



INTR

See OFF INTR and ON INTR.



INV

See MAT.



I PLOT

Supported On	UX WS DOS
Option Required	GRAPH
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

I PLOT moves the graphics pen from the current pen position to the point specified by adding the X and Y displacements to the current pen position. Plotting action is determined by the current line type and the optional pen control parameter.

Example Statements

```
I PLOT 0,5
```

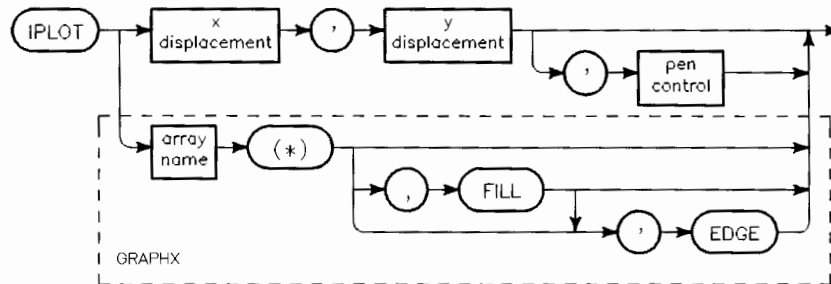
```
I PLOT Delta_x,Delta_y,Pen_control
```

The following examples require the GRAPHX binary.

```
I PLOT Array(*)
```

```
I PLOT Shape(*),FILL,EDGE
```

Syntax



Item	Description	Range
x displacement	numeric expression, in current units	--
y displacement	numeric expression, in current units	--
pen control	numeric expression, rounded to an integer; Default=1 (down after move)	-32 768 through +32 767
array name	name of two-dimensional, two-column or three-column numeric array. Requires GRAPHX.	any valid name

Semantics



Non-Array Parameters

The specified X and Y displacement information is interpreted according to the current unit-of-measure. Lines are drawn using the current pen color and line type.

The line is clipped at the current clipping boundary. If none of the line is inside the current clip limits, the pen is not moved, but the logical pen position is updated.

The optional pen control parameter specifies the following plotting actions; the default value is +1 (down after move). Zero is considered positive.

Pen Control Parameter

Pen Control	Resultant Action
-Even	Pen up before move
-Odd	Pen down before move
+Even	Pen up after move
+Odd	Pen down after move



I PLOT

Applicable Graphics Transformations

	Scaling	PIVOT	Csize	LDIR	PDIR
Lines (generated by moves and draws)	X	X			[4]
Polygons and rectangles	X	X			X
Characters (generated by LABEL)			X	X	
Axes (generated by AXES & GRID)	X				
Location of Labels	[1]	[3]		[2]	

¹The starting point for labels drawn after lines or axes is affected by scaling.

²The starting point for labels drawn after other labels is affected by LDIR.

³The starting point for labels drawn after lines or axes is affected by PIVOT.

⁴R PLOT and I PLOT are affected by PDIR.

Summary of Array Parameter Effects

When using an I PLOT statement with an array, the following table of operation selectors applies. An operation selector is the value in the third column of a row of the array to be plotted. The array must be a two-dimensional, two-column or three-column array. If the third column exists, it will contain operation selectors which instruct the computer to carry out certain operations. Polygons may be defined, edged (using the current pen), filled (using the current fill color), pen and line type may be selected, and so forth.

IPLLOT Array Parameter Effects

Column 1	Column 2	Operation Selector	Meaning
X	Y	-2	Pen up before moving
X	Y	-1	Pen down before moving
X	Y	0	Pen up after moving (Same as +2)
X	Y	1	Pen down after moving
X	Y	2	Pen up after moving
pen number	ignored	3	Select pen
line type	repeat value	4	Select line type
color	ignored	5	Color value
ignored	ignored	6	Start polygon mode with FILL
ignored	ignored	7	End polygon mode
ignored	ignored	8	End of data for array
ignored	ignored	9	NOP (no operation)
ignored	ignored	10	Start polygon mode with EDGE
ignored	ignored	11	Start polygon mode with FILL and EDGE
ignored	ignored	12	Draw a FRAME
pen number	ignored	13	Area pen value
red value	green value	14	Color
blue value	ignored	15	Value
ignored	ignored	>15	Ignored

FILL and EDGE

When FILL or EDGE is specified, each sequence of two or more lines forms a polygon. The polygon begins at the first point on the sequence, includes each successive point, and the final point is connected or closed back to the first point. A polygon is closed when the end of the array is reached, or when the value in the third column is an even number less than three, or in the range 5 to 8 or 10 to 15. Unexpected results can occur in attempts to FILL a polygon of zero area.

If FILL and/or EDGE are specified on the IPLLOT statement itself, it causes the polygons defined within it to be filled with the current fill color and/or

IPLOT

edged with the current pen color. If polygon mode is entered from within the array, and the FILL/EDGE directive for that series of polygons differs from the FILL/EDGE directive on the IPLOT statement itself, the directive in the array replaces the directive on the statement. In other words, if a “start polygon mode” operation selector (a 6, 10, or 11) is encountered, any current FILL/EDGE directive (whether specified by a keyword or an operation selector) is replaced by the new FILL/EDGE directive.

If FILL and EDGE are both declared on the IPLOT statement, FILL must occur first. If neither one is specified, simple line drawing mode is assumed; that is, polygon closure does not take place.

If you attempt to fill a figure on an HPGL plotter, the figure will not be filled, but will be edged, regardless of the directives on the statement.

Moving and Drawing

If the operation selector is less than or equal to two, it is interpreted in exactly the same manner as the third parameter in a non-array IPLOT statement. As mentioned above, even means lift the pen up, odd means put the pen down, positive means act after pen motion, negative means act before pen motion. Zero is considered positive.

Selecting Pens

The operation selector of 3 is used to select pens. The value in column one is the pen number desired. The value in column two is ignored.

Selecting Line Types

The operation selector of 4 is used to select line types. The line type (column one) selects the pattern, and the repeat value (column two) is the length in GDUs that the line extends before a single occurrence of the pattern is finished and it starts over. On the CRT, the repeat value is evaluated and rounded *down* to the next multiple of 5, with 5 as the minimum.

Selecting a Fill Color

Operation selector 13 selects a pen from the color map with which to do area fills. This works identically to the AREA PEN statement. Column one contains the pen number.

Defining a Fill Color

Operation Selector 14 is used in conjunction with Operation Selector 15. Red and green are specified in columns one and two, respectively, and column three has the value 14. Following this row in the array (not necessarily immediately), is a row whose operation selector in column three has the value of 15. The first column in that row contains the blue value. These numbers range from 0 to 32,767, where 0 is no color and 32,767 is full intensity. Operation selectors 14 and 15 together comprise the equivalent of an AREA INTENSITY statement, which means it can be used on a monochromatic, gray scale, or a color display.

Operation Selector 15 actually puts the area intensity into effect, but only if an operation selector 14 has already been received.

Operation selector 5 is another way to select a fill color. The color selection is through a Red-Green-Blue (RGB) color model. The first column is encoded in the following manner. There are three groups of five bits right-justified in the word; that is, the most significant bit in the word is ignored. Each group of five bits contains a number which determines the intensity of the corresponding color component, which ranges from zero to sixteen. The value in each field will be sixteen minus the intensity of the color component. For example, if the value in the first column of the array is zero, all three five-bit values would thus be zero. Sixteen minus zero in all three cases would turn on all three color components to full intensity, and the resultant color would be a bright white.

Assuming you have the desired intensities for red, green, and blue ranging from zero to one in the variables R, G, and B, respectively, the value for the first column in the array could be defined thus:

$$\text{Array}(\text{Row}, 1) = \text{SHIFT}(16*(1-B), -10) + \text{SHIFT}(16*(1-G), -5) + 16*(1-R)$$

If there is a pen color in the color map identical to that which you request here, that non-dithered color will be used. If there is not a similar color, you will get a dithered pattern.

IPLLOT

If you are using a gray scale display, Operation selector 5 uses the five bit values of the RGB color specified to calculate luminosity. The resulting gray luminosity is then used as the area fill. For detailed information on gray scale calculations, see the chapter “More About Color Displays” in the *HP BASIC Advanced Programming Techniques* manual.

Polygons

A six, ten, or eleven in the third column of the array begins a “polygon mode”. If the operation selector is 6, the polygon will be filled with the current fill color. If the operation selector is 10, the polygon will be edged with the current pen number and line type. If the operation selector is 11, the polygon will be both filled and edged. Many individual polygons (series of draws separated by moves) can be filled without terminating the mode with an operation selector 7. The first and second columns are ignored; therefore they should not contain the X and Y values of the first point of a polygon.

Operation selector 7 in the third column of a plotted array terminates definition of a polygon to be edged and/or filled and also terminates the polygon mode (entered by operation selectors 6, 10, or 11). The values in the first and second columns are ignored, and the X and Y values of the last data point should not be in them. Edging and/or filling will begin immediately upon encountering this operation selector.

Drawing a FRAME

Operation selector 12 does a FRAME around the current soft-clip limits. Soft clip limits cannot be changed from within the IPLLOT statement, so one probably would not have more than one operation selector 12 in an array to IPLLOT, since the last FRAME will overwrite all the previous ones.

Premature Termination

Operation selector 8 causes the IPLLOT statement to be terminated. The IPLLOT statement will successfully terminate if the actual end of the array has been reached, so the use of operation selector 8 is optional.



Ignoring Selected Rows in the Array

Operation selector 9 causes the row of the array it is in to be ignored. Any operation selector greater than fifteen is also ignored, but operation selector 9 is retained for compatibility reasons. *Operation selectors less than -2 are not ignored.* If the value in the third column is less than zero, only evenness/oddness is considered.

IVAL

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

IVAL converts a binary, octal, decimal, or hexadecimal string expression into an INTEGER.

Example Statements

```
Number=IVAL(String$,Radix)
PRINT IVAL("FE56",16)
```

Syntax



Item	Description	Range
string argument	string expression, containing digits valid for the specified base	(see table)
radix	numeric expression, rounded to an integer.	2, 8, 10 or 16

Semantics

The radix is a numeric expression that will be rounded to an integer and must evaluate to 2, 8, 10, or 16.

The string expression must contain only the characters allowed for the particular number base indicated by the radix. ASCII spaces are not allowed. Only one-byte ASCII characters can be used as digits.

Binary strings are presumed to be in two's-complement form. If all 16 digits are specified and the leading digit is a 1, the returned value is negative.

Octal strings are presumed to be in the octal representation of two's-complement form. If all 6 digits are specified, and the leading digit is a 1, the returned value is negative.

Decimal strings containing a leading minus sign will return a negative value.

Hex strings are presumed to be in the hex representation of the two's-complement binary form. The letters A through F may be specified in either upper or lower case. If all 4 digits are specified and the leading digit is 8 through F, the returned value is negative.

Radix	Base	String Range	String Length
2	binary	0 through 1111111111111111	1 to 16 characters
8	octal	0 through 177777	1 to 6 characters
10	decimal	-32 768 through +32 768	1 to 6 characters
16	hexadecimal	0 through FFFF	1 to 4 characters

Radix	Legal Characters	Comments
2	+,0,1	—
8	+,0,1,2,3,4,5,6,7	Range restricts the leading character. Sign must be a leading character.
10	+,-,0,1,2,3,4,5, 6,7,8,9	Sign must be a leading character.
16	+,0,1,2,3,4,5,6,7,8,9, A,B,C,D,E,F,a,b,c,d,e,f	A/a=10, B/b=11, C/c=12, D/d=13 E/e=14, F/f=15

IVAL

Two-Byte Language Specifics

Certain localized versions of HP BASIC, such as Japanese localized HP BASIC, support two-byte characters. IVAL *does not* allow two-byte characters. The string digits to be converted must be one-byte ASCII characters. For more information about two-byte characters, refer to the globalization chapters of the *HP BASIC Porting and Globalization* manual.



IVAL\$

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

IVAL\$ converts an integer value into a binary, octal, decimal, or hexadecimal string.

Example Statements

```
String$=IVAL$(Number, Radix)
PRINT IVAL$(Count MOD 256, 2)
```

Syntax



Item	Description	Range
"16-bit" argument	numeric expression, rounded to an integer	(see table)
radix	numeric expression, rounded to an integer	2, 8, 10, or 16

Semantics

The rounded argument must be a value that can be expressed (in binary) using 16 bits or less. The string digits returned are one-byte ASCII characters.

The radix must evaluate to be 2, 8, 10, or 16; representing binary, octal, decimal, or hexadecimal notation.

IVAL\$

If the radix is 2, the returned string is in two's-complement form and contains 16 characters. If the numeric expression is negative, the leading digit will be 1. If the value is zero or positive, there will be leading zeros.

If the radix is 8, the returned string is the octal representation of the two's-complement binary form and contains 6 digits. Negative values return a leading digit of 1.

If the radix is 10, the returned string contains 6 characters. Leading zeros are added to the string if necessary. Negative values have a leading minus sign.

If the radix is 16, the returned string is the hexadecimal representation of the two's-complement binary form and contains 4 characters. Negative values return a leading digit in the range 8 through F.

Radix	Base	Range of Returned String	String Length
2	binary	0000000000000000 through 1111111111111111	16 characters
8	octal	000000 through 177777	6 characters
10	decimal	-32 768 through +32 768	6 characters
16	hexadecimal	0000 through FFFF	4 characters

K

KBD - KNOBY

KBD

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

KBD returns 2, the select code of the keyboard.

Example Statements

```
STATUS KBD;Kbd_status
OUTPUT KBD;Clear$;
```

Syntax



KBD\$

Supported On	UX WS DOS
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

KBD\$ returns the contents of the keyboard buffer established by ON KBD.

Example Statements

```
PRINT KBD$;
Buffer$=Buffer$&KBD$
```

Syntax



Semantics

When an ON KBD branch is in effect, all subsequent keystrokes are trapped and held in a special “keyboard” buffer. The KBD\$ function returns the contents of this buffer and then clears it. A null string is returned if the buffer is empty or no ON KBD branch is active.

Non-ASCII keys are stored in the buffer as two bytes; the first has a decimal value of 255, and the second specifies the key. Pressing **CTRL** and a non-ASCII key simultaneously generates three bytes; the first two have a decimal value of 255, and the third specifies the key. See the *Second Byte of Non-ASCII Key Sequences* table in the “Useful Tables” section for a list of these keycodes.

The buffer can hold 256 characters. Further keystrokes are not saved and produce beeps. An overflow flag is set after the buffer is full. This flag can be checked by reading keyboard status register 5 and is cleared by reading the status register, SCRATCH A, and a **RESET** operation.

KBD\$

The buffer is cleared by KBD\$, OFF KBD, SCRATCH, SCRATCH A, INPUT, LINPUT, ENTER 2, STOP, END, and a **RESET** operation.

KBD CMODE

Supported On	UX WS DOS
Option Required	KBD
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

KBD CMODE enables/disables the HP 98203A/B/C keyboard compatibility mode on an ITF keyboard.

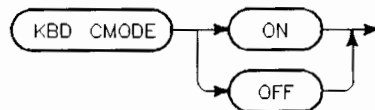
Example Statements

```
KBD CMODE ON
```

```
KBD CMODE OFF
```

```
IF Change_mode THEN KBD CMODE ON
```

Syntax



Semantics

Executing the KBD CMODE ON statement re-defines the softkeys of the ITF keyboard so they are compatible with the HP 98203A/B/C keyboard softkeys. This means that the eight function keys located at the top of the ITF keyboard, as well as the **Menu** and **System** keys, emulate function keys **k0** through **k9** of the HP 98203A/B/C Keyboard and their HP BASIC system definitions.

The following are the ITF softkey definitions before executing KBD CMODE ON:

KBD CMODE**KBD CMODE OFF**

Function Key	Softkey Definition
f1	f1's label
f2	f2's label
f3	f3's label
f4	f4's label
Menu	
System	
f5	f5's label
f6	f6's label
f7	f7's label
f8	f8's label

The following are the ITF softkey definitions after executing KBD CMODE ON:

KBD CMODE ON

Function Key	Softkey Definition
f1	k0's label
f2	k1's label
f3	k2's label
f4	k3's label
Menu	k4's label
System	k5's label
f5	k6's label
f6	k7's label
f7	k8's label
f8	k9's label

Executing the KBD CMODE OFF statement returns you back to the softkey key definitions of the ITF Keyboard.

KBD CMODE

The KBD CMODE statement does not affect KEY LABELS ON or OFF. What this means is the definitions of the softkeys change, but the softkey labels at the bottom of the display will not be turned on or off.

While in the Keyboard Compatibility mode, the System Function keys are accessed by using the **Extend char** key with the softkeys **f1** through **f8**. Note that using **Extend char** along with the **Menu** key turns the keylabels on and off in this mode. **Extend char** when pressed with the **User** or **System** keys exits the Keyboard Compatibility mode. Also, in the Keyboard Compatibility mode, **Shift** can be used with the eight softkeys and the **Menu** and **System** keys (as on an HP 98203A/B/C) to access keys **SHIFT-k0** through **SHIFT-k9**. When using HP BASIC/UX in X Windows, you may have problems accessing the System Function keys while in Keyboard Compatibility mode. See the window manager documentation for details.

Note that the functionality of this statement can be achieved through KBD CONTROL register 15.

For further information on HP 98203A/B/C keyboard compatibility mode, read the chapter called "Porting to Series 300" in the *HP BASIC Porting and Globalization*.

KBD LINE PEN

Supported On	UX WS DOS
Option Required	CRTX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

KBD LINE PEN sets the pen color to be used for the keyboard line and other associated areas of a color CRT.

Example Statements

```
KBD LINE PEN Pen_value
KBD LINE PEN 143
IF Color_blue THEN KBD LINE PEN 141
```

Syntax



Item	Description/Default	Range Restrictions
pen value	numeric expression	see semantics

Semantics

Pen color areas of the CRT which are associated with the keyboard line are:

- the run indicator
- all of the edit screen except the key labels
- the following annunciators:
 - softkey menu (e.g System, User 1, User 2, and User 3)

KBD LINE PEN

- CAPS indicator
- system-activity indicator (e.g. Idle, Running, etc.)
- the system message area

The set of KBD line colors is given in the table below:

Value	Result
< 16	The number is evaluated MOD 8 and resulting values produce the following: 0—black 1—white 2—red 3—yellow 4—green 5—cyan 6—blue 7—magenta
16 to 135	Ignored
136	White
137	Red
138	Yellow
139	Green
140	Cyan
141	Blue
142	Magenta
143	Black
144 to 255	Ignored

This statement has no effect on single plane monochrome displays. On gray scale (multi-plane monochrome) displays, this statement changes the display color to a different shade of gray.

For displays with bit-mapped alpha, KBD LINE PEN specifies the graphics pen to be used for subsequent alpha output. The range of values allowed with this statement are 0 through 255; these values are treated as

KBD LINE PEN

value MOD (2^n)

where n is the number of display planes.

KBD LINE PEN n and **CONTROL CRT**, 17; n set the value of CRT control register 17. These statements have no effect on control registers 15 and 16 which are set using **PRINT PEN** and **KEY LABELS PEN**, respectively.

Note that the functionality of this statement can be achieved through CRT **CONTROL** register 17.

KEY

See EDIT, LIST , LOAD, OFF KEY, ON KEY, SCRATCH, and STORE.

KEY LABELS

Supported On	UX WS DOS
Option Required	CRTX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

KEY LABELS turns the on-screen softkey labels on and off.

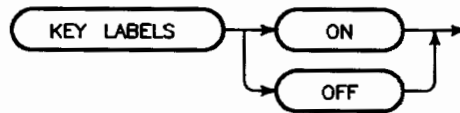
Example Statements

```
KEY LABELS ON
```

```
KEY LABELS OFF
```

```
IF Key_labels_on THEN KEY LABELS OFF
```

Syntax



Semantics

With ITF keyboards, the default is KEY LABELS ON. (You can also turn the key labels on and off by using the **Menu** key.) The default softkey menu that appears with an ITF keyboard is the:

- System menu if the KBD binary has *not* been loaded.
- User 1 menu if the KBD binary has been loaded.

The times when key labels are displayed depends on the current value of CRT STATUS register 12:

KEY LABELS

Value of CRT Register 12	Effect on Key Labels
0	Typing-aid key labels are <i>displayed until the program is run</i> , at which time they are turned off (until at least one ON KEY is executed). For more details on this mode, see the next table.
1	Typing-aid and softkey labels are <i>not displayed at any time</i> .
2	Typing-aid and softkey labels are <i>displayed at all times</i> .



The default value of this register is 0 for systems using 98203 keyboards, and 2 for systems using an ITF keyboard. The default is restored at power-on and when SCRATCH A is executed.

When the value of CRT register 12 is 0, softkey labels are ON or OFF as given in the following table:

Condition	KBD Binary Not Loaded	KBD Binary Loaded
No program running	Key labels off	Key labels on
Program running and ON KEY is not active	Key labels off	Key labels off
Program running and ON KEY is active	Key labels on	Key labels on

Executing a KEY LABELS ON or KEY LABELS OFF statement *does not* change the current softkey definitions.

KEY LABELS PEN

Supported On	UX WS DOS
Option Required	CRTX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

KEY LABELS PEN sets the pen color to be used for the softkey labels of a color CRT.

Example Statements

```
KEY LABELS PEN Pen_value
KEY LABELS PEN 143
IF Color_blue THEN KEY LABELS PEN 141
```

Syntax



Item	Description/Default	Range Restrictions
pen value	numeric expression	(see Semantics)

Semantics

The set of key labels colors is given in the following table:

KEY LABELS PEN

Value	Result
< 16	The number is evaluated MOD 8 and resulting values produce the following: 0—black 1—white 2—red 3—yellow 4—green 5—cyan 6—blue 7—magenta
16 to 135	Ignored
136	White
137	Red
138	Yellow
139	Green
140	Cyan
141	Blue
142	Magenta
143	Black
144 to 255	Ignored

This statement has no effect on single plane monochrome displays. On gray scale (multi-plane monochrome) displays, this statement changes the display color to a different shade of gray.

For displays with bit-mapped alpha, KEY LABELS PEN specifies the pen to be used for subsequent alpha output. The range of values allowed with this statement are 0 through 255; these values are treated as

$value \text{ MOD } (2^n)$

where n is the number of display planes.

KEY LABELS PEN

KEY LABELS PEN n and **CONTROL CRT, 16**; n set the value of CRT control register 16. These statements have no effect on control registers 15 and 17 which are set using **PRINT PEN** and **KBD LINE PEN**, respectively.

Note that the functionality of this statement can be achieved through **CRT CONTROL** register 16.

KNOB

See OFF KNOB and ON KNOB.

KNOBX

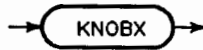
Supported On	UX* WS DOS*
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

KNOBX returns the net number of horizontal knob pulses counted since the last time the KNOBX counter was zeroed. Invoking the KNOBX function zeros the counter after it is read.

Example Statements

```
Position=KNOBX
IF KNOBX<0 THEN Backwards
```

Syntax



Semantics

Sampling occurs during the time interval established by the ON KNOB statement. The counter is zeroed when the KNOBX function is called and at the times specified in the Reset Table at the back of this manual. Clockwise rotation gives positive counts; counter-clockwise rotation gives negative counts. There are 120 counts for one revolution of the knob on an HP 98203A/B keyboard. HIL knobs return a greater number of counts for one revolution of the knob. If there is no active ON KNOB definition, KNOBX returns zero.

Counts are accumulated by the KNOBX function at the end of each ON KNOB sampling interval. The pulse count during each sampling interval is limited to - 127 through + 128 on an HP 98203A/B keyboard. HIL pulse counts are limited to -32 768 through +32 767 per sampling period. The limits of the KNOBX function are -32 768 through +32 767.

KNOBX

You can use a relative pointing device, such as the HP 46060A with an HP-HIL interface, if the KBD BIN is loaded.

Note KNOBX functions differently if BIN file KNB2_0 is loaded. Refer to the knob section of the “Porting to 3.0” chapter of *HP BASIC Porting and Globalization* for more information.

HP BASIC/UX Specifics

Knob support uses the HP BASIC version 3.0 definition. KNB2_0 binary functionality is not supported.

Devices to be addressed using KNOBX must not have been opened by the X Windows server. These devices must also be connected to the local system since they cannot be accessed on a remote system. See the section “Opening Input Devices” in the chapter “System-Level Customization” found in the *Using the X Window System, Version 11* manual, for details on how to prevent the X Window server from opening specified HIL devices.

HP BASIC/DOS Specifics

Knob support uses the HP BASIC 3.0 definition. KNB2_0 binary functionality is not supported.

KNOBY

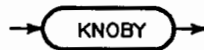
Supported On	UX* WS DOS*
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

KNOBY returns the net number of vertical knob pulses counted since the last time the KNOBY counter was zeroed. Invoking the KNOBY function zeros the counter after it is read.

Example Statements

```
Position=KNOBY
IF KNOBY<0 THEN Up
```

Syntax



Semantics

Sampling occurs during the time interval established by the ON KNOB statement. The counter is zeroed when the KNOBY function is called and at the times specified in the Reset Table at the back of this manual. Clockwise rotation gives positive counts; counter-clockwise rotation gives negative counts. There are 120 counts for one revolution of the knob on an HP 98203A/B keyboard. HIL knobs return a greater number of counts for one revolution of the knob. If there is no active ON KNOB definition, KNOBY returns zero.

Counts are accumulated by the KNOBY function at the end of each ON KNOB sampling interval. The pulse count during each sampling interval is limited to -127 through $+128$ on an HP 98203A/B keyboard. HIL pulse counts are limited to $-32\,768$ through $+32\,767$ per sampling period. The limits of the KNOBY function are $-32\,768$ through $+32\,767$.

KNOBY

You can use a relative pointing device, such as the HP 46060A with an HP-HIL interface, if the KBD BIN is loaded.

Note KNOBY functions differently if BIN file KNB2_0 is loaded. Refer to the knob section of “Porting to 3.0” chapter of *HP BASIC Porting and Globalization* for more information.

HP BASIC/UX Specifics

Knob support uses the HP BASIC 3.0 definition. KNB2_0 binary functionality is not supported.

Devices to be addressed using KNOBY must not have been opened by the X Windows server. These devices must also be connected to the local system since they cannot be accessed on a remote system. See the section “Opening Input Devices” in the chapter “System-Level Customization” found in the *Using the X Window System, Version 11* manual, for details on how to prevent the X Window server from opening specified HIL devices.

HP BASIC/DOS Specifics

Knob support uses the HP BASIC 3.0 definition. KNB2_0 binary functionality is not supported.



LABEL - LWC\$

L

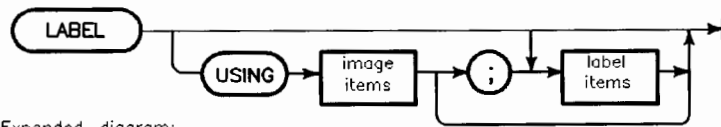
LABEL

Supported On	UX WS DOS
Option Required	GRAPH
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

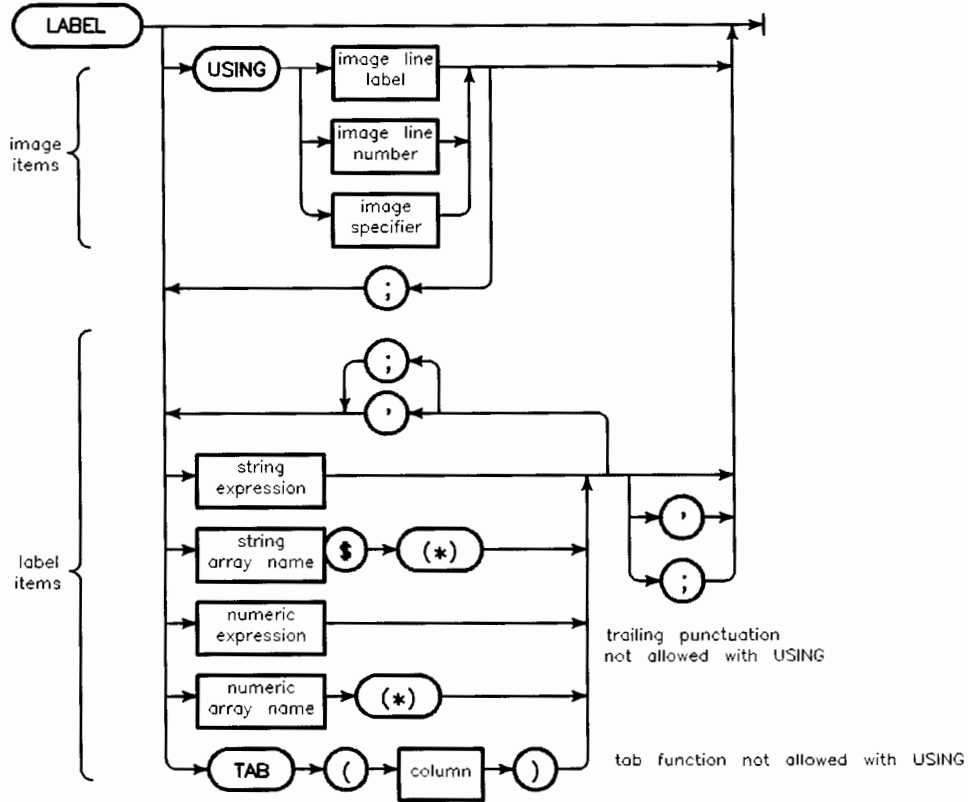
LABEL draws text labels with the graphics pen at the pen's current position. For information about LABEL as a secondary keyword, see ON KEY.

Example Statements

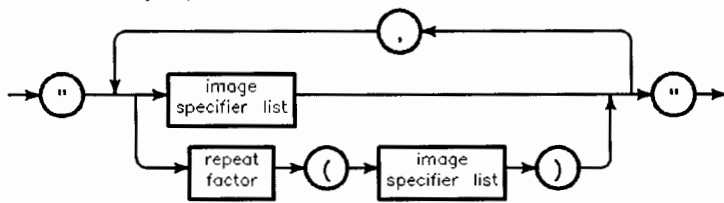
```
LABEL Number,String$  
LABEL Array(*)  
LABEL USING 160;X,Y,Z  
LABEL USING "5Z.DD";Money
```



Expanded diagram:

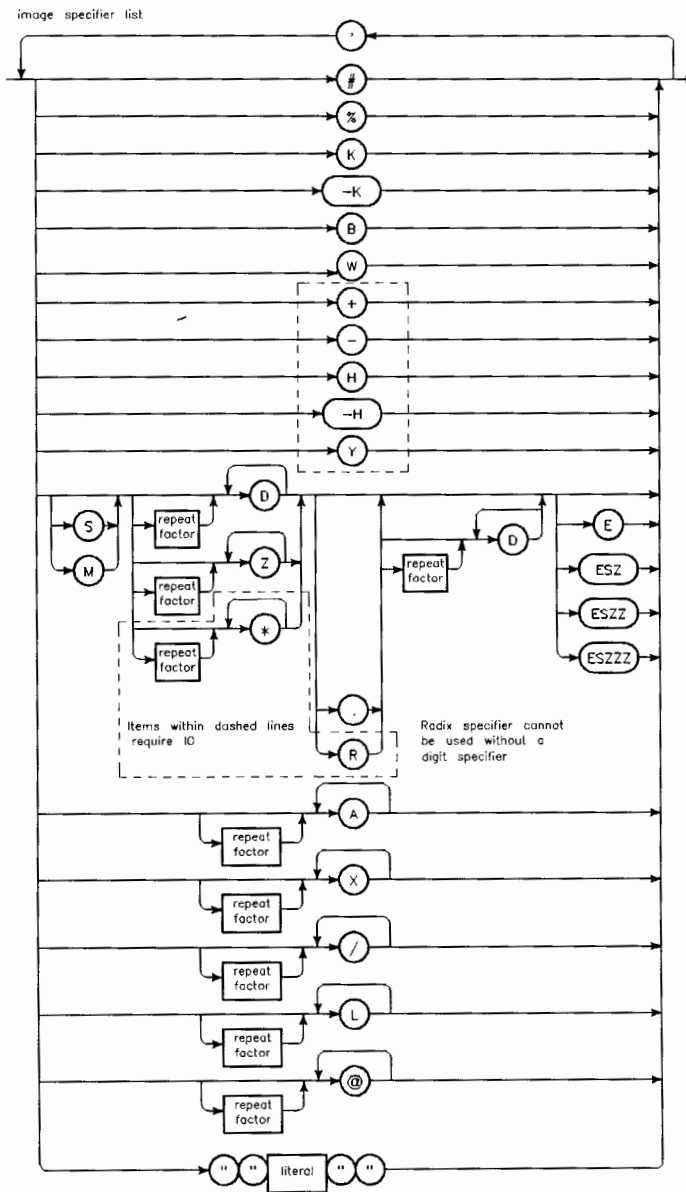


literal form of image specifier



LABEL

L



Item	Description	Range
image line number	integer constant identifying an IMAGE statement	1 through 32 766 (1 through 2 147 483 646 for HP BASIC/UX 700)
image line label	name identifying an IMAGE statement	any valid name
image specifier	string expression	(see drawing)
string array name	name of a string array	any valid name
numeric array name	name of a numeric array	any valid name
image specifier list	literal	(see diagram)
repeat factor	integer constant	1 through 32 767
literal	string constant composed of characters from the keyboard, including those generated using the ANY CHAR key	quote mark not allowed

L

Semantics

The label begins at the current logical pen position, with the current pen. Labels are clipped at the current clip boundary. The current pen position is updated at the end of the label operation.

The color and line type used for the label are determined by PEN and LINE TYPE respectively. The size (width and height) of the label is set by CSIZE. LABEL output is affected by origins specified by LORG, and rotations specified by LDIR

LABEL

L

Standard Numeric Format

The standard numeric format depends on the value of the number being output. If the absolute value of the number is greater than or equal to $1E-4$ and less than $1E+6$, it is rounded to 12 digits and displayed in floating-point notation. If it is not within these limits, it is displayed in scientific notation. The standard numeric format is used unless USING is selected, and may be specified by using K in an image specifier.

COMPLEX numbers are treated like two REAL numbers separated by a semicolon.

Automatic End-Of-Line Sequence

After the label list is exhausted, an End-of-Line (EOL) sequence is sent to the logical pen, unless it is suppressed by trailing punctuation or a pound-sign image specifier. The EOL sequence is also sent after every 256 characters. This "plot buffer exceeded" EOL is not suppressed by trailing punctuation, but is suppressed by the pound-sign specifier.

Control Codes

Character	Keystroke	Name	Action
CHR\$(8)	CTRL-H	backspace	Back up the width of one character cell.
CHR\$(10)	CTRL-J	line-feed	Move down the height of one character cell.
CHR\$(13)	CTRL-M	carriage-return	Move back the length of the label just completed.

Any control character that the LABEL statement does not recognize is treated as an ASCII blank [CHR\$(32)].

Applicable Graphics Transformations

L

	Scaling	PIVOT	CSIZE	LDIR	PDIR
Lines (generated by moves and draws)	X	X			[4]
Polygons and rectangles	X	X			X
Characters (generated by LABEL)			X	X	
Axes (generated by AXES & GRID)	X				
Location of Labels	[1]	[3]		[2]	

¹The starting point for labels drawn after lines or axes is affected by scaling.

²The starting point for labels drawn after other labels is affected by LDIR.

³The starting point for labels drawn after lines or axes is affected by PIVOT.

⁴RPLOT and IPLOT are affected by PDIR.



Arrays

Entire arrays may be output by using the asterisk specifier. Each element in an array is treated as an item by the LABEL statement, as if the items were listed separately, separated by the punctuation following the array specifier. If no punctuation follows the array specifier, a comma is assumed. COMPLEX array elements are treated as if the real and imaginary parts are separated by a semicolon. The array is output in row major order (rightmost subscript varies fastest).

LABEL Without USING

If LABEL is used without USING, the punctuation following an item determines the width of the item's label field; a semicolon selects the compact field, and a comma selects the default label field. When the label item is an array with the asterisk array specifier, each array element is considered a separate label item. Any trailing punctuation will suppress the automatic EOL

LABEL

sequence, in addition to selecting the label field to be used for the label item preceding it.

The compact field is slightly different for numeric and string items. Numeric items are output with one trailing blank. String items are output with no leading or trailing blanks.

The default label field labels items with trailing blanks to fill to the beginning of the next 10-character field.

Numeric data is output with one leading blank if the number is positive, or with a minus sign if the number is negative, whether in compact or default field.

LABEL With USING

When the computer executes a LABEL USING statement, it reads the image specifier, acting on each field specifier (field specifiers are separated from each other by commas) as it is encountered. If nothing is required from the label items, the field specifier is acted upon without accessing the label list. When the field specifier requires characters, it accesses the next item in the label list, using the entire item. Each element in an array is considered a separate item.

The processing of image specifiers stops when there is no matching display item (and the specifier requires a display item). If the image specifiers are exhausted before the display items, they are reused, starting at the beginning.

COMPLEX values require two REAL image specifiers (i.e. each COMPLEX value is treated like two REAL values.)

If a numeric item requires more decimal places to the left of the decimal point than provided by the field specifier, an error is generated. A minus sign takes a digit place if M or S is not used, and can generate unexpected overflows of the image field. If the number contains more digits to the right of the decimal point than are specified, it is rounded to fit the specifier.

If a string is longer than the field specifier, it is truncated, and the right-most characters are lost. If it is shorter than the specifier, trailing blanks are used to fill out the field.

Effects of the image specifiers on the LABEL statement are shown in the following table:

L-8 LABEL - LWCS



Image Specifier	Meaning
K	Compact field. Outputs a number or string as a label in standard form with no leading or trailing blanks.
-K	Same as K.
H	Similar to K, except the number is output using the European number format (comma radix). (Requires IO)
-H	Same as H. (Requires IO)
S	Outputs the number's sign (+ or -) as a label.
M	Outputs the number's sign as a label if negative, a blank if positive.
D	Digit specifier outputs one-digit character as a label. A leading zero is replaced by a blank. If the number is negative and no sign image is specified, the minus sign will occupy a leading digit position. If a sign is output, it will "float" to the left of the left-most digit.
Z	Same as D, except that leading zeros are output.
*	Same as Z, except that asterisks are output instead of leading zeros. (Requires IO)
.	Outputs a decimal-point radix specifier as a label.
R	Outputs a comma radix specifier as a label (European radix). (Requires IO)
E	Outputs as a label: an E, a sign, and a two-digit exponent.
ESZ	Outputs as a label: an E, a sign, and a one-digit exponent.
ESZZ	Same as E.
ESZZZ	Outputs as a label: an E, a sign, and a three-digit exponent.

LABEL**L**

Image Specifier	Meaning
A	Outputs a string character as a label. Trailing blanks are output if the number of characters specified is greater than the number available in the corresponding string. If the image specifier is exhausted before the corresponding string, the remaining characters are ignored. Use the specifier AA or 2A for two-byte globalization characters.
X	Outputs a blank as a label.
literal	Outputs as a label the characters contained in the literal.
B	Outputs as a label the character represented by one byte of data. This is similar to the CHR\$ function. The number is rounded to an INTEGER and the least-significant byte is sent. If the number is greater than 32 767, then 255 is used; if the number is less than -32 768, then 0 is used.
W	Outputs as a label two characters represented by the two bytes of a 16-bit, two's-complement integer. The corresponding numeric item is rounded to an INTEGER . If it is greater than 32 767, then 32 767 is used; if it is less than -32 768, then -32 768 is used. The most-significant byte is sent first.
Y	Same as W . (Requires IO)
#	Suppresses the automatic output of the EOL (End-Of-Line) sequence following the last label item.
%	Ignored in LABEL images.
+	Changes the automatic EOL sequence that normally follows the last label item to a single carriage-return. (Requires IO .)
-	Changes the automatic EOL sequence that normally follows follows the last label item to a single line-feed. (Requires IO)
/	Sends a carriage-return and a line-feed to the PLOTTER IS device.
L	Same as / .
@	Sends a form-feed to the PLOTTER IS device; produces a blank.



LDIR

Supported On	UX WS DOS
Option Required	GRAPH
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

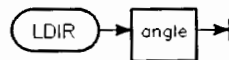
LDIR defines the angle at which labels or symbols are drawn. The angle is measured counter-clockwise from the X axis using the current angle mode.

Example Statements

LDIR 90

LDIR ACS(Side)

Syntax



Item	Description	Range
angle	numeric expression in current units of angle; Default = 0	(same as COS)

Semantics

LDIR affects the appearance of LABEL and SYMBOL output only; it does not affect the output of other graphics commands.

The rotation angle specified with LDIR is measured counterclockwise from the positive X axis. Thus, the positive X axis is at zero degrees, the positive Y axis is at 90 degrees, and so on. The unit of measure for angles can be set using DEG and RAD.

The angle is interpreted as shown in the following figure.

LDIR



LDIR EXAMPLES (in Degrees)

LDIR 06
LDIR 45
LDIR 90
LDIR 135
LDIR 180
LDIR 225
LDIR 270
LDIR 315

L-12 LABEL - LWC\$

LEN

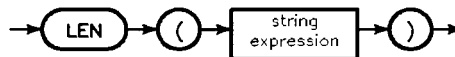
Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

LEN returns the current number of bytes in the specified string.

ASCII and Japanese Katakana characters are one byte long. Some languages use two-byte characters, such as Japanese Kanji.

Example Statements

```
Last=LEN(String$)
IF NOT LEN(A$) THEN Empty
```

Syntax**Semantics**

The length of the null string ("") is 0.

Two-Byte Language Specifics

Certain localized versions of HP BASIC, such as Japanese localized HP BASIC, support two-byte characters. If you use LEN to determine the length of a two-byte string *in characters*, you must divide the returned value by two. For more information about two-byte characters, refer to the globalization chapters of the *HP BASIC Porting and Globalization* manual.

LET

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

LET assigns values to variables. The keyword LET is optional.

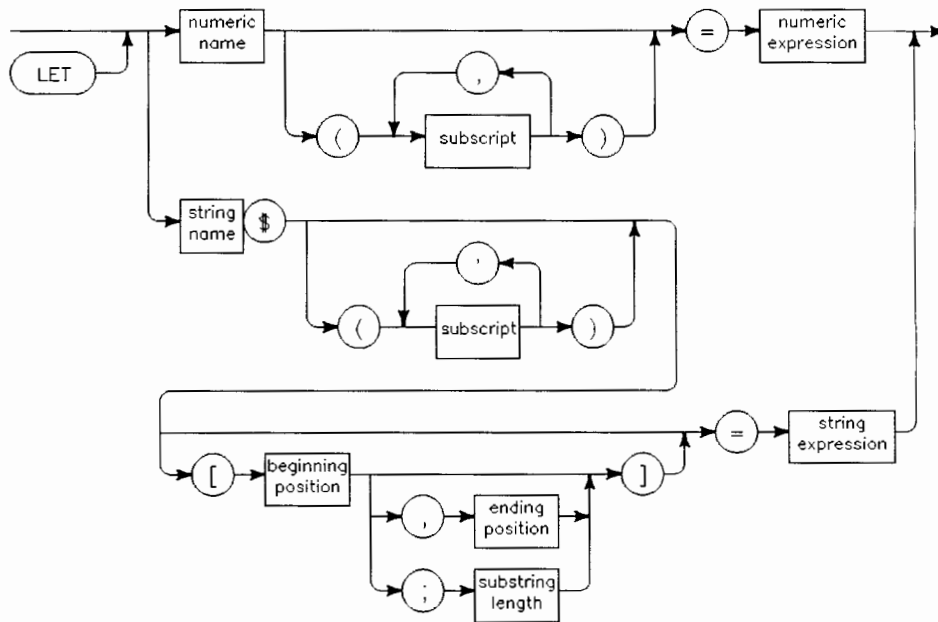
Example Statements

```
LET Number=33
```

```
Array(I+1)=Array(I)/2
```

```
String$="Hello Scott"
```

```
A$(7)[1;2]=CHR$(27)&"Z"
```



Item	Description	Range
numeric name	name of a numeric variable	any valid name
string name	name of a string variable	any valid name
subscript	numeric expression, rounded to an integer	-32 767 through +32 767 (see "array" in Glossary)
beginning position	numeric expression, rounded to an integer	1 through 32 767 (see "substring" in Glossary)
ending position	numeric expression, rounded to an integer	0 through 32 767 (see "substring" in Glossary)
substring length	numeric expression, rounded to an integer	0 through 32 767 (see "substring" in Glossary)

Semantics

The assignment is done to the variable which is to the left of the equals sign. Only one assignment may be performed in a LET statement; any other equal signs are considered relational operators, and must be enclosed in a parenthetical expression, as in this statement:

$$A=A+(B=1)+5$$

A variable can occur on both sides of the assignment operator, as in these statements:

$$I=I+1$$

$$\text{Source\$}=\text{Old\$}$$

A real expression will be rounded when assigned to an INTEGER variable, if it is within the INTEGER range. Out-of-range assignments to an INTEGER give an error. If a REAL or INTEGER value is assigned to a COMPLEX variable, the imaginary part receives the value 0. If a COMPLEX value is assigned to a REAL or INTEGER variable, the imaginary part is dropped.

The length of the string expression must be less than or equal to the dimensioned length of the string it is being assigned to. Assignments may be made into substrings, using the normal rules for substring definition. The string expression will be truncated or blank-filled on the right (if necessary) to

LET

fit the destination substring when the substring has an explicitly stated length. If only the beginning position of the substring is specified, the substring will be replaced by the string expression and the length of the recipient string variable will be adjusted accordingly; however, error 18 is reported if the expression overflows the recipient string variable.

If the name of the variable to the left of the equal sign begins with AND, DIV, EXOR, MOD or OR (the name of an operator) and the keyword LET is omitted, the prefix must have at least one uppercase letter and one lowercase letter in it. Otherwise, a live keyboard execution is attempted and fails, even though the line number is present.

LEXICAL ORDER IS

L

Supported On	UX WS DOS
Option Required	LEX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

LEXICAL ORDER IS defines the collating sequence for all string operations. It is valid for one-byte character sets.

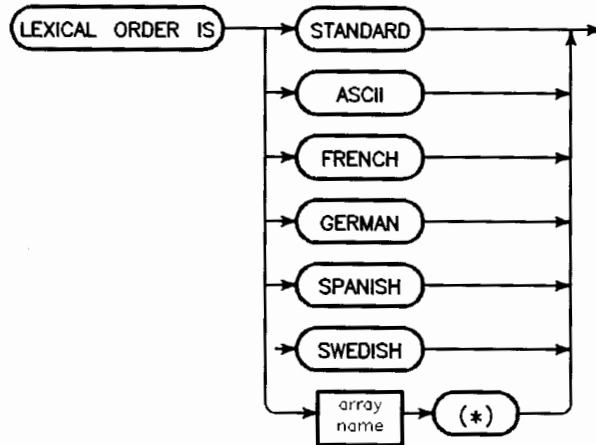
Example Statements

```
LEXICAL ORDER IS ASCII
LEXICAL ORDER IS FRENCH
LEXICAL ORDER IS My_lex_table(*)
```

LEXICAL ORDER IS

L

Syntax



Item	Description	Range
array name	the name of a one-dimensional INTEGER array, with at least 257 elements	any valid name

Semantics

The STANDARD lexical order is determined by the internal keyboard jumper preset to match the language on the keyboard. For example, with an English language or Katakana keyboard, the STANDARD lexical order is the same as the ASCII lexical order.

The default lexical order is STANDARD. This is also true after a SCRATCH A. The most recent LEXICAL ORDER IS statement overrides any previous definition and affects all contexts.

Lexical order allows languages to be properly collated. This includes such treatments as ignoring characters, dealing with accents, and character replacements. See *HP BASIC Programming Guide* for the details of pre-defined and user-defined lexical order tables.

L-18 LABEL - LWCS

Two-Byte Language Specifics

Certain localized versions of HP BASIC, such as Japanese localized HP BASIC, support two-byte characters. LEXICAL ORDER definitions are not supported for two-byte characters. For more information about two-byte characters, refer to the globalization chapters of the *HP BASIC Porting and Globalization* manual.

L

L

LGT

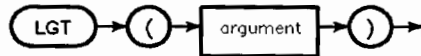
Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

LGT returns the common logarithm (base 10) of its argument.

Example Statements

```
Decibel=20*LGT(Volts)
PRINT "Log of";X;"=";LGT(X)
```

Syntax



Item	Description/Default	Range Restrictions
argument	numeric expression	> 0 for INTEGER and REAL arguments; see "Range Restriction Specifics" for COMPLEX arguments and underflow conditions

Semantics

If the argument is REAL or INTEGER, the value returned is REAL. If the argument is COMPLEX, the value returned is COMPLEX.

To compute the LGT of a COMPLEX value, the COMPLEX binary must be loaded.

Range Restriction Specifics

The formula used for computing the LGT of a COMPLEX value is:

$$\text{LOG}(\text{Argument})/\text{LOG}(10)$$

where **Argument** is a COMPLEX argument to the LGT function. Some values of a COMPLEX argument may cause errors in this computation. For example,

$$\text{LGT}(\text{CMPLX}(\text{MAXREAL}, \text{MAXREAL}))$$

will cause error 22 (error 21 in HP BASIC/UX 700) due to the LOG(**Argument**) calculation.

The following range restrictions apply in HP BASIC/UX 700 when underflow mode (CONTROL 32,7;mode) is set to Error or Ignore.

Range	Underflow Mode Error	Underflow Mode Ignore
Positive Maximum	+1.79769313486232E+308	+1.79769313486232E+308
Positive Minimum	+2.22507385850720E-308	+4.94065645841247E-324 ¹

¹ An underflow in Ignore mode results in a denormalized number that is less than the value for +MINREAL.

L

LINE TYPE

Supported On UX* WS DOS
Option Required GRAPH
Keyboard Executable Yes
Programmable Yes
In an IF ... THEN ... Yes

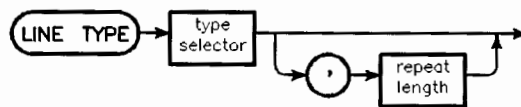
LINE TYPE selects a line type and repeat length for all lines, labels, frames, axes, and grids drawn with the graphics pen.

Example Statements

```
LINE TYPE 1
```

```
LINE TYPE Style,Repeat_len
```

Syntax



Item	Description	Range
type selector	numeric expression, rounded to an integer; Default = 1	1 through 10
repeat length	numeric expression, rounded to an integer; Default = 5	greater than 0

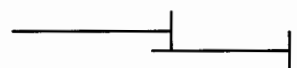
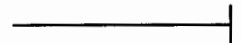
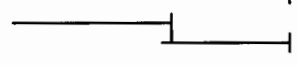

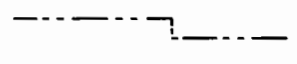
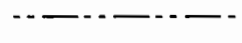
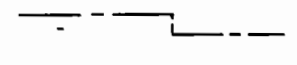
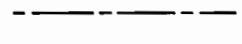
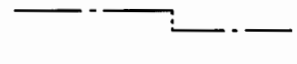

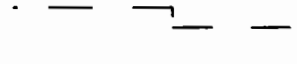
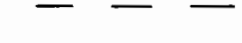
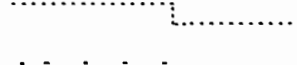
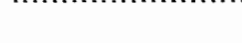
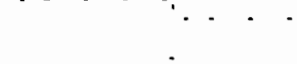

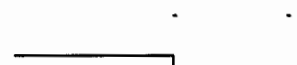

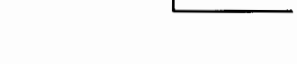

Semantics

At power-up the default line type is a solid line (type 1), and the default repeat length is 5 GDUs. The repeat length establishes the number of GDUs required to contain an arbitrary segment of the line pattern.

When plotting to the graphics display, the repeat length is evaluated and taken as the next lower multiple of 5, with a minimum value of 5.

When plotting to an external plotter, the line produced by the line identifier is device dependent. Refer to your plotter's documentation for further information.

The available CRT line types are shown here.

	LINE TYPE 10	
	LINE TYPE 9	
	LINE TYPE 8	
	LINE TYPE 7	
	LINE TYPE 6	
	LINE TYPE 5	
	LINE TYPE 4	
	LINE TYPE 3	
	LINE TYPE 2	
	LINE TYPE 1	



LINE TYPE

L

HP BASIC/UX Specifics

When using HP BASIC/UX with the sox11 driver in the X-Windows environment, the line pattern is reset at the beginning of each new vector when using DRAW, MOVE, or PLOT without an array. This may cause the line pattern to look different on a CRT than what you expect when the vectors are shorter than the repetition of the line pattern. Plotters do not exhibit this behavior. To get a continuous pattern, use PLOT A(*) with operation selector 10. HP BASIC/UX 700 uses the sox11 driver by default. Other HP BASIC/UX versions use the sox11 driver in X-Windows if initiated with the command `rmb -X`.

LINK

Supported On	UX WS DOS
Option Required	HFS or SRM
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

LINK allows the linking of two **file names** on the same HFS or SRM volume to a single physical file. If a wildcard specification for the source matches multiple files, the destination must be a directory.

Example Statements

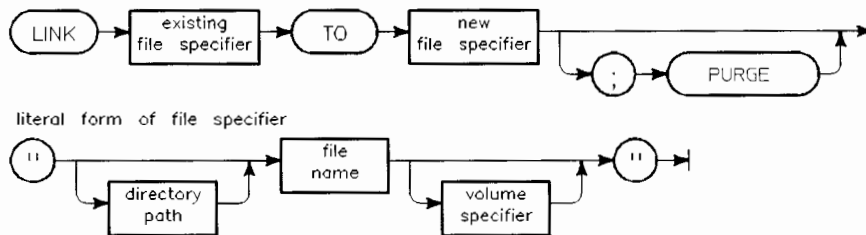
```
LINK "Org_file:CS80,700,0" TO "New_file"
```

```
LINK "old" TO "new";PURGE
```

```
LINK "source/*" TO "dest_dir"
```

```
LINK "exists" TO "file_[ABC]" ! WILDCARDS UX only
```

Syntax



LINK

L

Item	Description	Range
file specifier	string expression	(see diagram)
volume specifier	string expression	(see MASS STORAGE IS)
directory path	literal	(see MASS STORAGE IS)
file name	literal	depends on volume's format (see Glossary)

Semantics

The LINK statement works only with HFS or SRM.

LINKing files that are on different volumes is not possible. Since the files that are linked *must* be on the same volume, you need to give the volume specifier only with the first file used by the link statement. For example,

```
LINK "File1:INTERNAL,4" TO "File2"
```

is a legal statement because the second file specifier's default msvs is the first file specifier's msvs. However, the following statement:

```
LINK "News1:CS80,700,1" TO "News2:9133,702,0"
```

will give an error because the files are on different volumes.

If you RE-STORE or RE-SAVE to an HFS file that has links to it, the links will be broken. (This is not true of SRM or SRM/UX files.)

If you OUTPUT to a file that has links to it, the linked files will all have the same contents.

Using LINK with PURGE

You must use LINK with the secondary keyword PURGE to redefine an existing LINK, or an error will result. For example:

```
100 LINK "exists1" TO "new"  
110 LINK "exists2" TO "new" this will cause an error
```

```
100 LINK "exists1" TO "new"  
110 LINK "exists2" TO "new";PURGE executes without error
```

Note that line 110 in the second example breaks the link between `new` and `exists1` and creates a link between `new` and `exists2`.

Using Wildcards with LINK

If you are using a version of HP BASIC that supports wildcards, you can use them in file specifiers with LINK. You must first enable wildcard recognition using WILDCARDS. Refer to the keyword entry for WILDCARDS for details. While the old file specifier (source) may match more than one item, the new file specifier (destination) must match one and only one item in all cases. If the wildcard specification for the source matches multiple files, the destination must be a directory.

Note that HP BASIC handles the command

```
LINK "file_name" TO "dir_name"
```

in a different manner when wildcards are enabled than when they are disabled.

When wildcards are enabled, HP BASIC permits you to link a file to a directory. It interprets the above command as link the file `file_name` to the directory called `dir_name`.

When wildcards are disabled, HP BASIC interprets the above command as link the file `file_name` to the *file* called `dir_name`.

The PURGE secondary keyword allows the LINK command to redefine existing links. It can be used regardless of the state of wildcards.

LINPUT

Supported On	UX WS DOS
Option Required	None
Keyboard Executable	No
Programmable	Yes
In an IF ... THEN ...	Yes

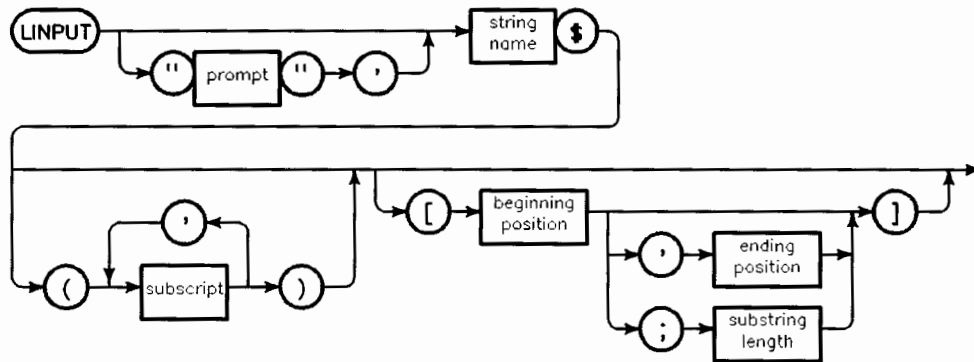
LINPUT accepts alphanumeric input from the keyboard for assignment to a string variable. The LINPUT statement allows commas or quotation marks to be included in the value of the string, and leading or trailing blanks are not deleted.

Example Statements

```
LINPUT "Next Command?",Response$
```

```
LINPUT Array$(I) [3]
```

Syntax



Item	Description	Range
prompt	a literal composed of characters from the keyboard, including those generated using the ANY CHAR key; Default = question mark	—
string name	name of a string variable	any valid name
subscript	numeric expression, rounded to an integer	−32 767 through +32 767 (see “array” in Glossary)
beginning position	numeric expression, rounded to an integer	1 through 32 767 (see “substring” in Glossary)
ending position	numeric expression, rounded to an integer	0 through 32 767 (see “substring” in Glossary)
substring length	numeric expression, rounded to an integer	0 through 32 767 (see “substring” in Glossary)

Semantics

A prompt, which remains until the LINPUT item is satisfied, appears on the CRT display line. If the last DISP statement suppressed its CR/LF, the prompt is appended onto the current display line contents. If the last DISP did not suppress the CR/LF, the prompt replaces the current display line contents. Not specifying a prompt results in the question mark being used as the prompt. Specifying the null string ("") for the prompt suppresses the question mark.

CONTINUE, **ENTER**, **EXECUTE**, **Return**, or **STEP** must be pressed to indicate that the entry is complete. If no value is provided from the keyboard, the null string is used. If **CONTINUE**, **ENTER**, **EXECUTE**, or **Return** is pressed to end the data input, program execution continues at the next program line. If **STEP** is pressed, the program execution continues at the next program line in single step mode. (If the LINPUT was stepped into, it is stepped out of, even if **CONTINUE**, **ENTER**, **EXECUTE**, or **Return** is pressed.)

Live keyboard operations are not allowed while a LINPUT is waiting for data entry. **PAUSE** (or **Stop** on an ITF keyboard) can be pressed so live keyboard

LINPUT

L

operations can be performed. The LINPUT statement is re-executed from the beginning when **CONTINUE** or **STEP** is pressed.

ON KBD, ON KEY and ON KNOB events are deactivated during an LINPUT statement. Errors do not cause an ON ERROR branch. If an input response results in an error, the LINPUT statement is re-executed.

LIST

L

Supported On	UX* WS DOS IN*
Option Required	EDIT
Keyboard Executable	Yes
Programmable	Yes (Except LIST BIN)
In an IF ... THEN ...	Yes

LIST lists the program or key definitions currently in memory. LIST BIN lists the names of all the binaries currently loaded in HP BASIC.

Example Statements

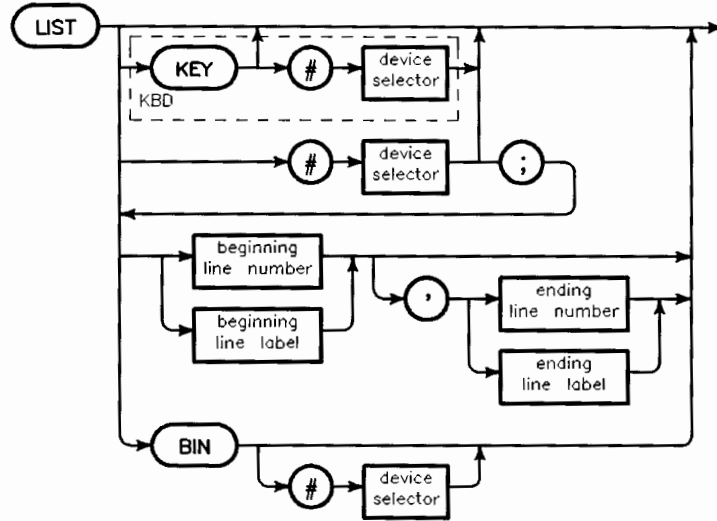
```
LIST
LIST 110,250
LIST #701
LIST #701;Label1,Label2
```

The following example is valid on HP BASIC/UX/WS/DOS and requires the KBD binary.

```
LIST KEY #Printer
```


LIST

L



Item	Description	Range
device selector	numeric expression; is rounded to an integer. Default is PRINTER IS device.	(see Glossary)
beginning line number	integer constant identifying program line	1 through 32 766 (1 through 2 147 483 646 for HP BASIC/UX 700)
beginning line label	name of a program line	any valid name
ending line number	integer constant identifying program line	1 through 32 766 (1 through 2 147 483 646 for HP BASIC/UX 700)
ending line label	name of a program line	any valid name

Semantics

When a label is used as a line identifier, the lowest-numbered line in memory having that label is used. When a number is used as a line identifier, the lowest-numbered line in memory having a number equal to or greater than the specified line is used. An error occurs if the ending line identifier occurs before the beginning line identifier or if a specified line label does not exist in the program.

Executing a LIST from the keyboard while a program is running causes the program to pause at the end of the current line. The listing is sent to the selected device, and program execution resumes. After the listing is finished, the amount of available memory, in bytes, is displayed.

Note that the default width of the PRINTER IS device is 80 characters, which means that a carriage-return (CR) and line-feed (LF) character will be sent after 80 characters are printed on any one line. You can change this with the WIDTH attribute of the PRINTER IS statement.

LIST *#device selector* is always done as if the WIDTH OFF printer attribute was in effect.

LIST KEY (Requires KBD and Does Not Require EDIT)

The LIST KEY statement lists the current typing-aid key definitions (*not* the labels of ON KEY definitions) to the specified device. If a key does not currently have a definition, it will not be listed.

LIST BIN (Does Not Require EDIT)

The LIST BIN statement is not programmable; it can only be used on the command line. LIST BIN lists the binaries currently loaded in memory. The name, version and brief description of the BIN is listed. For example:

NAME	VERSION	DESCRIPTION
GRAPH	5.0	Graphics
MAT	5.0	Matrix Statements

LIST

L

HP BASIC/UX Specifics

The “available memory” displayed at the end of a LIST, shows the available HP BASIC/UX workspace (not the system memory available).

LISTEN

LISTEN

See SEND.

L



LABEL - LWC\$ L-35

LIST WINDOW

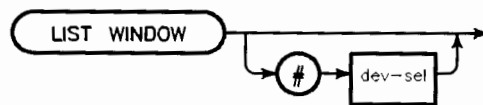
Supported On	UX WS*
Option Required	RMBUX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

LIST WINDOW lists the currently defined windows and their attributes. This statement can be entered in the HP BASIC/UX/WS editor, but it executes only in HP BASIC/UX in X.

Example Statements

```
LIST WINDOW
```

Syntax



Item	Description	Range
device_selector	numeric expression, rounded to integer. Default is PRINTER IS device	(see Glossary)

Semantics

This statement is only valid when running under X Windows. It then outputs a table of all currently defined windows and their attributes to the specified device, or if absent to the PRINTER IS device.

When not in a window system, this statement causes an error.

LOAD

L

Supported On	UX* WS DOS IN*
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

LOAD loads programs, binaries, or typing-aid softkey definitions into memory.

Example Statements

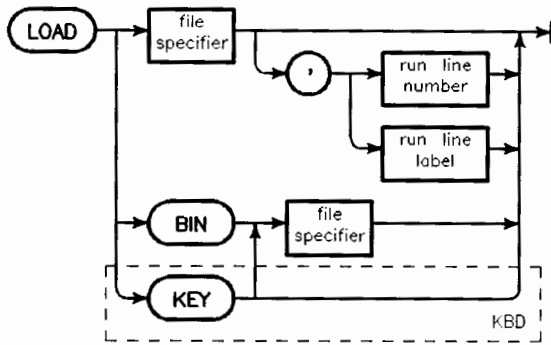
```
LOAD Filename$
LOAD "UTIL",Run_line
LOAD BIN "MAT" ! HP BASIC/WS/DOS
LOAD BIN "dir1/dir2/bin_file<SRM_READ_pass>
:REMOTE 21,5;LABEL Disc" ! HP BASIC/WS/DOS
```

The following example requires the KBD binary.

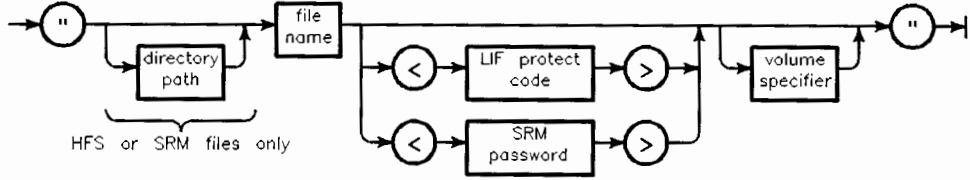
```
LOAD KEY "Typing_aids"
```

LOAD

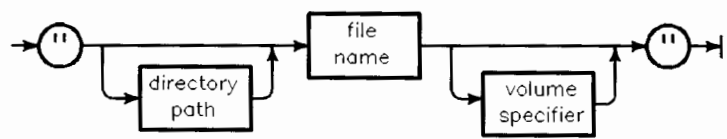
L



literal form of file specifier:



literal form of DFS file specifier:





Item	Description	Range
file specifier	string expression	(see drawing)
directory path	literal	(see MASS STORAGE IS)
file name	literal	depends on volume's format (see Glossary)
SRM password	literal; first 16 non-blank characters are significant	> not allowed
volume specifier	literal	(see MASS STORAGE IS)
run line number	integer constant identifying program line	1 through 32 765 (1 through 2 147 483 646 for HP BASIC/UX 700)
run line label	name of a program line	any valid name

Semantics

The HP BASIC program currently in memory and all variables not in COM are lost when a LOAD is executed. Every COM block in the newly-loaded program is compared with the COM blocks of the program in memory. If a COM area of the newly-loaded program does not match an existent COM area, the values in the old COM area are lost. Thus, some COM areas may be retained while others are lost.

If a PROG-type file requires a binary program that is not compatible with the current version of HP BASIC, the binary is skipped, a warning is printed, and the program is loaded. If it contains a binary that is compatible with the current version of HP BASIC, the binary is loaded.

LOAD is allowed from the keyboard if a program is not running. If no run line is specified, you must press **RUN** to initiate program execution, and execution will begin on the first line in the program. If a run line is specified, prerun initialization (see RUN) is performed, and program execution begins at the line specified. The line on which execution begins must exist in the main program context of the newly-loaded program. If you specify a line *number* and it doesn't exist, execution begins with the next higher-numbered line, provided that line is in the main program context.

LOAD

Executing LOAD from a program causes the new program file to be loaded, prerun, and program execution to resume. Execution begins at the line specified, or the lowest-numbered program line if a run line is not specified.

You can use wildcards to match a file specifiers with LOAD. You must first enable wildcard recognition using WILDCARDS. Refer to the keyword entry for WILDCARDS for details. Wildcard file specifiers used with LOAD must match one and only one file name.

Autostart Program Files

HP BASIC/WS automatically loads and runs a file called AUTOST if the file exists on the boot mass storage device (and if it is of type PROG). If the system is loaded from an HFS volume, the autostart file is /WORKSTATIONS/AUTOST. If the system is loaded from SRM, the autostart file is /SYSTEMS/AUTOST nn , where nn is the node number of the SRM interface installed in the computer you are booting; if this file does not exist, HP BASIC looks for /AUTOST.

HP BASIC/UX first checks if an autostart file (PROG, PROG2, ASCII, or HP-UX) was specified in the `rmb` command line. If not, it checks the `rmbrc` environment file(s). If one is not found, it checks the current directory, and then the home directory, for a file called AUTOST.

HFS Permissions

In order to LOAD a file from an HFS volume, you need to have R (read) permission on the file, and X (search) permission on the immediately superior directory as well as all other superior directories.

LOAD with SRM Volumes (not supported in HP BASIC/UX 700)

In order to LOAD a file from an SRM volume, you need to have READ access capability on the file, on the immediately superior directory, and on all other superior directories.

LOAD from an SRM volume is executed in shared mode, which means that several users can LOAD a file at the same time. Files being stored with the STORE or RE-STORE statements are locked during that operation and cannot be accessed for loading.

LOAD Requirements for Device Drivers

With HFS volumes, you must have all drivers for the disk from which you are loading the program. For instance, if you are loading from a CS80-type disk, you must have HPIB, CS80, and HFS binaries currently in memory. (This is not like other volumes. It is required because the Boot ROM does not contain drivers for HFS volumes, but it does contain drivers for LIF and SRM volumes.)

HP BASIC has binaries permanently loaded, but it is necessary to have the correct drivers configured into the HP-UX kernel. For example, if you are loading from a CS80-type disk, you must have the CS80 driver in the kernel. Check by using the `rmbconfig` program with the `-s` option.

LOAD BIN (HP BASIC/WS/DOS only)

LOAD BIN is used to load BIN files. (A BIN file contains either language extensions, such as MAT or GRAPH, or drivers, such as DISC and HPIB.) A BIN file may contain more than one of the extensions or drivers; if so only the extensions or drivers not already present in memory are loaded. Executing a LOAD BIN does not affect the currently loaded HP BASIC program or any variables.

HP BASIC/UX has permanently loaded binaries, so this statement is not appropriate for HP BASIC. It generates an error message.

LOAD BIN Requirements for Device Drivers (HP BASIC/WS/DOS only)

BIN files can usually be loaded from a mass storage device even though the BIN(s) to access that device are absent (as long as the Boot ROM has the required drivers). Most Boot ROMs have drivers for LIF and SRM volumes and HP-IB interfaces, but not for HFS volumes. If the Boot ROM does not have the drivers for the device from which you want to load a BIN file, then you will need to first install all required drivers for that device (such as HFS, CS80, and HP-IB).

LOAD

L

LOAD BIN with WILDCARDS

Before using a wildcard expression with LOAD BIN, you *must* load the binaries required to access the file system. For example, before using LOAD BIN with a wildcard on an SRM disk you must first load the SRM and DCOMM binaries.

LOAD BIN with SRM Volumes (HP BASIC/WS/DOS only)

LOAD BIN is executed in shared mode, which means that several users can load a BIN file at the same time. BIN files can be loaded into a workstation from the SRM without the SRM and DCOMM binaries present in the workstation (as described in the preceding paragraph). However, you cannot perform operations like STORE without these binaries.

LOAD KEY (Requires KBD)

LOAD KEY sets the typing-aid definitions of the softkeys according to the contents of the specified BDAT file. If the file is not in the proper format, an error occurs. The file containing the key definitions may be created by a user program. See the STORE KEY statement for file format.

All existing key definitions are cleared before the file's key definitions are loaded.

If LOAD KEY is executed without a file specifier, the keys are reset to their power-on values.

ON KEY definitions are not affected by LOAD KEY.

LOAD KEY with SRM Volumes

In order to LOAD KEY a file on an SRM volume, you need to have READ access capability on the immediately superior directory, as well as READ capability on all other superior directories.

LOAD KEY is executed in shared mode, which means that several users can perform a LOAD KEY from a BDAT file at the same time. Files being stored with the STORE KEY or RE-STORE KEY statements are locked during that operation and cannot be accessed for loading.

HP BASIC/UX Specifics

LOAD BIN generates an error message as it is not appropriate for HP BASIC/UX (binaries are permanently loaded).

L



L

LOADSUB

Supported On	UX WS DOS
Option Required	None
Keyboard Executable	Yes
Programmable	Yes (See Semantics)
In an IF ... THEN ...	Yes (See Semantics)

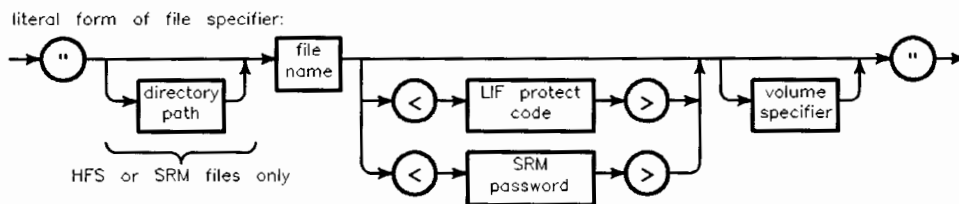
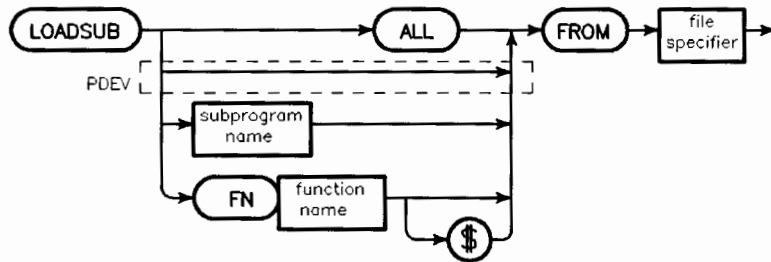
LOADSUB loads subprograms from a PROG file into memory.

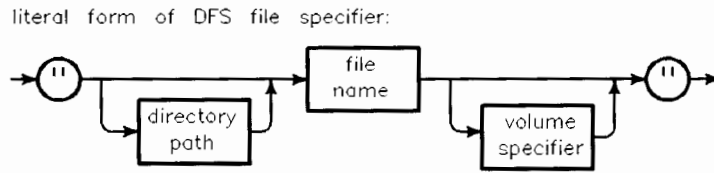
Example Statements

```
LOADSUB FNReplace$ FROM "Subs_file"
LOADSUB ALL FROM Subfile$
LOADSUB ALL FROM "/Dir3/Progfile<SRM_READ_pass>"
LOADSUB ALL FROM "/Dir1/Dir2/Prog23"
```

The following examples requires the PDEV binary.

```
LOADSUB FROM "My_subs:HP9895,700,1"
LOADSUB FROM "Subs_file"
```





Item	Description	Range
subprogram name	name of a SUB or CSUB subprogram	any valid name
function name	name of a user-defined function	any valid name
file specifier	string expression	(see drawing)
directory path	literal	(see MASS STORAGE IS)
file name	literal	depends on volume's format (see Glossary)
SRM password	literal; first 16 non-blank characters are significant	> not allowed
volume specifier	literal	(see MASS STORAGE IS)

Semantics

LOADSUB FROM

The command LOADSUB FROM (without a subprogram name) *is not programmable*; it is used before a program is run. It looks through the program and notices all the subprogram references which are unsatisfied. Unsatisfied references are statements which reference subprograms that don't yet exist in memory. It then accesses the specified file (which must be a PROG file), (which must have been saved as a .PRG program file), and loads all the needed subprograms, appending them to the end of the current program, renumbering as necessary. It also looks through the subprograms it just loaded to see if *they* call anything which is not yet in memory. If so, those references will be satisfied. This process repeats for each set of subprograms loaded until all the

LOADSUB

L routines that are referenced are loaded or until it is determined they are not in the specified file. At the end of the LOADSUB FROM command, if there are still unsatisfied references, an error message and a list of the subprogram names still needed is displayed.

LOADSUB with ALL or Subprogram Name

When LOADSUB is used with a subprogram name or ALL, LOADSUB loads the matching subprogram(s) from the specified file. This form of LOADSUB *is programmable*. If either the file name or the subprogram name specified is not found, or the file name is not a PROG file, an error will occur. As the subprogram is loaded, it will be renumbered to fit at the end of the program. LOADSUB does not cause the program or any data currently in memory to be lost.

HFS Permissions

In order to LOADSUB from a file on an HFS volume, you need to have R (read) access permission on the file, and X (search) permission on the immediately superior directory and on all other superior directories.

LOADSUB with SRM Volumes (not supported in HP BASIC/UX 700)

In order to LOADSUB from a file on an SRM volume, you need to have READ access capability on the immediately superior directory, as well as READ capability on all other superior directories.

With SRM, LOADSUB is executed in shared mode, which means that several workstations can perform a LOADSUB of a file at the same time. PROG files being stored with the STORE or RE-STORE statement are locked during that operation and cannot be accessed for loading.

LOADSUB with Wildcards

If you are using a version of HP BASIC that supports wildcards, you can use them in file specifiers with LOADSUB. You must first enable wildcard recognition using WILDCARDS. Refer to the keyword entry for WILDCARDS for details. Wildcard file specifiers used with LOADSUB must match one and only one file name.

LOCAL

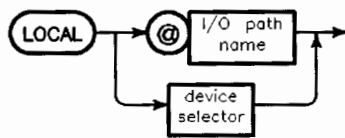
Supported On	UX WS DOS IN
Option Required	IO
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

LOCAL returns all specified devices to their local state.

Example Statements

```
LOCAL @Dvm
LOCAL 728
LOCAL Isc
```

Syntax



Item	Description	Range
I/O path name	name assigned to a device or devices	any valid name (see ASSIGN)
device selector	numeric expression, rounded to an integer	(see GLOSSARY)

LOCAL

L

Semantics

If only an interface select code is specified by the I/O path name or device selector, all devices on the bus are returned to their local state by setting REN false. Any existing LOCAL LOCKOUT is canceled.

If a primary address is included, the GTL message (Go To Local) is sent to all listeners. LOCAL LOCKOUT is not canceled.

Bus Actions

Summary of Bus Actions

	System Controller		Not System Controller	
	Interface Select Code Only	Primary Address Specified	Interface Select Code Only	Primary Address Specified
Active Controller	$\overline{\text{REN}}$	ATN MTA UNL LAG GTL	ATN GTL	ATN MTA UNL LAG GTL
Not Active Controller	$\overline{\text{REN}}$	Error	Error	Error



LOCAL LOCKOUT

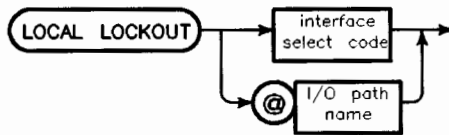
Supported On	UX WS DOS IN
Option Required	IO
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

LOCAL LOCKOUT sends the HP-IB LLO (local lockout) message, preventing an operator from returning the specified device from the remote state to local (front panel) control.

Example Statements

```
LOCAL LOCKOUT 7
LOCAL LOCKOUT Isc
LOCAL LOCKOUT @Hpib
```

Syntax



Item	Description	Range
I/O path name	name assigned to an interface select code	any valid name (see ASSIGN)
interface select code	numeric expression, rounded to an integer	7 through 31

LOCAL LOCKOUT

L

Semantics

The following conditions must be met to use LOCAL LOCKOUT without error:

- The computer sending LOCAL LOCKOUT *must* be Active Controller
- Only an interface select code may be specified, not a primary address

Either System Controllers or Non-system Controllers may send LOCAL LOCKOUT.

If a device is in the LOCAL state when this message is sent, it does not take effect on that device until the device receives a REMOTE message and becomes addressed to listen.

LOCAL LOCKOUT does not cause bus reconfiguration, but issues a universal bus command received by all devices on the interface whether addressed or not. The command sequence is ATN and LLO.

Bus Actions

Summary of LOCAL LOCKOUT Bus Actions

	System Controller		Not System Controller	
	Interface Select Code Only	Primary Address Specified	Interface Select Code Only	Primary Address Specified
Active Controller	ATN LLO	Error	ATN LLO	Error
Not Active Controller	Error	Error	Error	Error

LOCATOR

See READ LOCATOR and SET LOCATOR.

L



L**LOCK**

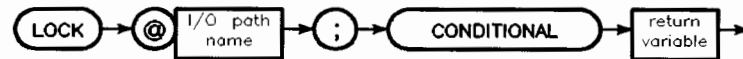
Supported On UX* WS DOS*
Option Required SRM and DCOMM
Keyboard Executable Yes
Programmable Yes
In an IF ... THEN ... Yes

LOCK prevents other SRM workstations from accessing the remote file to which the I/O path is currently assigned, before closing the file. No locking mechanism is available for LIF.

In HP BASIC/UX, LOCK prevents other processes from accessing a locked HFS file.

Example Statements

```
LOCK @File;CONDITIONAL Result
IF A THEN LOCK @File;CONDITIONAL Result
```

Syntax

Item	Description	Range
I/O path name	name identifying an I/O path	any valid name (See Glossary)
return variable	name of a numeric variable	any valid name (See Glossary.)

Semantics

This statement establishes sole access to an SRM file that has been opened with an ASSIGN statement. This exclusive access remains assigned to the workstation (or SRM, or HP BASIC/UX process) executing the LOCK statement until an UNLOCK statement is executed by that workstation. The UNLOCK function is also a result of SCRATCH A, **RESET**, and ASSIGN ... TO * (explicitly closing an I/O path).

A file may be locked several times. The system counts the number of LOCKs on a file, and an equal number of UNLOCKs must be executed to unlock the file. When an I/O path name is closed (for example, by ASSIGN ... TO *), *all* LOCKs of that I/O path name are cleared.

If the LOCK is successful, the value of the return variable will be zero. Otherwise, the return variable's value will be the error number corresponding to the cause of the LOCK's failure.

HP BASIC/UX Specifics

HP BASIC/UX supports LOCK for HFS files: establishing exclusive access to a file by the HP BASIC/UX process. In order to LOCK the file exclusively, you must have write permission on the file. You may LOCK a file with read-only permission if you have the LOCKRDONLY kernel privilege (see setprivprg(1M)). In addition, you must either own the file, or the file must have the set group-id bit on and the group search bit off. If this is not the case, an attempt is made to set up an advisory lock.

HP BASIC/UX does not support locking of RFA, NFS, or LIF files, although no error is generated when the LOCK statement is executed. Locking of pipes is not allowed; an attempt to LOCK a pipe generates a run-time error.

Also note that if two or more HP BASIC/UX processes are running on the same workstation, commands such as ENTER and OUTPUT will not block waiting for an SRM file to be unlocked. Instead, they generate an error.

HP BASIC/DOS Specifics

HP BASIC/DOS does not support LOCK for DFS files.

LOG

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

LOG returns the natural logarithm (base e) of the argument.

Example Statements

```
Time=-1*Rc*LOG(Volts/Emf)
PRINT "Natural log of";Y;"=";LOG(Y)
```

Syntax



Item	Description/Default	Range Restrictions
argument	numeric expression	> 0 for INTEGER and REAL arguments; see "Range Restriction Specifics" for COMPLEX arguments and underflow restrictions

Semantics

If the argument is REAL or INTEGER, the value returned is REAL. If the argument is COMPLEX, the value returned is COMPLEX.

To compute the LOG of a COMPLEX value, the COMPLEX binary must be loaded.

Range Restriction Specifics

The formula used for computing the LOG of a COMPLEX value is:

$$\text{CMLX}(\text{LOG}(\text{ABS}(\text{Argument})), \text{ARG}(\text{Argument}))$$

where **Argument** is a COMPLEX argument to the LOG function. The imaginary part of the result ($\text{ARG}(\text{Argument})$) is always given in radians and is between $-\pi$ and $+\pi$. Some values of a COMPLEX argument may cause errors in this computation. For example:

$$\text{LOG}(\text{CMLX}(\text{MAXREAL}, \text{MAXREAL}))$$

will cause error 22 (error 21 in HP BASIC/UX 700) due to the $\text{ABS}(\text{Argument})$ computation.

The following range restrictions apply in HP BASIC/UX 700 when underflow mode ($\text{CONTROL } 32,7;\text{mode}$) is set to Error or Ignore.

Range	Underflow Mode Error	Underflow Mode Ignore
Positive Maximum	+1.79769313486232E+308	+1.79769313486232E+308
Positive Minimum	+2.22507385850720E-308	+4.94065645841247E-324 ¹

¹ An underflow in Ignore mode results in a denormalized number that is less than the value for +MINREAL.



L

LOOP

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	No
Programmable	Yes
In an IF ... THEN ...	No

LOOP defines a loop which is repeated until the expression in an EXIT IF statement is evaluated as true (non-zero).

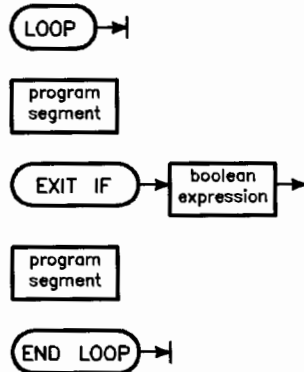
Example Program Segments

```
100 ! Reading to the end of a file
110 ASSIGN @File TO "MYFILE"
110 ON EOF GOSUB Done
120 LOOP
130     ENTER @File;Text$
140 END LOOP
150 Done: !

100 ! Process control loop
110 LOOP
120     Level=FNGet_level
130     EXIT IF Level>High_level
140     Pressure=FNSet_press(Decrease)
150     EXIT IF Pressure<Low_press
160 END LOOP
```

Syntax

L



Item	Description	Range
boolean expression	numeric expression; evaluated as true if nonzero and false if 0	—
program segment	any number of contiguous program lines not containing the beginning or end of a main program or subprogram, but which may contain properly nested construct(s).	—

Semantics

The LOOP ... END LOOP construct allows continuous looping with conditional exits which depend on the outcome of relational tests placed within the program segments. The program segments to be repeated start with the LOOP statement and end with END LOOP. Reaching the END LOOP statement will result in a branch to the first program line after the LOOP statement.

Any number of EXIT IF statements may be placed within the construct to escape from the loop. The only restriction upon the placement of the EXIT IF statements is that they must not be part of any other construct which is nested within the LOOP ... END LOOP construct.

LOOP

L

If the specified conditional test is true, a branch to the first program line following the `END LOOP` statement is performed. If the test is false, execution continues with the next program line within the construct.

Branching into a `LOOP ... END LOOP` construct (via a `GOTO`) results in normal execution from the point of entry. Any `EXIT IF` statement encountered will be executed. If execution reaches `END LOOP`, a branch is made back to the `LOOP` statement, and execution continues as if the construct had been entered normally.

Nesting Constructs Properly

`LOOP ... END LOOP` may be placed within other constructs, provided it begins and ends before the outer construct can end.

LORG

Supported On	UX WS DOS
Option Required	GRAPH
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

LORG specifies the relative origin of labels or symbols with respect to the current pen position.

Example Statements

```
LORG New_lorg
IF Y>Limit THEN LORG 3
```

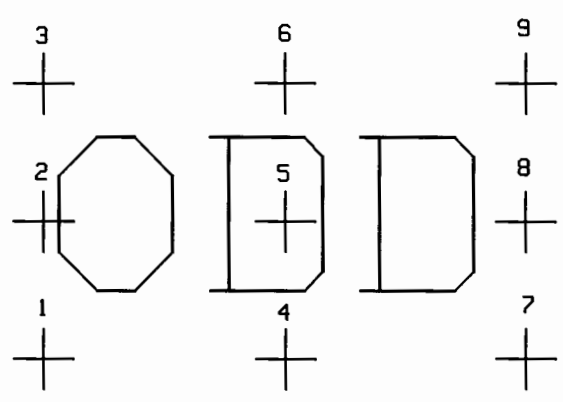
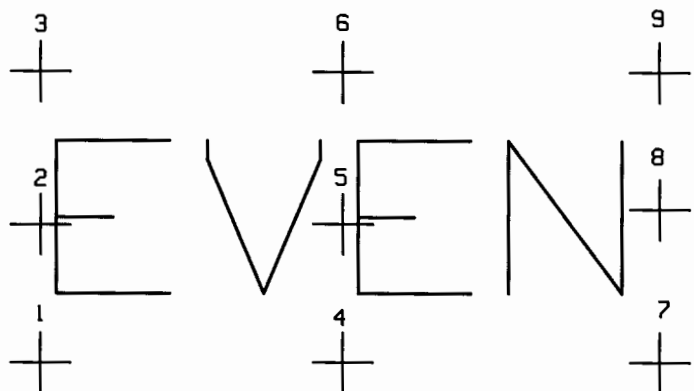
Syntax

Item	Description	Range
label origin position	numeric expression, rounded to an integer; Default = 1	1 through 9

Semantics

The following drawings show the relationship between a label and the logical pen position. The pen position before the label is drawn is represented by a cross marked with the appropriate LORG number.

LORG



L-60 LABEL - LWCS

LWC\$

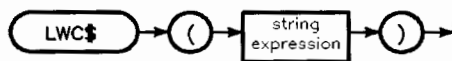
Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

LWC\$ replaces any uppercase characters with their corresponding lower-case characters.

Example Statements

```
Lower$=LWC$(Mixed$)
```

```
IF LWC$(Answer$)="y" THEN True_test
```

Syntax**Semantics**

The LWC\$ function converts only uppercase alphabetic characters to their corresponding lowercase characters and will not alter numerals or special characters.

The corresponding characters for the Roman Extension alphabetic characters are determined by the current lexical order. When the lexical order is a user-defined table, the correspondence is determined by the STANDARD lexical order.

LWC\$

L

Two-Byte Language Specifics

Certain localized versions of HP BASIC, such as Japanese localized HP BASIC, support two-byte characters. The LWC\$ function converts *only* one-byte characters and does not change two-byte characters. For more information about two-byte characters, refer to the globalization chapters of the *HP BASIC Porting and Globalization* manual.

M

MASS STORAGE IS - MTA

M



MASS STORAGE IS

Supported On	UX* WS DOS IN*
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

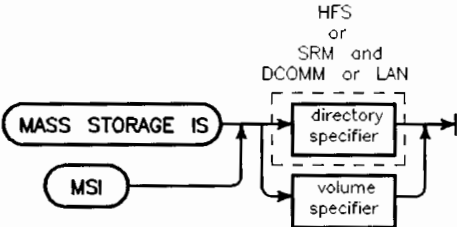
MASS STORAGE IS specifies the system mass storage device, which is either a disk drive (and directory) or a portion of memory specially configured with INITIALIZE. The MASS STORAGE IS device is used as the implied source or destination for all file-related operations that do not specify an explicit source or destination.

MASS STORAGE IS may be abbreviated as MSI when executed directly from the keyboard.

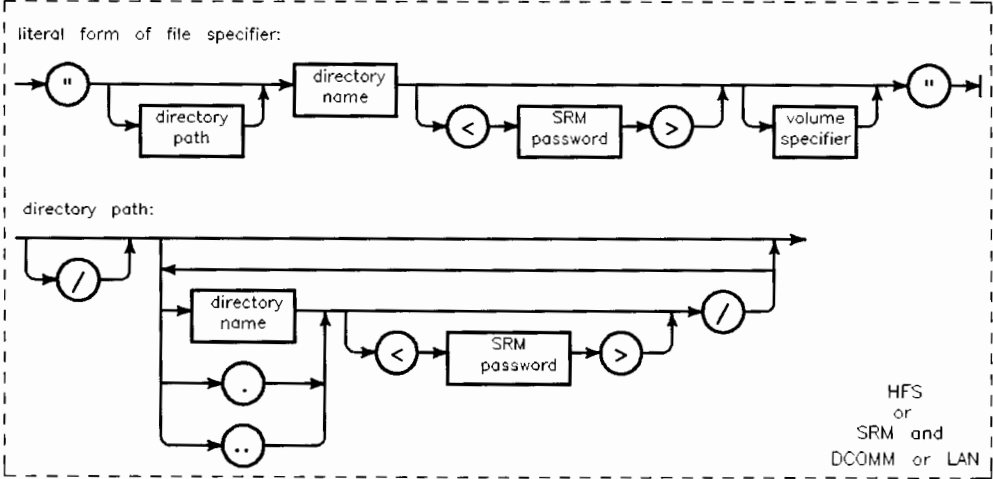
Example Statements

```
MASS STORAGE IS Vol_specifier$
MASS STORAGE IS Dir_path$&Vol_specifier$
MSI ":",700"
MSI ":",INTERNAL,4,1" ! HP BASIC/WS only
MSI ":",X,12"
MSI ":",REMOTE"
MSI "/Dir1/Dir2/MyDir"
MSI "..../.."
MSI ":",<SRM_READ_pass>"
MSI ":",HFS" ! HP BASIC/UX only
MSI ":",DOS" ! HP BASIC/DOS only
```

Syntax

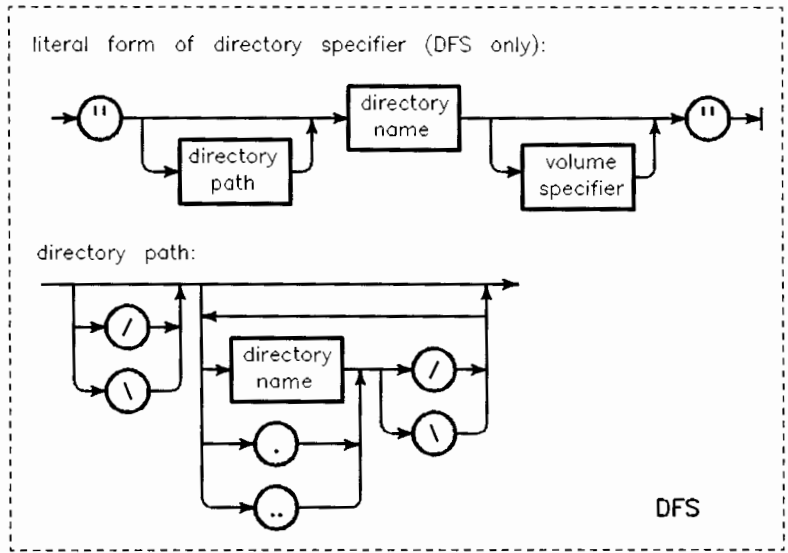


M

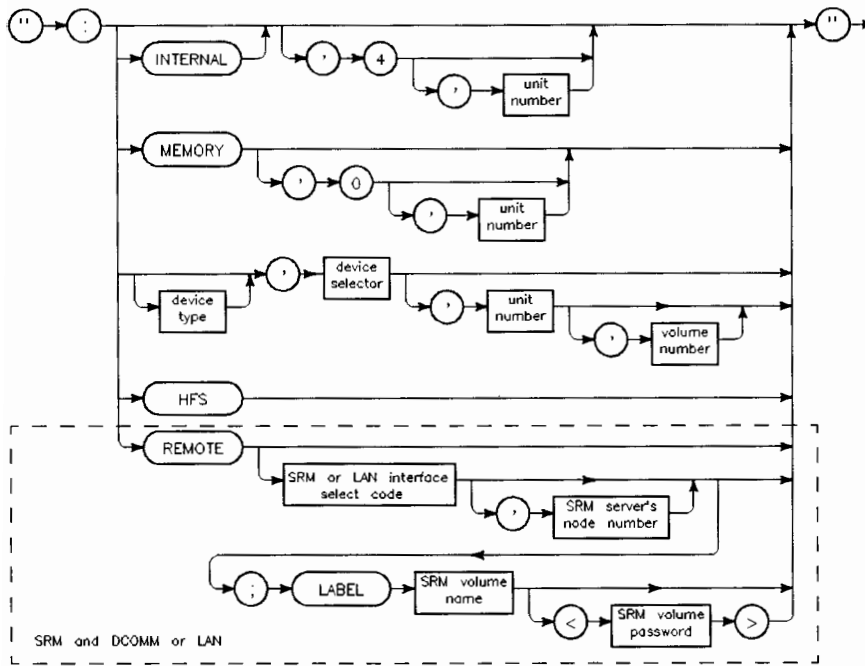


MASS STORAGE IS

M

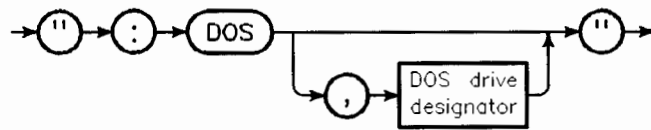


literal form of volume specifier:



M

literal form of DFS volume specifier:



DFS

MASS STORAGE IS

M

Item	Description	Range
directory specifier	string expression	(see drawing)
volume specifier	string expression	(see drawing)
directory path	literal	(see drawing)
directory name	literal	depends on volume's format (14 characters for HFS; 255 characters for HFS long file name systems (HP BASIC/UX only); 16 characters for SRM; and SRM/UX; see Glossary for details)
SRM password	literal; first 16 non-blank characters are significant (Note: SRM/UX ignores passwords.)	> not allowed
device type	literal	(see Semantics)
device selector	integer constant	(see Glossary)
unit number	integer constant; Default = 0	0 through 255 (device-dependent)
volume number	integer constant; Default = 0	(device-dependent)
SRM or LAN interface select code	integer constant identifying the SRM or LAN interface in the <i>workstation</i>	8 through 31
SRM server's node number	literal	0 through 63
SRM volume name	literal	any valid SRM volume name (see Glossary)
SRM volume password	literal (Note: SRM/UX ignores passwords.)	any valid SRM volume password (see Glossary)
DOS drive designator	literal	any valid DOS drive designator in the range A through Z (or a through z)

Semantics

All mass storage operations which do not specify a source or destination by either an I/O path name or volume specifier in the file specifier use the current system mass storage device.

MASS STORAGE IS can be abbreviated as MSI when entering a program line, but a program listing always shows the unabbreviated keywords.

If you are using a version of HP BASIC that supports wildcards, you can use them in volume specifiers with MSI. You must first enable wildcard recognition using WILDCARDS. Refer to the keyword entry for WILDCARDS for details. Wildcard file specifiers used with MSI must match one and only one volume name.

Device Type

The following table shows the *valid* device types. Most device types require an optional BIN for the statement to execute.

M

MASS STORAGE IS**M**

Device Type	Binary Required
INTERNAL (Models 226 and 236 only) MEMORY	none
HP 9121 HP 9133A/B/V/XV HP 9134A/B/XV HP 9135 (5 1/4 -inch disk requires HPIB not FHPIB) HP 913X HP 9895	DISK & HPIB or FHPIB
HP 82901 HP 82902 HP 8290X	DISK & HPIB
All "CS/80" and "SS/80" drives, for instance: HP 7908 HP 7914 HP 9122 HP 9133D/H/L HP 9134D/H HP 9153 HP 7946 etc.	CS80 & HPIB or FHPIB

MASS STORAGE IS

Device Type	Binary Required
REMOTE (SRM)	SRM & DCOMM
REMOTE (SRM/UX)	SRM & DCOMM or SRM & LAN
BUBBLE	BUBBLE
EPROM	EPROM
SCSI	SCSI
DOS drive	DFS

M

Note The 98625 Card (which requires the FHPiB binary) *cannot* be used with external 5 1/4 -inch disks.

If the device type specified is not valid, the system tests the device to determine its type. There are two exceptions to this.

1. If the device selector is 0 and the device type is invalid, the device type is assumed to be MEMORY.
2. If the device type is valid and the driver BIN for the device is not loaded, the system considers the device an invalid device type.

If a valid device type is specified and the system finds a different device at the device selector, error 72 occurs.

MASS STORAGE IS

Non-Disk Mass Storage

Memory volumes are created by the INITIALIZE statement. They are removed by SCRATCH A or by turning off the power. The unit number for a MEMORY volume may be 0 through 31.

M

The following is for HP BASIC/WS only:

A bubble memory card may have an select code of 8 through 31. (Use of this card requires the BUBBLE BIN.) A bubble memory card is always unit number 0. It is recommended that these cards be given a high hardware-interrupt level to avoid error 314 in overlapped applications.

When writing data into EPROM (requires the EPROM BIN), specify the select code of the EPROM Programmer card that is connected to the desired EPROM memory card. When reading data from EPROM, specify a select code of 0 or use the select code of the currently connected EPROM Programmer card. If the programmer card at the specified select code is not connected to the specified EPROM memory card, an error is reported. If the select code of 0 is used, you must specify "EPROM" in the mass storage unit specifier; otherwise, the system assumes MEMORY.

The unit numbers are given to the EPROM memory cards at power-up according to relative memory addresses. The card with the lowest address is given unit number 0, the card with the next greater address is given unit number 1, and so forth.

MSI with SRM, SRM/UX, and HFS Volumes

With hierarchical volumes (such as SRM, SRM/UX, and HFS), MASS STORAGE IS can also be used to specify the current working directory.

In order to specify an HFS directory as the current working directory, you need to have X (search) permission of the immediately superior directory as well as on all other superior directories.

In order to specify an SRM directory as the current working directory, you need to have READ access capability on all superior directories.

If you specify an SRM volume password in an MSI statement, that password is automatically applied to all accesses that use the default volume (that is, when

no volume specifier is included in the file specifier) until a mass storage volume specifier is included in a subsequent MSI. SRM/UX ignores passwords.

An SRM path name is limited to six levels. To MSI to a directory which is more than six levels deep, you must execute two or more MSI statements.

HP BASIC provides an abbreviated form of the msvs to refer to the current SRM directory. ":REMOTE" refers to the SRM directory you booted from, or if you have performed an MSI to the SRM, :REMOTE refers to the last SRM directory used in an MSI statement. If you did not boot from the SRM and you are accessing it for the first time, you should specify the entire msvs.

M

MSI with DFS Volumes

The DFS binary provided with the HP Measurement Coprocessor provides direct access to the PC's DOS drives. The DOS drive designator is included in the volume specifier (for example: ":DOS,C"). Note that either the forward slash (/) or the back slash(\) may be used in the directory path.

MSI and Driver Binaries

With HP BASIC, executing MASS STORAGE IS requires accessing the volume (since the system cannot determine whether a volume is a LIF or an HFS format). This operation requires that all drivers for the interface, disk, and directory format be present; for instance, you must have HPIB, CS80, and HFS binaries currently loaded in order to MSI to an HFS directory. If media is not present (hence cannot be accessed), HP BASIC assumes the volume is LIF format.

HP BASIC/UX Specifics

HP BASIC/UX provides an abbreviated form of the msvs to refer to the current directory for HFS. ":HFS" refers to the most recent HFS directory used in an MSI command.

HFS is a valid logical device type, and if HFS is specified with a non-HFS device selector, the device selector will be ignored (unless that device selector has been mapped to an HFS directory in the `rmbrc` environment file; see *Installing and Maintaining HP BASIC/UX*).

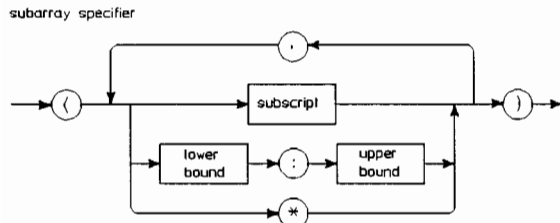
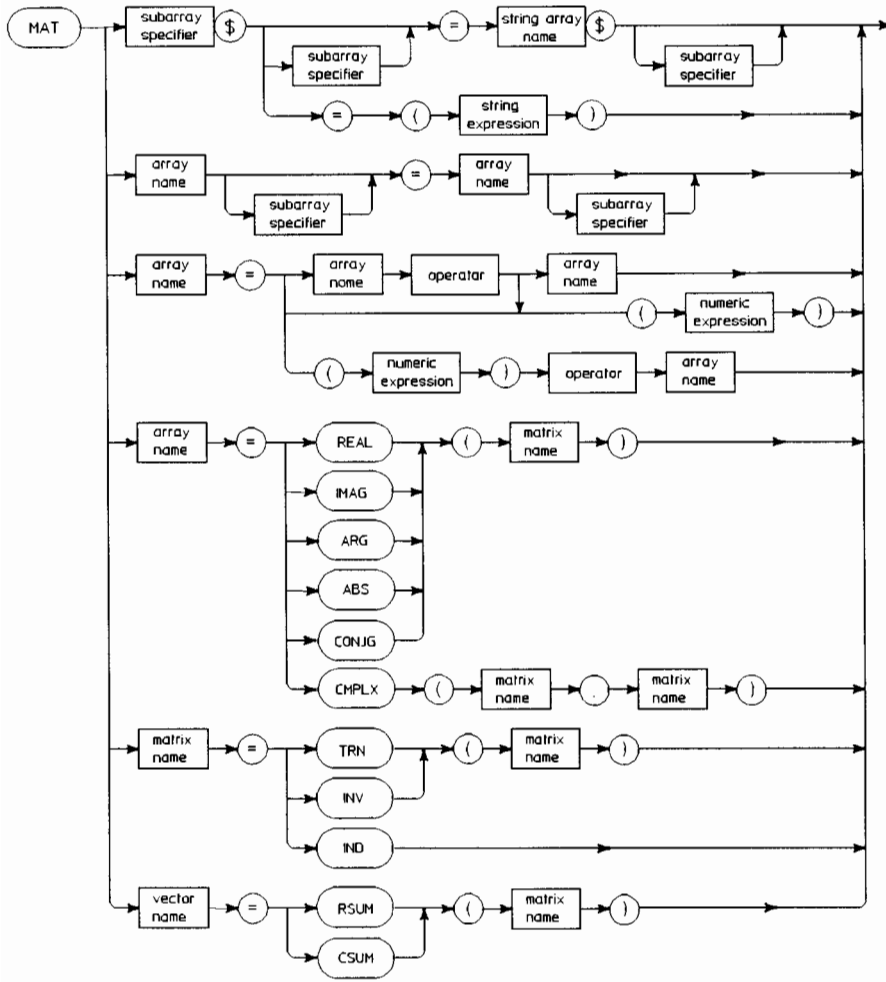
MAT

Supported On	UX WS DOS
Option Required	MAT
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

MAT performs a variety of operations on matrices, and other numeric and string arrays.

Example Statements

```
MAT Array= A*(Ref+1/3)
MAT String$= (RPT$(" ",80))
MAT Clone= Parent
MAT A= Array1<>Array2
MAT Vector= RSUM(Matrix)
MAT Transposition= TRN(Matrix)
MAT Identity= IDN
MAT Des_array(-1:0,2:4)= Sor_array
MAT Array_1= Array_2(-4:1)
MAT Destination(3,*,*)= Source(*,2,*)
MAT Result= REAL(Complex_array)
MAT New_array= IMAG(Complex_array)
MAT Return_ary= CMLX(Array1,Array2)
MAT Des_ary= CONJG(Complex_array)
MAT Array= ARG(Complex_array)
MAT Matrix_1= (CMLX(34.56,-23.78))
MAT Magnitudes= ABS(Complex_array)
```



MAT

Semantics

The MAT statement allows you to:

- Copy a string expression into a string array or copy the contents of one string array into another string array.
- Copy a numeric expression into an array.
- Copy two REAL arrays into a COMPLEX array with the first REAL array representing the real part of the COMPLEX elements and the second REAL array representing the imaginary parts.
- Copy the contents of one array or subarray into another array or subarray.
- Add an array and a numeric expression, or two arrays.
- Subtract a numeric expression from an array, an array from a numeric expression, or an array from an array.
- Multiply an array by a numeric expression or another array.
- Divide a numeric expression by an array, an array by a numeric expression, or an array by an array.
- Compare an array to a numeric expression or to another array.
- Calculate the Identity, Inverse, Transpose, Sum of rows, and Sum of columns of a matrix.
- Extract the real part or imaginary parts of a COMPLEX array.
- Compute the COMPLEX conjugate, argument or absolute value (magnitude) of COMPLEX array elements.
- Calculate the absolute value of a numeric array.

Note

If an error occurs during the calculations involved in a MAT assignment the result array will contain only a partial result. Since you will have no idea which entries are valid, the contents of the array should be considered invalid.

Numeric Operations

In the case of operators, the specified operation is generally performed on every array element, and the results are placed in corresponding locations of the result array (the exception is the * operator, which is discussed under Matrix Multiplication, below.) This means that the result array must have the same “size” and “shape” (though not necessarily the same subscript ranges) as the operand array(s). Note that “size” refers to the number of elements in the array and “shape” refers to the same number of dimensions and elements in each dimension, respectively (e.g. both of these subscript specifiers have the same shape: (-2:1,-1:10) and (1:4,9:20)). If necessary, the system will redimension the result array to make it the proper size. The redimensioning can only take place, however, if the dimensioned size of the result array has at least as many elements as the current size of the operand array(s).

When two arrays are operated on, they must be exactly the same size and shape. If not, the computer returns an error. The specified operation is performed on corresponding elements in each operand array and the result is placed in the corresponding location of the result array. Multiplication of the elements of two arrays is performed with a period rather than an asterisk. The asterisk is reserved for matrix multiplication described below.

Relational Operators

Relational operations are performed on each element of the operand array(s). If the relation is TRUE, a 1 is placed in the corresponding location of the result array. If the relation is FALSE, a 0 is recorded. The result array, therefore, consists of all 0's and 1's. Note that the *only* comparison operators allowed between COMPLEX expressions or arrays are: = and <>.

Complex Operations

Complex functions can be used by the MAT statement to:

- extract the real and/or imaginary parts of a COMPLEX array and assign them to a resultant array,
- create a COMPLEX array from two REAL or INTEGER arrays,
- compute the COMPLEX conjugate, argument or absolute value (magnitude) of COMPLEX array elements and assign them to a resultant array.

MAT

The complex functions available with the MAT statement are given below. The arguments used with these functions can be INTEGER, REAL or COMPLEX arrays.

REAL(Array)	assigns the real parts of each array element to the corresponding element in the resultant array.
IMAG(Array)	assigns the imaginary parts of each array element to the corresponding element in the result array.
CMPLX(Array1, Array2)	creates COMPLEX values from two numeric arrays by assigning each element of the first array (Array1) to the corresponding real part of the result array element, and each element of the second array (Array2) to the corresponding imaginary part of the result array element (if it is COMPLEX). If either of the array arguments are COMPLEX arrays, only the real part of that array is used in the creation of the values.
CONJG(Array)	computes the conjugate of each COMPLEX array element and assigns this result to the corresponding element in the result array.
ARG(Array)	computes the argument of each COMPLEX array element and assigns this result to the corresponding element in the result array.
ABS(Array)	computes the absolute value of each COMPLEX array element and assigns this result to the corresponding element in the result array.

Matrix Multiplication

The asterisk is used for two operations. If it is between an array and a numeric expression, each element in the array is multiplied by the numeric expression. If it is between two matrices, it results in matrix multiplication. If A and B are the two operand matrices, and C is the result matrix, the matrix multiplication is defined by:

$$C_{ij} = \sum_{k=1}^n A_{ik} B_{kj}$$

where n is the number of elements in a column in the matrix A . (This formula assumes that the array subscripts run from 1 through N ; in actuality, the computer only requires that the two arrays be the correct size and shape, the actual values of the subscripts are unimportant.)

Note that the subscript values of the result array correspond to the rows of the first operand matrix and the columns of the second operand matrix. Note also that the column subscript of the first operand array is equal to the row subscript of the second operand array. We can summarize these observations in two general rules:

- The result matrix will have the same number of rows as the first operand matrix and the same number of columns as the second operand matrix.
- Matrix multiplication is legal if, and only if, the column size of the first operand matrix is equal to the row size of the second operand matrix.

A third rule of matrix multiplication is:

- The result matrix cannot be the same as either operand matrix.

If either array is **COMPLEX**, the operation is done in **COMPLEX** math. If one or both operands is **REAL**, the calculation is done in **REAL** math. If both operands are **INTEGER**, the computation is also **INTEGER**. If the result matrix and the operand matrixes are different types (i.e., one is **REAL** and the others are **INTEGER**), the computer makes the conversion necessary for the assignment. However, the conversion is made *after* the multiplication is calculated, so even if the matrix receiving the result is **REAL**, the multiplication can generate an **INTEGER** overflow when the operands are **INTEGER** matrixes.

The computer allows you to do matrix multiplication on vectors by treating the vectors as if they were matrices. If the first operand is a vector, it is treated as a 1-by- N matrix. If the second operand is a vector, it is treated as an N -by-1 matrix.

M

MAT

Copying Subarrays

A subarray is a subset of an array (an array within an array). A subarray is indicated by a specifier after the array name as follows:

```
Array_name(subarray_specifier)
Array_name$(subarray_specifier)
```

For example, to specify the entire second column of a two-dimensional array, use the following subarray:

```
Array_name(*,2)
```

Copying subarrays is useful in these situations:

- copying a subarray into an array
- copying an array into a subarray
- copying a subarray into a subarray
- copying a portion of an array into itself

For a complete discussion of this subject, read the section entitled “Copying Subarrays” found in the “Numeric Arrays” chapter of the *HP BASIC Programming Guide* manual. (Note that you can also copy subarrays of string arrays.)

Before discussing the rules for subarrays the concept of range needs to be understood as it appears in this text. The two ranges related to subarrays are the subscript range and default range. The subscript range specifies a set of elements starting with a beginning element position and ending with a final element position. For example, 5:8 specifies a range of four elements starting with element 5 and ending at element 8. The default range is denoted by an asterisk (*) and it represents all of the elements in a dimension. For example, suppose you wanted to copy the entire first column of a two dimensional array, you would use the following subarray specifier: (*,1), where * represents all the rows in the array and 1 represents *only* the first column.

Follow these rules when copying subarrays:

- Subarray specifiers *must not* contain all subscript expressions (i.e. (1,2,3) is not allowed, it will produce a syntax error). This rule applies to all subarray specifiers.

- Subarray specifiers *must not* contain all asterisks (*) or default ranges (i.e. (*,*,*)) is not allowed, it will produce a syntax error). This rule applies to all subarray specifiers.
- If two subarrays are given in a MAT statement, there *must be* the same number of ranges in each subarray specifier. For example,

```
MAT Des_array1(1:10,2:3)= Sor_array(5:14,*,3)
```

is the correct way of copying a subarray into another subarray provided the default range given in the source array (Sor_array) has only two elements in it. Note that the source array is a three-dimensional array. However, it still meets the criteria of having the same number of ranges as the destination array because two of its entries are ranges and one is an expression.

- If two subarrays are given in a MAT statement, the subscript ranges in the source subarray *must be* the same shape as the subscript ranges in the destination subarray. For example, the following is *legal*:

```
MAT Des_array(1:5,0:1)= Sor_array(3,1:5,6:7)
```

however, the one below is *not* legal:

```
MAT Des_array(0:1,1:5)= Sor_array(1:5,0:1)
```

because both of its subarray specifiers do not have the same shape (i.e. the rows and columns in the destination subarray do not match the rows and columns in the source subarray).



CSUM

The secondary keyword CSUM computes the sum of each column in a matrix and places the results in a vector. The result vector must have at least as many elements as the matrix has columns. If the vector is too large or its current size is too small (and there are enough elements in its original declaration to allow redimensioning), the computer redimensions it. If the result vector and the argument array are different types (i.e., one is REAL and the other is INTEGER), the computer makes the necessary conversion. However, the conversion is made *after* the column sums are calculated, so even if the vector receiving the result is REAL, CSUM can generate an INTEGER overflow when the argument is an INTEGER array.

MAT

IDN

The secondary keyword IDN turns a square matrix into an identity matrix. An identity matrix has 1s along the main diagonal and 0s everywhere else. The matrix *must* be square.

M

INV

The secondary keyword INV finds the inverse of a square matrix. A matrix multiplied by its inverse produces an identity matrix. The inverse is found by using the pivot-point method. If the value of the determinant (see DET) is 0 after an INV, then the matrix has no inverse—whatever inverse the computer came up with is invalid. If the value of the determinant is very small compared with the elements in the argument matrix, then the inverse may be invalid and should be checked.

If the result matrix is not the same size and shape as the argument matrix, the computer will attempt to redimension it. If it is too large, or its current size is too small (and there are enough elements in its original declaration to allow redimensioning) the computer redimensions it. An error is returned if the computer cannot redimension the result array.

RSUM

The secondary keyword RSUM computes the sum of each row in a matrix and places the values in a vector. The result vector must be large enough to hold the sums of each row. If it is too large, or its current size is too small (and there are enough elements in its original declaration to allow redimensioning) the computer redimensions it. If the result vector and the argument array are different types (i.e., one is REAL and the other is INTEGER), the computer makes the necessary conversion. However, the conversion is made *after* the row sums are calculated, so even if the vector receiving the result is REAL, RSUM can generate an INTEGER overflow when the argument is an INTEGER array.

TRN

The secondary keyword TRN produces the transpose of a matrix. The transpose is produced by exchanging rows for columns and columns for rows. The result matrix must be dimensioned to be at least as large as the current size of the argument matrix. If it's the wrong shape, the computer redimensions it. The result and argument matrices cannot be the same.

The transpose of an N-by-M matrix is an M-by-N matrix, and each element is defined by switching the subscripts. That is, $A(m,n)$ in the argument matrix equals $B(n,m)$ in the result matrix. (This description assumes that the array subscripts run from 1 through M and 1 through N; in actuality, the computer only requires that the array be the correct size and shape, the actual values of the subscripts are unimportant.)

M

MAT REORDER

Supported On	UX WS DOS
Option Required	MAT
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

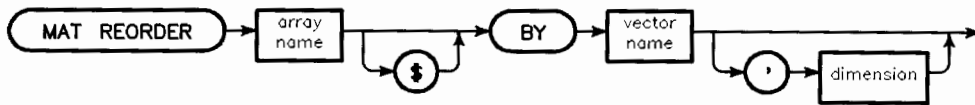
MAT REORDER reorders elements in an array according to the subscript list in a vector.

Example Statements

```
MAT REORDER Array BY Vector,Dimension
```

```
MAT REORDER Lines$ BY New_order
```

Syntax



Item	Description	Range
array name	name of an array	any valid name
vector name	name of a one-dimensional numeric array	any valid name
dimension	numeric expression, rounded to an integer; Default=1	1 through 6; \leq the RANK of the array

Semantics

The dimension parameter is used to specify which dimension in a multidimensional array is to be reordered. If no dimension is specified, the computer defaults to dimension 1. The vector must be the same size as the specified dimension and it should contain integers corresponding to the subscript range of that dimension (no duplicate numbers, or numbers out of range). The vector used cannot be a COMPLEX vector, but COMPLEX arrays can be re-ordered.

Vectors generated by a MAT SORT TO statement are of the proper form for reordering (see MAT SORT).

M

MAT SEARCH

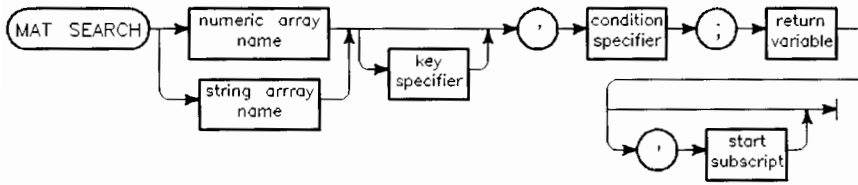
Supported On	UX WS DOS
Option Required	MAT
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

MAT SEARCH searches for user-defined conditions within a numeric or string array and places information returned into a variable for recall and examination.

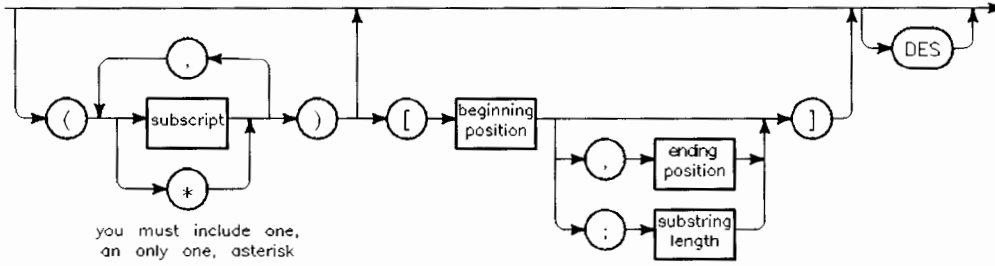
Example Statements

```
MAT SEARCH Number_array,LOC MAX;Loc_max
MAT SEARCH Source,LOC(<3);Location,4
MAT SEARCH Array(1,*) DES,LOC MIN;Loc_min,6
MAT SEARCH Vector,#LOC(2);Non_two_values
MAT SEARCH String$(*,2,3) DES,MAX;Max_value$
MAT SEARCH Word$(*,2),MIN;Min_plus$[2;10],Start_pos
```

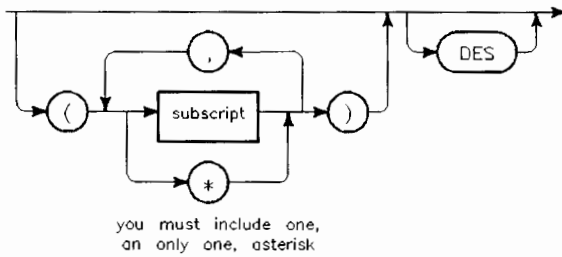
MAT SEARCH



string key specifier:

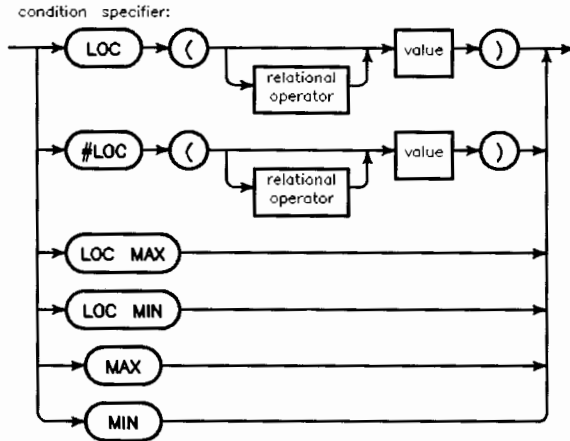


numeric key specifier:



M

MAT SEARCH



M

Item	Description/Default	Range Restrictions
numeric arrayname	name of a numeric array	any valid name
string array name	name of a string array	any valid name
subscript	numeric expression, rounded to an integer	-32 768 through +32 767 (see "array" in Glossary)
beginning position	numeric expression, rounded to an integer	1 through 32 767 (see "string" in Glossary)
ending position	numeric expression, rounded to an integer	0 through 32 767 (see "string" in Glossary)
substring length	numeric expression, rounded to an integer	0 through 32 767 (see "string" in Glossary)
return variable	< name of a numeric or string variable(as appropriate)	see "Semantics"
starting subscript	starting location within the vector being searched	-32 768 through +32 767 (see "array" in Glossary)

Semantics

Numeric searching comparisons are performed in the INTEGER mode for integer-precision arrays, in the REAL mode for real-precision arrays, and in the COMPLEX mode for complex arrays (which use real-precision for their real and imaginary parts). Note that the only numeric comparisons allowed in the COMPLEX mode are = and <> relational operators.

String arrays can be searched using all of the condition specifiers mentioned above. (If you want to search a substring within each element, see the subsequent discussion of searching substrings.)

The default search order for arrays is from the lower bound to the upper bound. This is considered to be an ascending search order. You can search an array in a descending search order (upper bound to lower bound) by using the secondary keyword DES in the key specifier. The following table clarifies the two types of search orders:

Search Order	Starting Subscript Given	No Starting Subscript Given
ascending (default)	starting subscript <i>to</i> upper bound	lower bound <i>to</i> upper bound
descending	starting subscript <i>to</i> lower bound	upper bound <i>to</i> lower bound

The key specifier must be included when the array has more than one dimension, and, for an n-dimensional array, must have one "*" and n-1 subscripts. This creates a one-dimensional slice to be searched.

The remaining sections mainly talk about numeric arrays; however, these sections also apply to searching string arrays.

DES

To search an array by descending subscript values, use the secondary keyword DES in the array's key specifier:

```
MAT SEARCH Array(1,*) DES,MAX;Max_value,6
```



MAT SEARCH

This secondary keyword causes a search to begin at the upper subscript bound and proceed toward the lower bound of that same dimension. If a **starting subscript** is specified in the **MAT SEARCH** statement, then the search will begin at that specified location in the dimension being searched and proceed toward the lower bound.

M

LOC(relational comparison)

LOC is used in the **MAT SEARCH** process for numeric and string arrays to scan the specified locations until it finds the first value which makes the comparison true. The **relational comparison** it uses is made up of two parts: an operator and a string or numeric expression (e.g. (>10) or (<>"CAT")). Operators determine the type of comparisons made. The following operators may be used: >, <, =, >=, <=, <>. The default relational operator is =.

When LOC is executed the value returned to the *return variable* is the subscript of the first location found that satisfied the LOC condition.

#LOC(relational comparison)

The condition **#LOC** is used in the **MAT SEARCH** process for numeric and string arrays to scan the specified locations and return a count of the number of locations whose contents satisfy the condition. The explanation for the **relational comparison** for this condition is the same as that given in the previous section.

MAX

MAX is used in the **MAT SEARCH** process for numeric and string arrays to scan all specified locations to find and return the maximum value found in the search. If the array is a string array, a string value is returned.

LOC MAX

LOC MAX is used in the **MAT SEARCH** process for numeric and string arrays to scan all specified locations to find and return the subscript of the first location in which the maximum value was found.

MIN

MIN is used in the **MAT SEARCH** process for numeric and string arrays to scan all specified locations to find and return the minimum value found in the search. If the array is a string array, a string value is returned.

LOC MIN

LOC MIN is used in the **MAT SEARCH** process for numeric and string arrays to scan all specified locations to find and return the subscript of the first location in which the minimum value was found.

M**Searching Substrings**

To search a substring of each string array element, specify that substring (in square brackets) as part of the key specifier. For example:

```
MAT SEARCH A$(*,1)[3,5],LOC("CAT");B$
```

searches the 3rd through 5th characters of each string for the string value **CAT**. Note that a **MAT SEARCH** of string arrays allows you not only to define the elements to be searched, but also to define substrings within each element. Substrings may lie anywhere within the dimensioned size of the string. If a substring lies outside the current string length, the null string is used as the searching key.

M

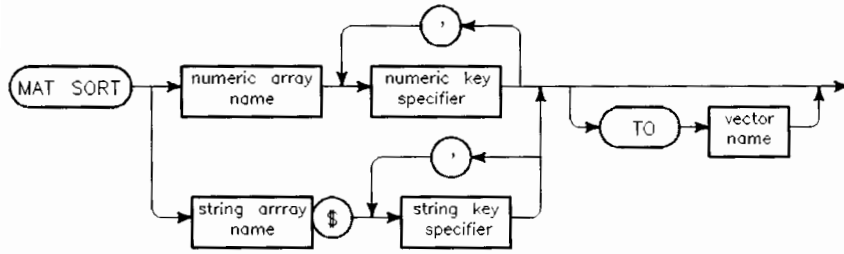
MAT SORT

Supported On	UX WS DOS
Option Required	MAT
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

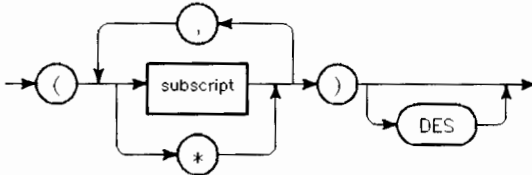
MAT SORT sorts an array along one dimension according to lexical or numerical order. In a string array, the current LEXICAL ORDER IS table is used for the sorting comparisons.

Example Statements

```
MAT SORT Array(Tag,*)
MAT SORT Vals(1,*,3),(2,*,5) DES
MAT SORT Start_vec TO End_vec
MAT SORT String$(*,2)[1;3] TO Order
```

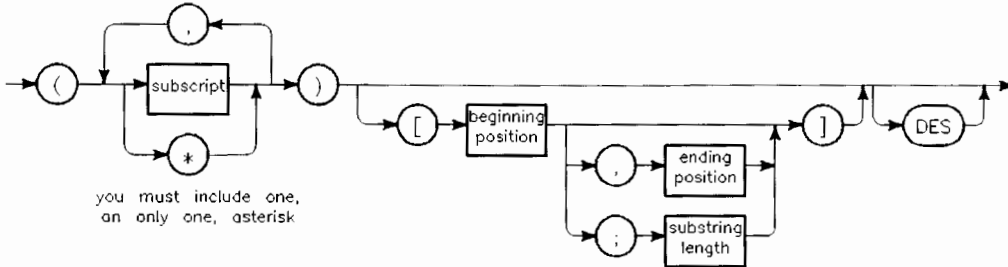


numeric key specifier:



you must include one,
an only one, asterisk

string key specifier:



you must include one,
an only one, asterisk

M

MAT SORT

Item	Description	Range
numeric array name	name of a numeric array	any valid name
string array name	name of a string array	any valid name
vector name	name of a one-dimensional numeric array	any valid name
subscript	numeric expression, rounded to an integer	-32 768 through +32 767 (see "array" in Glossary)
beginning position	numeric expression, rounded to an integer	1 through 32 767 (see "substring" in Glossary)
ending position	numeric expression, rounded to an integer	0 through 32 767 (see "substring" in Glossary)
substring length	numeric expression, rounded to an integer	0 through 32 767 (see "substring" in Glossary)

M

Semantics

The elements to be compared are defined by a key specifier. The dimension to be sorted is marked with an asterisk, and the subscript values in the key specifier define which elements in that dimension should be used as the sorting values. Once (*), (* DES, DES, or a blank specifier appears in the list following the array name, no other items can be added. Note that COMPLEX arrays *cannot* be MAT SORTed, because this statement's sorting routine uses < and > relational comparisons and these comparisons *are not* allowed with COMPLEX data types.

For multidimensional arrays, when two sort keys are swapped, all elements in their subarrays are swapped, too. For example, if a three-dimensional array is sorted on (2,*,3), where the values for locations (2,4,3) and (2,7,3) are out of sequence, these two values are swapped. When this happens, the subarrays (*,4,*) and (*,7,*) are also swapped.

In the case of ties, the computer leaves the elements in their current order. However, you can define additional key specifiers to be used for ties. Whenever

the computer encounters a tie, it will look to the next (moving from left to right) key specifier to break the tie. It will look at as many key specifiers as necessary to resolve the tie. In theory, there is no limit to the number of key specifiers you can have in one MAT SORT statement. In practice, it is limited by the length of a stored line on the computer you are dealing with. Each key must have an asterisk marking the same dimension.

Normally, the system sorts in ascending order. You can sort in descending order by using the secondary keyword DES. DES applies only to the key specifier which it follows. All others use the default ascending order.

MAT SORT of string arrays allows you not only to define the elements to be sorted, but also to define substrings within each element. Substring specifiers refer only to the key specifier that immediately precedes them. Substrings may lie anywhere within the dimensioned size of the string. If a substring lies outside the current string length, the null string is used as the sorting key.

In addition to actually sorting an array, you can use MAT SORT ... TO to store the new order in a vector and leave the original array intact. If the vector is too large, or its current size is too small (and there are enough elements in its original declaration to allow redimensioning) the computer redimensions it. After a MAT SORT TO statement, the array will be unchanged. The vector will contain the subscript values of the sorted dimension in their new order. You can then order the array or other parallel arrays using the REORDER statement. You can also use the contents of the vector to access the original array indirectly.

M

MAX

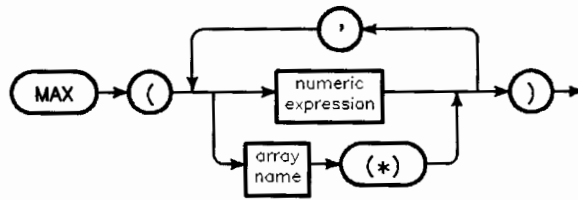
Supported On UX WS DOS IN
Option Required MAT
Keyboard Executable Yes
Programmable Yes
In an IF ... THEN ... Yes

MAX returns a value equal to the greatest value in the list of arguments. If an array is specified as an argument, then each element of the array is considered a separate value. An INTEGER is returned only if all arguments in the list are INTEGER.

Example Statements

```
Biggest=MAX(Elements(*))  
PRINT MAX(Item1,17,Total/3)  
Result=MAX(Floor,MIN(Ceiling,Argument))
```

Syntax



Item	Description	Range
array name	name of a numeric array	any valid name

Semantics

COMPLEX arguments are not allowed with this function.

Note

It is possible for the space needed for MAX to exceed the temporary storage allocated for expression evaluation. If the computer is close to overflowing memory this can be a *fatal* error and can crash the computer. It is recommended that statements including MAX not contain more than 20 variables and constants. An array is counted as one variable.

M

M

MAXLEN

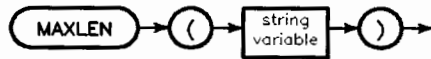
Supported On	UX WS DOS
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

MAXLEN returns the maximum (declared) length of a string variable in bytes. The declared length is specified in the DIM, COM, or ALLOCATE statement. If you are using ASCII characters, the number of bytes equals the number of characters.

Example Statements

```
MAXLEN(String$)
N_columns=MAXLEN(String_array$(1))
```

Syntax



Item	Description	Range
string variable	any simple string variable or subscripted string array element	(see Semantics)

Semantics

If the length of a string variable is not explicitly declared (using COM, DIM, or ALLOCATE) before it appears in a program, it will automatically have a length of 18 characters. This function does not return the *current* length of the variable; use the LEN function for that purpose.

MAXREAL

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

MAXREAL returns the largest positive REAL number available in the range of the computer.

Example Statements

```
IF X<=LGT(MAXREAL) THEN Y=10^X
Half_max=MAXREAL/2
```

**Syntax****Semantics**

The value of MAXREAL is approximately 1.797 693 134 862 32E+308.

MERGE ALPHA WITH GRAPHICS

Supported On	UX WS DOS*
Option Required	GRAPH
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

MERGE ALPHA WITH GRAPHICS is used to merge the “simulated” separate alpha and graphics rasters set up by the SEPARATE ALPHA FROM GRAPHICS statement.

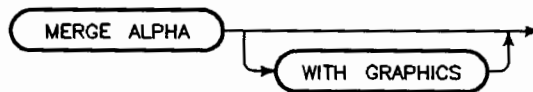
MERGE ALPHA gives an error on terminals in HP BASIC/UX. SEPARATE ALPHA gives an error in X on HP BASIC/UX.

Example Statements

```
MERGE ALPHA
```

```
IF done THEN MERGE ALPHA WITH GRAPHICS
```

Syntax



Semantics

This statement is used to return the simulated separate alpha and graphics rasters on multi-plane bit-mapped alpha displays to their “overlapped” (default) mode. If the display is *not* a bit-mapped alpha display, an error will be reported.

The statement performs the following actions:

1. PLOTTER IS CRT, “INTERNAL” is executed.

MERGE ALPHA WITH GRAPHICS

2. If the display is a multi-plane, bit-mapped alpha display, then the following actions are also taken; however, note that these actions do not take place when running in the X Window environment.
 - a. The alpha mask is set to its maximum value ($2^n - 1$, where n is the number of display planes).
 - b. The alpha pen is set to its default color.
 - c. The display is cleared (CLEAR SCREEN).
 - d. The graphics mask is set to its maximum value ($2^n - 1$, where n is the number of display planes).
 - e. The color map is re-initialized (to the default entries)

Here is a HP BASIC program that performs similar configuration of a 4-plane, bit-mapped alpha display:

```
100 PLOTTER IS CRT,"INTERNAL" ! To enable GESCAPE.
110 ALPHA MASK 15 ! Restore default.
120 CLEAR SCREEN
130 ALPHA ON ! Display alpha plane.
140 GRAPHICS ON ! Display graphics planes.
150 INTEGER Gm(0) ! Set up array for GESCAPE.
160 Gm(0)=15 !
170 GESCAPE CRT,7,Gm(*) ! Restore default.
180 PLOTTER IS CRT,"INTERNAL" ! To reset color map.
190 ALPHA PEN 4 ! Restore default.
200 END
```

M

MIN

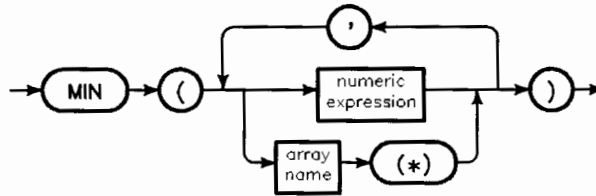
Supported On	UX WS DOS IN
Option Required	MAT
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

MIN returns a value equal to the least value in the list of arguments. If an array is specified as part of the list of arguments, then each element of the array is considered a separate value. An INTEGER is returned only if all arguments in the list are INTEGER.

Example Statements

```
Smallest=MIN(Elements(*))
PRINT MIN(Item1,17,Total/3)
```

Syntax



Item	Description	Range
array name	name of a numeric array	any valid name

Semantics

COMPLEX arguments are not allowed with this function.

Note

It is possible for the space needed for MIN to exceed the temporary storage allocated for expression evaluation. If the computer is close to overflowing memory this can be a *fatal* error and can crash the computer. It is recommended that statements including MIN not contain more than 20 variables and constants. An array is counted as one variable.

M

MINREAL

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

MINREAL returns the smallest positive REAL number available in the range of the computer.

Example Statements

```
IF X>=LOG(MINREAL) THEN Y=EXP(X)
```

Syntax



Semantics

The value of MINREAL is approximately 2.225 073 858 507 24E-308.

MOD

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

MOD returns the remainder of a division.

Example Statements

```
Remainder=Dividend MOD Divisor
PRINT "Seconds =";Time MOD 60
```

Syntax



Item	Description	Range
dividend	numeric expression	—
divisor	numeric expression	not equal to 0

Semantics

MOD returns an INTEGER value if both arguments are INTEGER. Otherwise the returned value is REAL. COMPLEX arguments are not allowed with this function.

For INTEGERS, MOD is equivalent to $X - Y \times (X \text{ DIV } Y)$. This may return a different result from the modulus function on other computers when negative numbers are involved.

MODULO

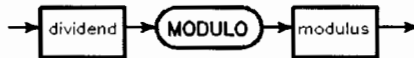
Supported On UX WS DOS IN
Option Required None
Keyboard Executable Yes
Programmable Yes
In an IF ... THEN ... Yes

MODULO returns the integer remainder resulting from a division.

Example Statements

```
Remainder=Dividend MODULO Divisor  
PRINT "Seconds =";Time MODULO 60
```

Syntax



Item	Description	Range
dividend	numeric expression	range of REAL
modulus	numeric expression	range of REAL, ≠ 0

Semantics

The type of the result is the higher of the types of the two operands. If the modulus is zero, then error 31 occurs. COMPLEX arguments are not allowed with this function. $X \text{ MODULO } Y$ is equivalent to $X - Y \times \text{INT}(X/Y)$. The result satisfies:

```
0 <= (X MODULO Y) < Y if Y>0  
Y < (X MODULO Y) <= 0 if Y<0
```

MOVE

Supported On	UX WS DOS IN
Option Required	GRAPH
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

MOVE moves the physical and logical position of the graphics pen to specified X and Y coordinates without drawing a line.

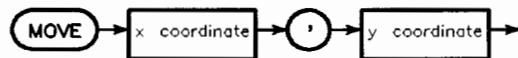
Example Statements

MOVE 10,75

MOVE Next_x,Next_y



Syntax



Item	Description	Range
x coordinate	numeric expression in current units	—
y coordinate	numeric expression in current units	—

Semantics

The pen is raised before the move and remains up after the move. The X and Y coordinates are interpreted according to the current unit-of-measure.

If both current physical pen position and specified pen position are outside current clip limits, no physical pen movement is made; however, the logical pen position is moved to the specified coordinates.

MOVE

Applicable raphics Transformations

	Scaling	PIVOT	CSIZE	LDIR	PDIR
Lines (generated by moves and draws)	X	X			[4]
Polygons and rectangles	X	X			X
Characters (generated by LABEL)			X	X	
Axes (generated by AXES & GRID)	X				
Location of Labels	[1]	[3]		[2]	

¹The starting point for labels drawn after lines or axes is affected by scaling.

²The starting point for labels drawn after other labels is affected by LDIR.

³The starting point for labels drawn after lines or axes is affected by PIVOT.

⁴RPLOT and IPLOT are affected by PDIR.

MOVELINES

Supported On	UX WS DOS
Option Required	EDIT and PDEV
Keyboard Executable	Yes
Programmable	No
In an IF ... THEN ...	No

M

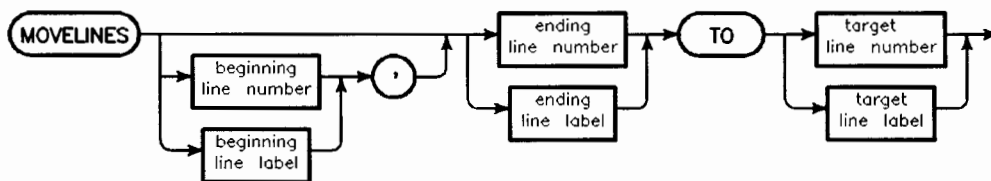
MOVELINES moves contiguous program lines from one location to another. If only one line identifier is specified, only that line is moved.

Example Statements

```

MOVELINES 1200 TO 3250
MOVELINES 10,440 TO 540
MOVELINES Label1,Label2 TO Label3
    
```

Syntax



MOVELINES

Item	Description	Range
beginning line number	integer constant identifying program line	1 to 32 766 (1 through 2 147 483 646 for HP BASIC/UX 700)
beginning line label	name of a program line	any valid name
ending line number	integer constant identifying program line	1 to 32 766 (1 through 2 147 483 646 for HP BASIC/UX 700)
ending line label	name of a program line	any valid name
target line number	integer constant identifying program line	1 to 32 766 (1 through 2 147 483 646 for HP BASIC/UX 700)
target line label	name of a program line	any valid name

M

Semantics

If the ending line identifier is not specified, only one line is moved.

The target line identifier will be the line number of the first line of the moved program segment. Moved lines are renumbered if necessary. The code (if any) which is "pushed down" to make room for the moved code is renumbered if necessary.

Line number references to the moved code are updated as they would be by a REN command (except external references to non-existent lines are renumbered).

If there are any DEF FN or SUB statements in the moved code, the target line number must be greater than any existing line number.

If you try to move a program segment to a line number *contained* in the segment, an error will result and no moving will occur.

MOVELINES

If the starting line number does not exist, the next line is used. If the ending line number does not exist, the previous line is used. If a line label doesn't exist, an error occurs and no moving takes place.

If an error occurs *during* a MOVELINES (for example, a memory overflow), the move is terminated and the program is left partially modified.

M

MOVE WINDOW

Supported On	UX WS*
Option Required	RMBUX
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

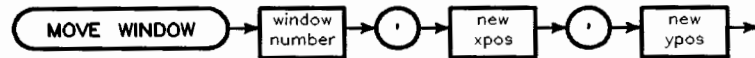
MOVE WINDOW moves a window to a new location specified in pixel units (0,0 is upper left). This statement can be entered in the HP BASIC/UX/WS editor, but executes only in HP BASIC/UX in X.

Example Statements

```
MOVE WINDOW 609, 100, 100
```

```
MOVE WINDOW My_plot,Xval,Yval
```

Syntax



Item	Description	Range
window number	numeric expression, rounded to integer	600 through 699
new xpos	numeric expression, rounded to integer in pixel units	integer
new ypos	numeric expression, rounded to integer in pixel units	integer

Semantics

This statement is only valid when running under X Windows. It then moves the window specified by the window number to a new location on the CRT. When not in a window system, this statement will cause an error. The specified window must be one created with the CREATE WINDOW statement, or be the root HP BASIC window (number 600).

The new xpos and new ypos parameters specify the new upper left corner position in pixel coordinates. The coordinates 0,0 specifies the upper left corner of the CRT. If the xpos and ypos parameters are greater than the size of the CRT then the window is moved off the screen and no longer visible.

The position of the window within the stack of windows remains the same. The contents of the window are moved with the window. The window is not altered.

M

MSI

MSI is identical to MASS STORAGE IS.

M

MTA

See SEND.

M

N

NEXT - NUM

N
1

NEXT - NUM N-1

NEXT

See FOR ... NEXT.

N

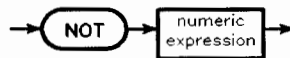
NOT

Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

NOT returns 1 if its argument equals 0. Otherwise, 0 is returned.

Example Statements

```
Invert_flag=NOT Std_device
IF NOT My_job THEN Sleep
```

Syntax**Semantics**

When evaluating the argument, a non-zero value (positive or negative) is treated as a logical 1; only zero is treated as a logical 0. Complex values are not allowed.

The logical complement is shown below:

A	NOT A
0	1
1	0

NPAR

Supported On	UX WS DOS
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

NPAR returns the number of parameters passed to the current subprogram. If execution is currently in the main program, NPAR returns 0.

N

Example Statements

```
IF NPAR>3 THEN Extra  
Factors=NPAR-2
```

Syntax



NUM

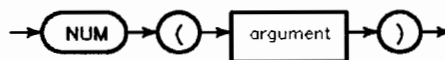
Supported On	UX WS DOS IN
Option Required	None
Keyboard Executable	Yes
Programmable	Yes
In an IF ... THEN ...	Yes

NUM returns the decimal value of the ASCII character code of the first byte in the specified string. The range of returned values is 0 through 255.

Example Statements

```
Ascii_val=NUM(String$)
A$[I;1]=CHR$(NUM(A$[I])+32)
```

Syntax



Item	Description	Range
argument	string expression	not a null string

Two-Byte Language Specifics

Certain localized versions of HP BASIC, such as Japanese localized HP BASIC, support two-byte characters. NUM handles two-byte characters one *byte* at a time, not one *character* at a time. You must use substrings to identify each byte of a two-byte character. For more information about two-byte characters, see the globalization chapters of *HP BASIC Porting and Globalization*.



Copyright © 1993
Hewlett-Packard Company
Printed in U.S.A. E1293



98616-90201