HP-UX Technical BASIC Reference Manual

Volume 2

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PACKARD

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Notice

Portable Computer Division
1000 N.E. Circle Blvd.
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Volume 1

Contents

Chapter 7

Keyword Summary

3 Glossary

A

alpha display: The portion of the display that receives alphanumeric information, including errors, warnings, characters entered from the keyboard, and output from statements such as `CAT`, `DIRECTORY`, `XREF`, `SCAN`, `DISP` and `LIST`.

angle mode: The current units used for interpreting angles—degrees, radians, or grads. The angle mode is changed by executing `DEG`, `RAD`, or `GRAD`.

argument: The parameter of a function.

arithmetic operators: +, −, *, /, ^, \ (or DIV), MOD.

array: A numeric or string variable that has been defined explicitly or implicitly to have one or two dimensions. An array is explicitly dimensioned when memory is reserved for it by a `DIM`, `REAL`, `SHORT`, `INTEGER`, or `COM` statement. Each item in an array is called an *element*. A numeric array can be dimensioned so that all its elements have REAL, SHORT, or INTEGER precision. A string array is dimensioned such that all its elements have the same maximum string length.

When an array is dimensioned, the number of elements in the array is defined by specifying the array *upper bound*. The *lower bound* is defined by the program option base (default=0). An array is implicitly dimensioned when a program references an array element before the array has been explicitly dimensioned. Implicitly dimensioned arrays have an upper bound equal to 10.

assignment statement: A statement in which a value is assigned to a variable.

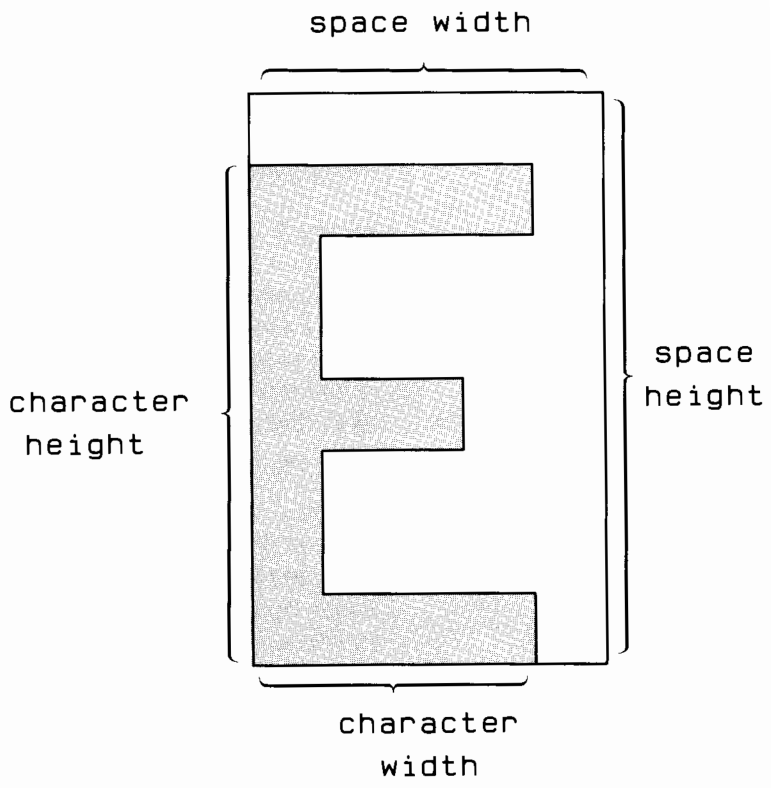
B

bit: A single digit in base 2 that must be 1 or 0.

byte: A group of eight bits. A byte evaluates to a decimal number in the range 0 through 255.

C

character space: The area occupied by both a character and the space surrounding the character that separates it horizontally and vertically from other characters.



clip: Establishing plotting boundaries. Plotting boundaries restrict the plotting area to a portion of the total area available (the physical limits or graphics limits specified by `LIMIT`). Restrictions imposed by the plotting boundaries do not affect the logical pen position. Pen position is set by the current scale, and may lie outside the plotting boundaries. However, no lines, axes, or grids are drawn outside the plotting boundaries.

concatenate: To join together two or more strings.

conditional branching: A form of branching that occurs only when a specified condition or set of conditions is met.

control characters: Characters interpreted by devices as instructions.

current working directory: The current working directory is accessed by mass storage statements when a file name is used alone, rather than as part of part of an HP-UX path name. The current working directory can be changed by executing the `MASS STORAGE IS` statement.

D

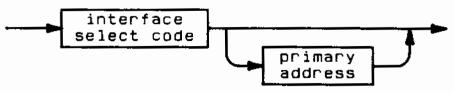
data pointer: An internal mechanism used to indicate the next `DATA` statement item to be read.

default: The action taken or value used unless otherwise specified. The system "wakes up" using certain default values. In addition, many BASIC statements have optional parameters which use default values when no parameter is specified.

default graphics conditions: See **graphics default conditions.**

device name:* The name assigned to each disc drive unit by the operating system at power on, used as part of an HP-UX path name. The device names are listed in the /dev directory.

device selector: A numeric expression used to designate the device or interface acting as source or destination of data in an input/output operation. The device selector consists of a valid interface select code or a valid combination of interface select code and primary address.



The interface select code is a one- or two-digit integer in the range 0 through 10. Select codes 0 through 2 are reserved for internal devices. The primary address is a two-digit number in the range 00 through 31.

E

end-of-line (EOL) sequence: The sequence of characters sent to an output device at the end of a `PRINT`, `DISP`, `LABEL`, or `OUTPUT` list. The default EOL is carriage return/line feed.

escape sequence: A sequence of characters beginning with the escape (ESC) character, CHR$(27).

* Machine-dependent parameter. Device names may be used by single-user systems with removable file structures.

F

file name: A sequence of 1 to 14 characters used to identify a particular file. Any keyboard character can be used except slash and leading colon. The file name is entered into the directory in which the file is located.

file pointer: A mechanism used to indicate where in an open data file the next item of data will be read or printed.

file selector: An integer in the range 11 through 20, used to assign an I/O path to a file.

flag: A bit that can be individually set (1), cleared (0), and read. Individual flags are set using the `SFLAG` statement, and cleared using the `CFLAG` statement. The `SFLAG` statement can also be used to set and/or clear up to the entire 64 flags at a time.

flat file structure: A file structure in which each disc has only one directory—the top-level directory.

free field format: An output format used with simple (without `USING`) `DISP`, `PRINT`, and `OUTPUT` statements in which items are output left-justified in a field of 11, 21, or 32 columns. Free field format is specified by separating items by commas.

function: A procedural call that returns a value. The call can be to a user-defined function or to a function provided by BASIC. The value returned by the function replaces the function call as the expression containing the function is evaluated.

G

global declarations: Declarations and system status parameters that are unaffected by switching between the main BASIC program and subprograms. All non-local declarations are global. (See **local declarations.**)

graphics area: The area enclosed by the graphics limits. No plotting or labeling can occur outside this area.

graphics default conditions: The graphics default conditions are activated at power-on, at reset, and whenever a `PLOTTER IS` or `LIMIT` statement is executed. The default conditions are:

- Plotting boundaries (set by `CLIP` and `LOCATE`) are set to the graphics limits.
- The plotting area is scaled in graphics units (GU's), the default scale.
- The computer is set to user units mode with user units (UU's) equal to graphics units (GU's).
- Pen color is set to pen 1.
- Lines are drawn using line type 1.
- Labels are drawn using the default character size.
- Labels are positioned as LORG 1.
- Labeling direction is left-to-right (LDIR 0).
- The logical pen moves to the orgin (lower left corner).

graphics display: The portion of display memory used as destination for graphics output.

graphics limits: The area of a plotting device beyond which no plotting or labeling can occur. Graphics limits can be set manually and read by the `PLOTTER IS` statement, or they can be set by `LIMIT`.

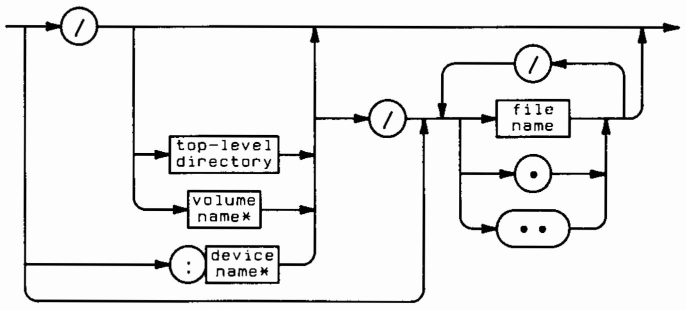
graphics units scale: 1/100 of the shortest axis on the plotting device. Graphic units scaling is active at reset and whenever `PLOTTER IS`, `LIMIT`, or `SETGU` is executed.

H

hard clip limits: The physical limits of a plotting device.

hierarchy: The precedence system that determines the order in which operations are performed in numeric and string expressions. Operations with the highest precedence are performed first. Multiple operations with the same precedence are performed from left to right. Refer to **Reference Tables** for tables of the math and string hierarchies.

HP-UX path name: The complete name of a file. The pathname starts at the root directory (absolute path name) or at the current working directory (relative path name) and traces the path leading to the file through the file hierarchy.



* Implemented for certain single-user systems with removable file systems.

I

interface select code: An integer in the range 0 through 10, used to provide an I/O path to an interface or internal device. Numbers 0 through 2 are reserved for internal devices.

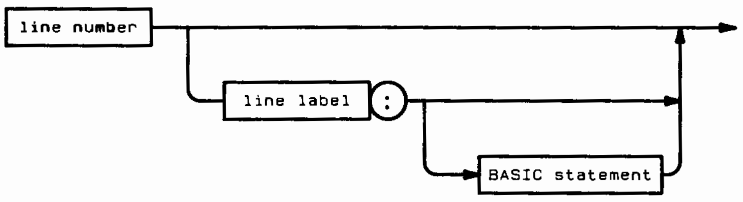
interrupt: An interruption to normal program execution caused by a particular event. Event-initiated interrupts include `ON KEY#`, `ON KYBD`, `ON ERROR`, `ON INTR`, `ON TIMER`, and `ON TIMEOUT` branching.

J

Julian Day number: An astronomical convention representing the number of days since January 1, 4713 B.C.

L

line label: A character string up to 31 characters long used to identify a program line. The label can contain letters, numbers, and the underscore character; the first character must be a letter. A colon separates the line label from the BASIC statement it identifies.



literal: A string constant containing characters entered from the keyboard, including the metacharacter, ~.

local declarations—declarations and system status parameters that are in affect only within the main program or subprogram in which they are declared. The local declarations are:

OFF EOT	↔	ON EOT
OFF ERROR	↔	ON ERROR
OFF INTR	↔	ON INTR
OFF KEY#	↔	ON KEY#
OFF KEYBD	↔	ON KEYBD
OFF TIMEOUT	↔	ON TIMEOUT
OFF TIMER	↔	ON TIMER#
TRACE	TRACE VAR	TRACE ALL

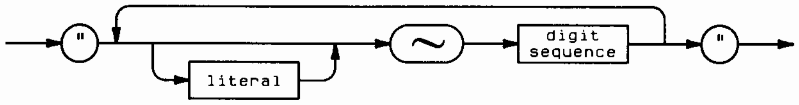
logical expression: A numeric expression that evaluates to 1 (true) or 0 (false). Logical expressions may contain relational (= < > <= >= #) and logical (AND, OR, NOT, EXOR) operators.

logical pen: The position of the plotting pen as specified in a plotting statement. The logical pen position is different from the actual pen position when a plotting statement specifies coordinates outside the plotting boundaries or graphics limits.

M

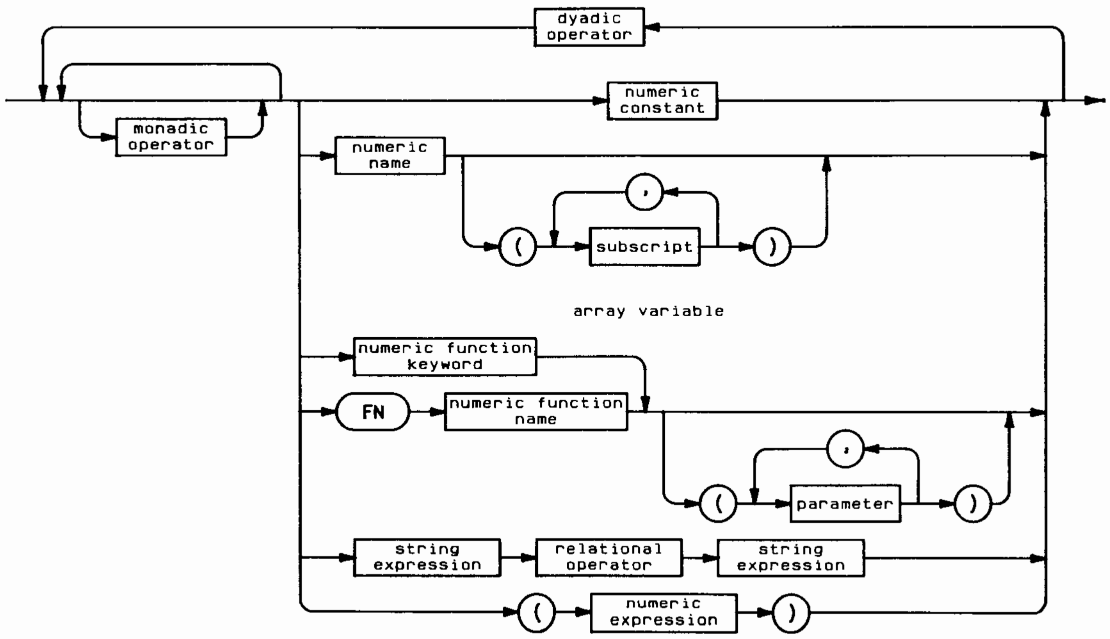
matrix: A two-dimensional array.

metacharacter: A character (~) used within a literal to indicate that the next character or group of characters has special significance.



N

numeric expression: An expression that evaluates to a numeric result.



Item	Description
monadic operator	An operator that performs its operation on the expression immediately to its right: +, −, NOT.
dyadic operator	An operator that performs its operation on the two expressions it is between: ^, *, /, \, MOD, DIV, +, −, =, <, >, #, <=, >=, AND, OR, EXOR.
numeric constant	A numeric quantity whose value is expressed using numerals and optional decimal point and exponent.
numeric name	The name of a numeric variable.
subscript	A numeric expression used to reference an element of an array.
numeric function keyword	A BASIC keyword that invokes a function, returning a numeric value.
numeric function name	The name of a user-defined function that returns a numeric value.
parameter	A numeric or string expression that is passed to a function.
relational operator	An operator which returns a 1 (true) or 0 (false) based on the results of a relational test of the operands it separates: =, <, >, #, <=, >=.

O

option base: The explicit or implied lower bound of all arrays in a program. The default option base is 0.

P

path name: See **HP-UX path name**.

plotting area: The area, designated by `CLIP` or `LOCATE`, in which lines and axes may be drawn.

plotting boundaries: Boundaries of the plotting area. Labels may be placed outside the plotting boundaries; however, they must be within the graphics limits. The plotting area specified by `CLIP` and `LOCATE` can be entirely within the graphics limits, or it can extend outside the graphics limits or physical limits of the device. However, no plotting or labeling is permitted outside the graphics limits. Plotting boundaries are in effect when the computer is in users units (UU's) mode. The plotting boundaries are set equal to the graphics limits when the computer is set to graphics units (GU's) mode.

prerun error: An error occurring in the context of a program, such as referencing a non-existent line, duplicate user-defined functions, and illegal array dimensions.

primary address: A number used in conjunction with the interface select code to define the device selector. On certain interfaces, the primary address describes the location of a device on an interface. On other interfaces, the primary address describes certain characteristics of the device. The primary address must be a two-digit number in the range 00 through 31.

print-all mode: An output mode, enabled by executing the `PRINT ALL` statement, in which all displayed alphanumeric output is also sent toutput is also sent to the PRINTER IS printer. Print-all mode is canceled by executing `NORMAL`.

R

relational expression: An expression consisting of two numeric expressions or two string expressions separated by a relational operator. A relational expression evaluates to true (1) or false (0).

relational operator: =, >, <, <>, #, <=, or >=

S

simple variable: A variable in which one value can be stored; a non-array variable.

standard number format: The format used to output numbers when no other format is specified. Numbers are output as follows:

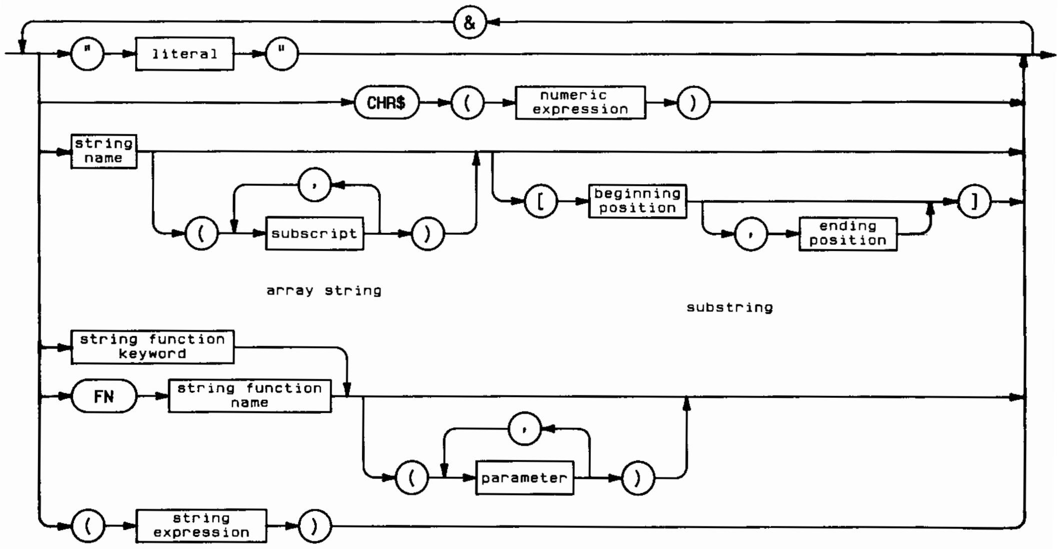
- All significant digits of a number are output.
- Excess zeros to the right of the decimal point are suppressed.
- Leading zeros to the left of the decimal point are truncated.
- Numbers whose absolute values are greater than or equal to 1 are output with no exponents if they can be represented precisely in the number of digit places available.*
- Numbers between -1 and 1 are output showing all significant digits and no exponent if they can be represented precisely in the number of decimal places available.*
- All other numbers are expressed in scientific notation with a mantissa† in the range 1 through 10, followed by E, a minus sign if necessary, and the numeric value of the exponent.

* Machine-dependent value.

† The number of decimal places in the mantissa is machine-dependent.

string constant: A data type that may contain literals and concatenated CHR$ functions. The first character in the string is in position 1. The length of the string is the current number of characters in the string, excluding the metacharacter (~), and cannot exceed the dimensioned length. If a string is not explicitly dimensioned, it is implicitly dimensioned to 18 characters. When a string is empty, it is called a null string and has a length of zero. A null string can be represented as an empty literal (for example, A$="") or as a substring in which the ending position is one less than the beginning position (for example, A$[4,3]).

string expression: An expression that evaluates to a string result.



Item	Description
literal	A string constant composed of any character generated from the keyboard.
numeric expression	—
string name	The name of a string variable.
subscript	A numeric expression used to specify an element of an array.
beginning position	A numeric expression specifying the position of the first character in a substring.
ending position	A numeric expression specifying the position of the last character in a substring.
string function keyword	A BASIC keyword that invokes a function returning a string value.
string function name	The name of a user-defined function that returns a string value.
parameter	A numeric or string expression that is passed to a function.

subprogram: A program segment that can be detached from the main program and stored it its own subprogram file. When a subprograms is called by a program or other subprogram, the called subprogram is loaded, if necessary, into computer memory at the end of the calling (sub)program and automatically run. Calling a subprogram has no effect on BASIC and binary programs currently in memory.

All subprograms must begin with a `SUB` statement and end with a `SUBEND` or `SUBEXIT` statement. Line numbers and line labels within the subprogram are independent of the main program or other subprograms. For example, both the main program and subprogram can have the same line numbers.

A subprogram is invoked by execution of a `CALL` statement. The `CALL` statement includes an optional list of parameters passed to the subprogram by value or address.

subscript: A number that specifies the row or column location of an element of an array.

substring: A contiguous series of characters that comprises all or part of a string. If no ending position is specified, the substring includes all characters from the specified beginning position to the end of the string.

syntax error: An error returned when attempting to enter an improperly constructed statement or command.

T

top-level directory: The highest-level directory on a disc. In the system hierarchy of files, the top-level directory of each mounted disc is located directly beneath the operating system root directory. In single-user systems with removable file systems, the volume name of the disc becomes the top-level directory when the disc is mounted. In a "flat" file structure, the top-level directory is the only directory file on the disc.

trigonometric mode: The current units for interpreting angles—degrees, radians, or grads. The trigonometric mode is changed by executing `DEG`, `RAD`, or `GRAD`.

V

variable name: A name of a numeric or string variable. All string variable names must end with the character $. Names can be up to 32 characters long, and can be any sequence of letters, numbers and the underscore character, except that the first character must be a letter.

vector: A one-dimensional array.

volume name: A name used by single-user systems with removable file systems to identify a particular disc. A volume name is assigned to the disc when it is formatted. When the disc is mounted by the operating system, the volume name is entered into the root directory as the name of the top-level directory on the disc.

4 Reference Tables

Math Hierarchy

Precedence	Operator
Highest	Parentheses; may be used to force any order of operations
	Functions; user-defined and BASIC
	Exponentiation: ^
	Monadic operators: +, −, NOT
	Multiplication and division: *, /, MOD, DIV or \
	Addition and subtraction: +, −
	Relational operators: =, <, >, <=, >=, # or <>
↓	AND
Lowest	OR EXOR

String Hierarchy

Precedence	Operator
Highest	Parentheses
↓	Functions (user-defined and BASIC), substring operations
Lowest	Concatenation: &

US ASCII Character Set

ASCII Char.	Equivalent Forms				HP-IB
	Dec	Binary	Oct	Hex	
NUL	0	00000000	000	00	
SOH	1	00000001	001	01	GTL
STX	2	00000010	002	02	
ETX	3	00000011	003	03	
EOT	4	00000100	004	04	SDC
ENQ	5	00000101	005	05	
ACK	6	00000110	006	06	
BEL	7	00000111	007	07	
BS	8	00001000	010	08	GET
HT	9	00001001	011	09	TCT
LF	10	00001010	012	0A	
VT	11	00001011	013	0B	
FF	12	00001100	014	0C	
CR	13	00001101	015	0D	
SO	14	00001110	016	0E	
SI	15	00001111	017	0F	
DLE	16	00010000	020	10	
DC1	17	00010001	021	11	LLO
DC2	18	00010010	022	12	
DC3	19	00010011	023	13	
DC4	20	00010100	024	14	DCL
NAK	21	00010101	025	15	

ASCII Char.	Equivalent Forms				HP-IB
	Dec	Binary	Oct	Hex	
SYNC	22	00010110	026	16	
ETB	23	00010111	027	17	
CAN	24	00011000	030	18	SPE
EM	25	00011001	031	19	SPD
SUB	26	00011010	032	1A	
ESC	27	00011011	033	1B	
FS	28	00011100	034	1C	
GS	29	00011101	035	1D	
RS	30	00011110	036	1E	
US	31	00011111	037	1F	
space	32	00100000	040	20	LA0
!	33	00100001	041	21	LA1
"	34	00100010	042	22	LA2
#	35	00100011	043	23	LA3
$	36	00100100	044	24	LA4
%	37	00100101	045	25	LA5
&	38	00100110	046	26	LA6
'	39	00100111	047	27	LA7
(	40	00101000	050	28	LA8
)	41	00101001	051	29	LA9
*	42	00101010	052	2A	LA10
+	43	00101011	053	2B	LA11

US ASCII Character Set (continued)

ASCII Char.	Equivalent Forms				HP-IB
	Dec	Binary	Oct	Hex	
,	44	00101100	054	2C	LA12
-	45	00101101	055	2D	LA13
.	46	00101110	056	2E	LA14
/	47	00101111	057	2F	LA15
0	48	00110000	060	30	LA16
1	49	00110001	061	31	LA17
2	50	00110010	062	32	LA18
3	51	00110011	063	33	LA19
4	52	00110100	064	34	LA20
5	53	00110101	065	35	LA21
6	54	00110110	066	36	LA22
7	55	00110111	067	37	LA23
8	56	00111000	070	38	LA24
9	57	00111001	071	39	LA25
:	58	00111010	072	3A	LA26
;	59	00111011	073	3B	LA27
<	60	00111100	074	3C	LA28
=	61	00111101	075	3D	LA29
>	62	00111110	076	3E	LA30
?	63	00111111	077	3F	UNL
@	64	01000000	100	40	TA0
A	65	01000001	101	41	TA1
B	66	01000010	102	42	TA2
C	67	01000011	103	43	TA3
D	68	01000100	104	44	TA4
E	69	01000101	105	45	TA5
F	70	01000110	106	46	TA6
G	71	01000111	107	47	TA7
H	72	01001000	108	48	TA8
I	73	01001001	109	49	TA9
J	74	01001010	110	50	TA10
K	75	01001011	111	51	TA11
L	76	01001100	114	4C	TA12
M	77	01001101	115	4D	TA13
N	78	01001110	116	4E	TA14
O	79	01001111	117	4F	TA15
P	80	01010000	120	50	TA16
Q	81	01010001	121	51	TA17
R	82	01010010	122	52	TA18
S	83	01010011	123	53	TA19
T	84	01010100	124	54	TA20
U	85	01010100	125	55	TA21

US ASCII Character Set (continued)

ASCII Char.	Equivalent Forms				HP-IB
	Dec	Binary	Oct	Hex	
V	86	01010110	126	56	TA22
W	87	01010111	127	57	TA23
X	88	01011000	130	58	TA24
Y	89	01011001	131	59	TA25
Z	90	01011010	132	5A	TA26
[	91	01011011	133	5B	TA27
\	92	01011100	134	5C	TA28
]	93	01011101	135	5D	TA29
^	94	01011110	136	5E	TA30
_	95	01011111	137	5F	UNT
'	96	01100000	140	60	SC0
a	97	01100001	141	61	SC1
b	98	01100010	142	62	SC2
c	99	01100011	143	63	SC3
d	100	01100100	144	64	SC4
e	101	01100101	145	65	SC5
f	102	01100110	146	66	SC6
g	103	01100111	147	67	SC7
h	104	01101000	150	68	SC8
i	105	01101001	151	69	SC9
j	106	01101010	152	6A	SC10

ASCII Char.	Equivalent Forms				HP-IB
	Dec	Binary	Oct	Hex	
k	107	01101011	153	6B	SC11
l	108	01101100	154	6C	SC12
m	109	01101101	155	6D	SC13
n	110	01101110	156	6E	SC14
o	111	01101111	157	6F	SC15
p	112	01110000	160	70	SC16
q	113	01110001	161	71	SC17
r	114	01110010	162	72	SC18
s	115	01110011	163	73	SC19
t	116	01110100	164	74	SC20
u	117	01110101	165	75	SC21
v	118	01110110	166	76	SC22
w	119	01110111	167	77	SC23
x	120	01111000	170	78	SC24
y	121	01111001	171	79	SC25
z	122	01111010	172	7A	SC26
{	123	01111011	173	7B	SC27
|	124	01111100	174	7C	SC28
}	125	01111101	175	7D	SC29
~	126	01111110	176	7E	SC30
DEL	127	01111111	177	7F	SC31

Roman Extension Character Set

ASCII Char	Equivalent Forms	
	Dec	Binary
	128	10000000
	129	10000001
	130	10000010
	131	10000011
	132	10000100
	133	10000101
	134	10000110
	135	10000111
	136	10001000
	137	10001001
	138	10001010
	139	10001011
	140	10001100
	141	10001101
	142	10001110
	143	10001111
	144	10010000
	145	10010001
	146	10010010
	147	10010011
	148	10010100
	149	10010101
	150	10010110
	151	10010111
	152	10110000
	153	10011001
	154	10011010
	155	10011011
	156	10011100
	157	10011101
	158	10011110
	159	10011111
space	160	10100000
À	161	10100001
Â	162	10100010
È	163	10100011
Ê	164	10100100
Ë	165	10100101
Î	166	10100110
Ï	167	10100111
´	168	10101000
`	169	10101001
ˆ	170	10101010
¨	171	10101011

Roman Extension Character Set (continued)

ASCII Char	Equivalent Forms		ASCII Char	Equivalent Forms	
	Dec	Binary		Dec	Binary
˜	172	10101100	ê	193	11000001
Ù	173	10101101	ô	194	11000010
Û	174	10101110	û	195	11000011
£	175	10101111	á	196	11000100
¯	176	10110000	é	197	11000101
	177	10110001	ó	198	11000110
	178	10110010	ú	199	11000111
°	179	10110011	à	200	11001000
Ç	180	10110100	è	201	11001001
ç	181	10110101	ò	202	11001010
Ñ	182	10110110	ù	203	11001011
ñ	183	10110111	ä	204	11001100
¡	184	10111000	ë	205	11001101
¿	185	10111001	ö	206	11001110
¤	186	10111010	ü	207	11001111
£	187	10111011	Å	208	11010000
¥	188	10111100	î	209	11010001
§	189	10111101	Ø	210	11010010
ƒ	190	10111110	Æ	211	11010011
¢	191	10111111	å	212	11010100
â	192	11000000	í	213	11010101

Roman Extension Character Set (continued)

ASCII Char	Equivalent Forms	
	Dec	Binary
ø	214	11010110
æ	215	11010111
Ä	216	11011000
í	217	11011001
Ö	218	11011010
Ü	219	11011011
É	220	11011100
ï	221	11011101
ß	222	11011110
Ô	223	11011111
Á	224	11100000
Ã	225	11100001
ã	226	11100010
Ð	227	11100011
đ	228	11100100
Í	229	11100101
Ì	230	11100110
Ó	231	11100111
Ò	232	11101000
Õ	233	11101001
õ	234	11101010

ASCII Char	Equivalent Forms	
	Dec	Binary
Š	235	11101011
š	236	11101100
Ú	237	11101101
Ÿ	238	11101110
ÿ	239	11101111
Þ	240	11110000
þ	241	11110001
	242	11110010
	243	11110011
	244	11110100
	245	11110101
–	246	11110110
¼	247	11110111
½	248	11111000
ª	249	11111001
º	250	11111010
«	251	11111011
■	252	11111100
»	253	11111101
±	254	11111110
	255	11111111

Reset Conditions

Condition	Power-on	Reset	Scratch	Run	Chain	Init	Call	Subend	Load
CRT:									
CRT IS	1	R	—	—	—	—	—	—	—
ALPHA/GRAPHICS	alpha	R	R	R	R	R	—	—	R
Current Display Line	2	—	—	—	—	—	—	—	—
CURSOR ON/OFF	on	R	R	—	—	—	—	—	—
Keyboard:									
Typing Aids	default	R	—	—	—	—	—	—	—
User-defined keys (in programs)	none	R	R	—	—	—	*	*	—
ENABLE KYBD	none	R	—	—	—	—	—	—	—
Keyboard mode	typewriter	—	—	—	—	—	—	—	—
Printer:									
PRINT ALL	off	R	—	—	—	—	—	—	—
Print Column	1	R	R	R	R	R	—	—	R
PRINTER IS	2	2	—	—	—	—	—	—	—
Variables:									
Program variables	none	—	R	R	R	†	—	—	R
Keyboard variables	none	R	R	R	R	R	—	—	R
COMmon variables	none	—	R	—	—	—	—	—	R
OPTION BASE	0	—	R	R	R	R	*	*	R
Graphics:									
PLOTTER IS	1	R	—	—	—	—	—	—	—
Graphics display	none	R	R	R	R	R	R	R	R
GU's/UU's mode	UU's	UU's	—	—	—	—	—	—	—
Scaling units	GU's	GU's	—	—	—	—	—	—	—
Pen	1	1	—	—	—	—	—	—	—
LINE TYPE	1	1	—	—	—	—	—	—	—
CSIZE	default	default	—	—	—	—	—	—	—
LORG	1	R	—	—	—	—	—	—	—
Graphics limits	device limits	R	—	—	—	—	—	—	—
Plotting area	graphics limits	R	—	—	—	—	—	—	—
Pen location	lower-left	R	—	—	—	—	—	—	—
PDIR	0	0	—	—	—	—	—	—	—
LDIR	0	0	—	—	—	—	—	—	—

* `CALL` suspends the program ON KEY# assignments and option base. They are restored by `SUBEND`.

† Allocated.

R — returned to power-on state.
— — no effect.

Reset Conditions (continued)

Condition	Power-on	Reset	Scratch	Run	Chain	Init	Call	Subend	Load
Math:									
DEFAULT ON/OFF	on	R	—	—	—	—	—	—	—
Trigonometric mode	rad	R	—	—	—	—	—	—	—
RANDOMIZE seed	default value	R	—	—	—	—	—	—	—
Clock functions:									
TIME	—	—	—	—	—	—	—	—	—
DATE	—	—	—	—	—	—	—	—	—
Even-initiated branching:									
ON EOT	off	—	R	R	R	—	*	*	—
ON ERROR	off	—	R	R	R	R	*	*	—
ON INTR	off	—	R	R	R	R	*	*	—
ON KEY#	off	—	R	R	R	R	*	*	—
ON KYBD	off	—	R	R	R	R	*	*	—
ON TIMEOUT	off	—	R	R	R	R	*	*	—
ON TIMER#	off	—	R	R	R	R	*	*	—
Mass Storage:									
ASSIGN# buffers	none	R	R	R	R	R	—	—	R
MASS STORAGE IS	cwd†	—	—	—	—	—	—	—	—
CHECK READ	off	—	—	—	—	—	—	—	—
READ#/PRINT# pointer	none	—	—	—	—	—	—	—	—
Tracing:									
TRACE	off	R	R	—	—	—	*	*	R
TRACE VAR	off	R	R	—	—	—	*	*	R
TRACE ALL	off	R	R	—	—	—	*	*	R
NPAR	0	R	R	R	R	R	R	—	R
READ/DATA pointer	none	R	R	R	R	R	‡	‡	R
Binary Programs	none	—	R	—	—	—	—	—	R
BASIC program	none	—	R	—	—	—	—	—	—
Subprogram(s)	none	—	R	—	—	—	—	—	R
flags	cleared	—	R	R	R	—	R	—	R

* CALL disables tracing and even-initiated branching until control returns to the calling program. SUBEND disables tracing and branching in the subprogram.

† Current working directory.

‡ CALL saves the position of the DATA pointer; SUBEND restores its position.

R	returned to power-on state.
—	no effect.

Boundaries and Scaling

Condition or Statement	Parameter Units	Effect on Mode GU's vs. UU's	Effect on Scaling Units	Effect on Graphics Limits	Effect on Plotting Boundaries
Power-on or Reset	—	In UU's	UU's=GU's Shortest dimension= 100 GU's	Set to default graphics limits of the graphics display	Set to default graphics limits of the graphics display
PLOTTER IS	—	Set to UU's mode	UU's=GU's	Read from device	Set to graphics limits
LIMIT	mm	Set to UU's mode	UU's=GU's	Set according to LIMIT parameters	Set to graphics limits
LOCATE	GU's	No effect	No effect	No effect	Set according to LOCATE parameters
CLIP	Current units	No effect	No effect	No effect	Set according to CLIP parameters
UNCLIP	—	No effect	No effect	No effect	Set to current graphics limits
SCALE	UU's	Set to UU's mode	Set according to SCALE parameters	No effect	No effect
SHOW	UU's	Set to UU's mode	Set in equal x,y units according to SHOW parameters	No effect	No effect
MSCALE	mm	Set to UU's mode	Set to mm units according to MSCALE parameters	No effect	No effect
SETGU	—	Set to GU's mode	GU's	No effect	Temporarily set to graphics limits
SETUU	—	Set to UU's mode	UU's	No effect	Restores plotting boundaries

Reflecting Plots WITH LIMIT, LOCATE, SCALE and SHOW

Order of Statement Parameters	**Effect**
x-max, x-min, y-min, y-max	Reflects output across y-axis
x-min, x-max, y-max, y-min	Reflects output across x-axis
x-max, x-min, y-max, y-min	Reflects output across origin

Pen Up/Down Status

Statement	**Pen Status after Execution**
AXES	Up
DRAW	Down
FRAME	Up
GRID	Up
IDRAW	Down
IMOVE	Up
IPLOT	Determined by parameter
LABEL	Up
LAXES	Up
LGRID	Up
LIMIT	Up
MOVE	Up
PENUP	Up
PLOT	Determined by parameter
PLOTTER IS	Up
RPLOT	Determined by parameter
XAXIS	Up
YAXIS	Up

Pen Control With PLOT, IPLOT, and RPLOT

Pen Control Parameter	Pen Action
Positive, even	Pen moved and then lifted
Positive, odd	Pen moved and then lowered
Negative, even	Pen lifted and then moved
Negative, odd	Pen lowered and then moved

Graphics Display Pen Numbers

Pen Number	Graphics Display Operation
$\geqslant 1$	Plots white dots.
0	Pen is deactivated and does not plot.
-1 or <-2	Plots black dots.
-2	Performs an exclusive or, plotting white dots over black dots and black dots over white dots.

Pen Numbers With GCLEAR

Pen Number	Display Background Color After GCLEAR
$\geqslant 1$	Black
-1 or $\leqslant -2$	White
0	Uses previous pen number

Branch Precedence Table

Branch precedence indicates the order in which event-initiated branches are taken. Events with lower precedence can interrupt an active service routine. When two branches are pending, the one with the lower precedence number is taken first. When the first line of the service routine has been executed, the second pending branch is taken (unless the first line disables that branching).

Priority	**Branch Type**	**Select Code**							
		3	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	ON ERROR	← 1 →							
2	ON INTR	2	3	4	5	6	7	8	9
3	ON TIMEOUT	10	11	12	13	14	15	16	17
4	ON EOT	18	19	20	21	22	23	24	25
5	ON TIMER#	← 26 →							
6	ON KYBD	← 27 →							
7	ON KEY#	← 28 →							

HP-IB Control-Line Signals

Mnemonic	Message Name	Response
ATN	Attention	The Controller Active device asserts ATN true to source commands on the data bus or, in conjunction with EOI, to do a parallel poll. When ATN is false, data may be sent over the data bus by a designated talker.
DAV	Data Valid	Allows source to validate data lines.
EOI	End or Identify	Terminates a flow of data, and can be used with ATN to do a parallel poll.
IFC	Interface Clear (Abort)	The system controller uses this to place talkers and listeners in an unaddressed state. If control has been passed, the system controller again becomes active controller when it asserts IFC.
NDAC	Not Data Accepted	Used by devices to inform the source that data has been accepted.
NRFD	Not Ready For Data	Used to inform the source that all listener devices are ready for data.
REN	Remote Enable	Removes all devices from Local Lockout mode and causes all devices to revert to manual control. Any device that is addressed to listen while REN is true is placed in the REMOTE mode of operation.
SRQ	Service Request	Indicates a device's need for interaction with the controller.

HP-IB Multiple-Line Commands

Mnemonic	Message Name	Decimal Value	Response
DCL	Device Clear	20	Causes all devices to be initialized to a predefined or power-up state.
GET	Group Execute Trigger	8	Signals one or more devices to simultaneously initiate a set of device-dependent actions.
GTL	Go To Local	1	Causes selected device(s) to switch to local (front panel) control.
LAG (LA0–LA30)	Listen Address Group	32–62	A group of 31 listen addresses, one of which corresponds to the listen address of the interface.
LLO	Local Lockout	17	Disables remote-mode override switch (the LOCAL button) on peripheral device(s).
SCG (SC0–SC31)	Secondary Command Group	96–127	A group of 32 commands that are only recognized if they immediately follow a talk or listen address.
SDC	Selected Device Clear	4	Causes a specified device to be initialized to a predefined or power-up state.
SPD	Serial Poll Disable	25	Devices exit serial poll mode and are not allowed to send their status byte.
SPE	Serial Poll Enable	24	Devices enter serial poll mode and are allowed to send their status byte when addressed to talk.
TAG (TA0–TA30)	Talk Address Group	64–94	A group of 31 talk addresses.
TCT	Take Control	9	Passes bus controller responsibilities from the current controller to a device that can assume the bus supervisory role.
UNL	Unlisten	63	Device(s) become unaddressed to listen.
UNT	Untalk	95	Device(s) become unaddressed to talk.

5 I/O Registers

I/O Buffer Registers

Status Registers

Register	Default Value	Function
SR0	1	Buffer empty pointer
SR1	0	Buffer fill pointer
SR2	0	Active-in select code
SR3	0	Active-out select code

Control Registers

Register	Default Value	Function
CR0	1	Buffer empty pointer
CR1	0	Buffer fill pointer

HP-IB Interface

Status Register 0: Interface Identification

Status Register 0 always returns the value 1 ("00000001"), the identification code for an HP-IB interface.

Control Register 0: Parity Control

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Not Used				Odd	Even	Always 1	Always 0
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status Register 1: Interrupt Cause

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
IFC	LA	CA	TA	SRQ	DCL or SDC	GET	SCG
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Control Register 1: Interrupt Mask

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
IFC	LA	CA	TA	SRQ	DCL or SDC	GET	SCG
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status Register 2: HP-IB Control Lines

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Not Used	REN	SRQ	ATN	EOI	DAV	NDAC	NRFD
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Control Register 2: HP-IB Control Lines

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Not Used	REN	SRQ	ATN	EOI	DAV	NDAC	NRFD
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status Register 3: HP-IB Data Lines

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
DIO8	DIO7	DIO6	DIO5	DIO4	DIO3	DIO2	DIO1
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Control Register 3: HP-IB Data Lines

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
DIO8	DIO7	DIO6	DIO5	DIO4	DIO3	DIO2	DIO1
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status Register 4: HP-IB Address/System Controller

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Not Used		System Con-troller	HP-IB Address				
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status Register 5: HP-IB State

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
SC	LA	CA	TA	SPE	Parity Error	REN	LLO
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status Register 6: Secondary Command Register

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Not Used			Secondary Command				
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Control Register 16: EOL Control

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
EOI Enable	Not Used				Number of Characters in EOL Sequence		
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Control Registers 17 through 23: EOL Sequence

Control Registers 17 through 23 contain the decimal value of the characters sent as the EOL (end-of-line) sequence.

Serial Interface

The various cables are indicated in the registers tables by the following superscripts:

- * Modem Cable F/M.
- † Instrumentation Cable F/F.
- ‡ Printer Cable F/F.

Status Register 0: Interface I.D.

This register always returns the value 2 ("00000010"), the identification code for a serial interface.

Status/Control Register 1: Interrupt Mask

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Break Received	Framing Error	Parity Error	Received Data Available	DCD* RTS†‡	Auto-discon-nect	DSR* RTS† Not Used‡	CTS* DTR† ‡
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status/Control Register 2: Modem Control Signals

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Not Used					DRS* No Connection† DSR‡	RTS* DCD† ‡	DTR* CTS /DSR† CTS‡
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status Register 3: Modem Status

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Not Used				DCD* RTS† ‡	Not Used	DSR* DTR† Not Used‡	CTS* DTR† ‡
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Control Register 3: Standard Baud Rates

Control Register 3 selects a standard baud rate for transmitted and received data.

Table A-3. Standard Baud Rates

Value	0	1	2	3	4	5	6	7
Baud Rate	50	75	110	134.5	150	200	300	600
Value	8	9	10	11	12	13	14	15
Baud Rate	1200	1800	2000	2400	2600	4800	7200	9600

Status/Control Register 4: Line Characteristics

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Not Used	Set Break	Force Parity	Even Parity	Enable Parity	Stop Bits	Character Length	
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Parity Selection

Bit 5	Bit 4	Bit 3	Parity Specified
0	0	0	No Parity bit
0	0	1	Odd parity
0	1	1	Even parity
1	0	1	Always 1
1	1	1	Always 0

Character Length

Bit 1	Bit 0	Character Length
0	0	5
0	1	6
1	0	7
1	1	8

Status/Control Register 5: Modem Features

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Not Used		Receive Hand-shake	Transmit Hand-shake	DCD* RTS†‡	Not Used	DSR* DTR†‡ Not Used‡	CTS* DTR†‡
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status/Control Registers 6 and 7: Divisor

These registers specify the divisor used by the baud rate generator to establish a non-standard baud rate:

1. Divisor = 115,200 ÷ (Baud Rate)
2. Status/Control Register 6 value = (Divisor) DIV 256
3. Status/Control Register 7 value = (Divisor) MOD 256

Status/Control Register 8: Error Replacement Character

This register contains the decimal value of the ASCII character used as the parity and framing error replacement character.

Status/Control Register 9: Transmitter/Receiver Control

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Enable Transmitter	Strip Received Rubouts	Strip Received Nulls	Change Character if Error	Set Bit 7 of Character if Error	Reset Receive Queue	Auto-Echo Enable	Enable Receiver
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status Register 10: Line Status

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Not Used		Transmit Register Empty	Break Received	Framing Error	Parity Error	Not Used	Received Data Available
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status Register 11: I/O Termination Cause

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
End of Output Data List	End of Input Data List	COUNT Satisfied	CR15 Character Received	CR14 Character Received	CR13 Character Received	CR12 Character Received	DELIM Character Received
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Control Register 11: Input Data Control

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Enable Transmit Flag	Disable Transmit Flag	Not Used	Terminate if CR15	Terminate if CR14	Terminate if CR13	Terminate if CR12	Not Used
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Control Registers 12 through 15: Termination Characters

These registers contain the decimal value of the input termination characters specified by Control Register 11.

Control Register 16: End-of-Line Sequence

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Auto RTS Enable	EOL Transmit Disable	EOL Character Count					
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Control Registers 17 through 23: EOL Sequence Characters

Control Registers 17 through 23 contain the decimal value of the characters sent as the EOL (end-of-line) sequence.

BCD Interface

Status Register 0: Interface Identification

Status Register 0 always returns the value 3 ("00000011"), the interface identification code for a BCD interface.

Status Register 1: Interrupt Cause

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Generated from Function B (Most Significant Digit)				Generated from Function A (Most Significant Digit)			
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Control Register 1: Interrupt Mask

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Function B (Most Significant Digit)				Function A (Most Significant Digit)			
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status Register 2: Control Line Messages

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
I/OA	I/OB	CTLA	CTLB	FLGA	FLGB	Not Used	
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

0=input; 1=output

0=ready; 1=busy

Control Register 2: Handshake Lines and Port 10

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
I/OA	I/OB	CTLA	CTLB	Port 10 Output (when available)			
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status/Control Register 3: Mantissa Digits

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Number of Digits for Channel B Mantissa (0-11)				Number of Digits for Channel A Mantissa (0-11)			
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status/Control Register 4: Exponent Digits

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Number of Digits for Channel B Exponent (0-3)				Number of Digits for Channel A Exponent (0-3)			
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status/Control Register 5: Function Digits

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Number of Digits for Channel B Function (0-11)				Number of Digits for Channel A Function (0-11)			
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status/Control Register 6: Decimal Point Placement

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Number of Mantissa Digits to the Right of the Decimal Point (Channel B)				Number of Mantissa Dights to the Right of the Decimal Point (Channel A)			
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status/Control Register 7: Control Sense and Handshake Mode

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Logic Sense I/OA	Logic Sense I/OB	Logic Sense CTLA	Logic Sense CTLB	Logic Sense FLGA	Logic Sense FLGB	Hand-shake Mode A	Hand-shake Mode B
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status/Control Register 8: Mantissa and Exponent Digit Sense

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Logic Sense for Channel B Mantissa and Exponent Digits				Logic Sense for Channel A Mantissa and Exponent Digits			
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status/Control Register 9: Function Digit Sense

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Logic Sense for Channel B Function Digits				Logic Sense for Channel A Function Digits			
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status/Control Register 10: Handshake Lines and Port 10

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Exponent B Logic Sense	Mantissa B Logic Sense	Exponent A Logic Sense	Mantissa A Logic Sense	Logic Sense for Port 10 Data			
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status Register 0 : Interface Identification

Status Register 0 always returns the Value 4 ("00000100"), the identification code of the GPIO interface.

Control Register 0: Parity Control

Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Not Used				Odd	Even	Always One	Always Zero
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status Register 1: Interrupt Cause

Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
FLGD	FLGC	FLGB	FLGA	Not Used		Parity Error	Not Used
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Control Register 1: Interrupt Mask

Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
FLGD	FLGC	FLGB	FLGA	Not Used		Parity Error	Not Used
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status Register 2: Line Status

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
FLGD	FLGC	FLGB	FLGA	CTLD	CTLB	CTLC	CTLA
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Control Register 2: Assertion Control

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
RESB	RESA	Not Used		CTLD	CTLB	CLTC	CTLA
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status/Control Register 3: Handshake Line Normalization

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Invert FLGD	Invert FLGC	Invert FLGB	Invert FLGA	Invert CTLD	Invert CTLB	Invert CTLC	Invert CTLA
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status/Control Register 4: Data Normalization and Handshake Control

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Handshake Mode		Flag Transition	Always 1	Invert Port D	Invert Port C	Invert Port B	Invert Port A
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status/Control Register 5: Primary Address and Trigger Action

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
R7> DATA	R7= DATA	R7< DATA	Enable Auto Response	Primary Address			
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status/Control Register 6: Strobe Control

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Resolution Increment	Strobe Pulse Duration						
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status/Control Register 7: Trigger Character

Bits 0 through 7 contain the decimal Value of the trigger character.

Status/Control Register 8: Output Enable

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Not Used						Output Enable B	Output Enable A
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status/Control Register 9: Output Inhibit

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Not Used							Enable Output Inhibit
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Control Register 16: EOL Control

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Not Used					Number of Characters in EOL Sequence		
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Control Registers 17 through 23: EOL Sequence

Control Registers 17 through 23 contain the decimal Values of the characters sent as the EOL (end-of-line) sequence.

HP-IL Interface

Status Register 0: Interface Identification

Status register 0 always returns the value 5 ("00000101"), the identification code for an HP-IL interface.

Status Register 1: Interrupt Cause

Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
IFC	LA	CA	TA	SRQ	CLR	GET	DDC
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Control Register 1: Interrupt Mask

Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
IFC	LA	CA	TA	SRQ	CLR	GET	DDC
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status Register 2: Last Control Bits

Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Not Used					C2	C1	C0
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Control Register 2: Next Control Bits

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Not Used					C2	C1	C0
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status Register 3: Last Loop Byte

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
D7	D6	D5	D4	D3	D2	D1	D0
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Control Register 3: Next Data Byte

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
D7	D6	D5	D4	D3	D2	D1	D0
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status Register 4: Loop Address

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
AAD	Not Used		A4	A3	A2	A1	A0
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Control Register 4: Loop Address

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
AAD	Not Used		A4	A3	A2	A1	A0
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status Register 5: Interface Status

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Tx	LA	CA	TA	SRQ	EAR	REN	LLO
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Control Register 5: Interface Status

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Not Used							EAR
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status Register 6: Device-Dependent Commands

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Not Used		T/L	C4	C3	C2	C1	C0
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Status Register 7: Responding Devices

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Not Used			A4	A3	A2	A1	A0
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Control Register 16: EOL Control

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
End Frame Enable	Not Used				EOL2	EOL1	EOL0
Value = 128	Value = 64	Value = 32	Value = 16	Value = 8	Value = 4	Value = 2	Value = 1

Control Registers 17 through 23: EOL Sequence

Control registers 17 through 23 contain the decimal value of the characters sent as the EOL (end-of-line) sequence.

6 Errors

The following table lists prerun (program initialization) and runtime error and warning conditions. Syntax errors are not listed. With DEFAULT ON, conditions 1 through 8 return a warning message and default value. With DEFAULT OFF, an error message is returned and execution halts.

Keep in mind that prerun errors occur before program execution begins, and therefore cannot be trapped by ON ERROR routines.

Warning Number	Message	Causes
1		Not used.
2	OVERFLOW	Overflow; returns maximum value for specified precision. ■ REAL, SHORT, or INTEGER value is out of range. ■ Division by 0.
3	COT/CSC=INF	COT or CSC of n×180°; returns INF
4	TAN/SEC=INF	TAN or SEC of n×90°; returns INF
5	0^NEG	Zero raised to a negative power; returns INF
6	0^0	Zero raised to the zero power; returns 1
7	NULL DATA	Executing AXAMCOL or AMINCOL for a vector; returns 0.
8		Not used.

Error Number	Message	Causes
9	NEG^NON-INT	Negative value raised to a non-integer power.
10	SQR(−)	Square root of a negative number.
11	ARG OUT OF RANGE	Argument or parameter out of range: ■ ATN2(0,0). ■ ASN or ACS with n>1 or n<−1. ■ ON...GOTO/GOSUB parameter out of range.
12	LOG(0)	Logarithm of zero.
13	LOG(−)	Logarithm of a negative number.
14		Not used.
15	SYSTEM	System error; attempt to save the current program in a new file. Report the error by contacting your dealer, sales representative, or Response Center.*
16	CONTINUE BEFORE RUN	Program not allocated: ■ Program or subprogram was not allocated before executing CONT. ■ The current (sub) program has been changed (deallocated) since the program was paused.
17 and 18		Not used.
19	MEM OVF	Memory overflow: ■ Attempting to initialize a program that requires more than existing memory. ■ Attempting to load a program that requires more than existing memory. ■ Insufficient memory to dynamically load a binary program. ■ Attempting an operation for which insufficent memory is available; e.g., opening a file, concatenating a string, creating an I/O buffer.
20 and 21		Not used.
22	SECURED	Attempting to violate system file security; e.g.: ■ Attempting to overwrite a directory. ■ Attepting to edit, list, store, or overwrite a secured BASIC/PROG file. ■ Attempting to open a secured BASIC/DATA file. ■ Attempting to access a file for which system permission is denied.

* In addition to Error 15, BASIC provides a series of messages in the form *Basic fault number xxx* in the event of a system failure. If you receive a Basic fault message, note the fault number and the conditions leading to the failure. Then, contact your dealer, sales representative, or Response Center.

Error Number	Message	Causes
23 and 24		Not used
25	BAD BIN LOAD	LOADBIN operation has failed: ■ The specified file does not exist. ■ The specified file is not formatted properly.
26 through 29		Not used.
30	OPTION BASE	OPTION BASE ERROR ■ More than one OPTION BASE statement. ■ OPTION BASE statement follows an array declaration. ■ OPTION BASE parameter is not 0 or 1.
31		Not used.
32	COM MISMATCH	Common variable mismatch.
33	DATA TYPE	Data type mismatch: ■ READ variable and DATA constant do not agree. ■ Attempting to read a string into a READ# numeric variable.
34	NO DATA	Insufficient data: ■ The DATA list has been used. ■ RESTORE has been executed with no DATA statement
35	DIM EXIST VRBL	Attempting to dimension a variable that has previously been explicitly or implicitly dimensioned.
36		Not used.
37	DUP FN	Duplicate user-defined function name.
38	NO FN END	A second DEF FN statement has been executed before the first function was ended with FN END.
39	FN MISSING	Referencing a non-existent user-defined function: ■ Attempting to executed FN END with no matching DEF FN. ■ Branching to the middle of a function.
40	FN PARAM	Illegal function parameter; function parameter mismatch.
41		Not used.
42	RECURSIVE FN CALL	Recursive user-defined function.

Error Number	**Message**	**Causes**
43	NUMERIC INPUT	Numeric input is required.
44	TOO FEW INPUTS	Too few inputs for INPUT or MAT INPUT.
45	TOO MANY INPUTS	More items were given than were requested by INPUT.
46	NEXT MISSING	FOR with no matching NEXT.
47	NO MATCHING FOR	NEXT with no matching FOR.
48 and 49		Not used.
50	BIN PROG MISSING	Binary program could not be found in memory.
51	RETURN W/O GOSUB	Attempt to execute RETURN before GOSUB.
52	IMAGE	Illegal IMAGE format string: ■ Unrecognized image specifier. ■ Illegal quotation marks around format string.
53	PRINT USING	Illegal PRINT USING: ■ Data overflows image specifier. ■ Data type does not match image specifier.
54	TAB	Illegal TAB argument; default=TAB(0) (no change in position).
55	SUBSCRIPT	Array subscript out of dimensioned range.
56	STRING OVF	String overflow; a string is too large for the length of a string variable.
57	MISSING LINE	Referencing a nonexistent line.
58 and 59		Not used.
60	WRITE PROTECT	■ The meduim is write-protected. ■ The file is secured against overwriting.
61 and 62		Not used.
63	DUP NAME	Duplicate path name for RENAME, CREATE, or COPY.
64 and 65		Not used.

Error Number	Message	Causes
66	FILE CLOSED	Attempting to access (by READ# or PRINT#) or close a closed file.
67	FILE NAME	Incorrect file name or path name: ■ File with specified path name was not found. ■ Path name not enclosed in quotes. ■ Attempt to purge an open file.
68	FILE TYPE	File type mismatch: ■ Attempt to treat a program file as a data file, or vice versa. ■ Attempt to SECURE a file with an inappropriate security type. ■ Attempting to MERGE or FINDPROG a non-BASIC file.
69	RANDOM OVF	Random overflow: ■ Attempt a READ#/PRINT# beyond the existing number of bytes in logical record with random file access. ■ Attempt to PRINT# a string to a logical record with fewer than 4 bytes available. ■ UNIX kernal tables are full; a new drive cannot be loaded.
70	READ	FAILURE by MERGE or FINDPROG to access the mass storage medium.
71	EOF	End-of-file; attempting to PRINT#/READ# beyond the end of the file.
72	RECORD	Attempting to READ#/PRINT# to a nonexistent record.
73 through 87		Not used.
88	BAD STATEMENT	SUB statement must be first line of subprogram.
89	INVALID PARAM	Invalid parameter; parameter out of range.
90		Not used.
91	MISSING PARAM	Missing parameter.
92 through 100		Not used.

Error numbers over 100 often have more than one message associated with them. In cases where no error message is displayed (for example, in an ON ERROR routine), the errors can be differentiated by the module number returned by the ERROM function.

Error Number	Message	ERROM Number	Causes
101	XFR	192	Warning; program paused with an active TRANSFER.
102 through 108			Not used.
109	# DIMS	176	Incorrect number of dimensions in an array.
109	PRGM TYPE	232	Attempting to CALL a non-subprogram file.
110	NOT A 3-VECTOR	176	The specified vector does not have 3 elements.
111	DIM MISMATCH	176	Incorrect number of array elements.
111	I/O OPER	192	The I/O operation is invalid for the specified interface.
111	RECURSIVE	232	A subprogram attempts to CALL or SCRATCHSUB itself.
112	DETERMINATE IS 0	176	Determinate of a matrix is 0.
113	DIM SIZE	176	Dimension size: ■ Total number of redimension elements exceeds number originally dimensioned. ■ Attempt to create an empty array with option base 0.
113	INTERFACE-DEPENDENT	192	Interface dependent error: ■ HP-IB: interface must be system controller. ■ Serial: UART receiver overrun. ■ BCD: port 10 is not currently available. ■ GPIO: odd number of bytes was transferred in the 16-bit word configuration. ■ HP-IL: take control message was ignored by the device.
113	PARAM MISMATCH	232	Mismatch between CALL and SUB parameters.

Error Number	Message	ERROM Number	Causes
114	NOT SQUARE	176	Array is not square.
114	INTERFACE-DEPENDENT	192	Interface-dependent error: ■ HP-IB, HP-IL: interface must be active controller. ■ Serial: receiver buffer overrun. ■ BCD: port 10 not currently available. ■ GPIO: FHS transfer was aborted.
115	NON-VECTOR	176	Array is not a vector.
115	INTERFACE-DEPENDENT	192	Interface-dependent error: ■ HP-IB, HP-IL: interface must be addressed to talk. ■ Serial: automatic disconnect forced. ■ BCD: FHS transfer aborted. ■ GPIO: configuration does not allow output enable or output operation on port A or port B.
115	SUB STMT MSG	232	SUB statement is missing in called subprogram.
116	INTERFACE-DEPENDENT	192	Interface-dependent error: ■ HP-IB, HP-IL: interface must be addressed to listen. ■ BCD: data direction mismatch has occurred. ■ GPIO: CTL line is not in the proper state.
117	INTERFACE-DEPENDENT	192	Interface-dependent error: ■ HP-IB, HP-IL: interface must be non-controller. ■ BCD: command was directed to nonexistent field.
118	INTERFACE-DEPENDENT	192	Interface-dependent error: ■ BCD: CTL is not in the proper state to start the operation. ■ HP-IL: a transmission error or protocol violation occurred.
119	INTERFACE-DEPENDENT	192	Interface-dependent error: ■ BCD: data format does not match mode of the interface. ■ HP-IL: addressed talker ignored the start of transmission message.
120	NO M.S. DEVICE	208	No mass storage device is currently active.
121 through 123			Not used.
124	ISC	192	Illegal interface select code.

Error Number	Message	ERROM Number	Causes
125	ADDR	192	Improper primary address.
125	VOLUME	208	The specified volume name (top-level directory) was not found.
126	BUFFER	192	I/O buffer problem: ■ Attempting to OUTPUT or TRANSFER data to a full buffer. ■ Attempting to ENTER data from an empty buffer. ■ The specified string variable is not a declared I/O buffer.
126	PLOTTER IS	1	The designated plotter does not respond.
126	MSUS	208	The specified device name was not found.
127	NUMBER	192	Invalid number: ■ Incoming character sequence is not a valid number. ■ Number being output has exceeded the range specified by the "e" format.
127	READ VFY	208	A read verify error has occurred.
128	EARLY TERM	192	Buffer was emptied before all enter fields were satisfied.
128	FULL	208	The directory or mass storage medium is full.
129	VAR TYPE	192	An ENTER variable does not match the image specified for that variable.
130	NO TERM	192	Required terminator was not received during ENTER.
130	DISC	208	Disc error: ■ The mass storage medium is not initialzed or formatted. ■ The mass storage device drive latch is open. ■ The mass storage medium is damaged.
131	TIMEOUT	192	An I/O timeout has occurred.

7 Keyword Summary

General Math Functions and Operators

ABS	Absolute value.
CEIL	Smallest integer $\geqslant$ the argument.
DIV	Integer portion of a quotient.
EPS	Smallest machine number.
EXP	e^x
FLOOR	Largest integer $\leqslant$ the argument.
FP	Fractional part of the argument.
INF	Largest machine number.
INT	Largest integer $\leqslant$ the argument.
IP	Integer part of a number.
LET	Variable assignment.
LGT	Log to the base 10.
LOG	Log to the base e.
MAX	Larger of two values.
MIN	Smaller of two values.
MOD	Modulo operator; remainder of division.
PI	π
RANDOMIZE	Modifies the seed used by RND.
RMD	Remainder of division.
RND	Random number.
SGN	Sign of a number.
SQR	Square root.
VAL	Numeric equivalent of a string.

Trigonometric Functions and Operations

ACS	Arccosine (in the 1st or 2nd quadrant).
ASN	Arcsine (in 1st or 4th quadrant).
ATN	Arctangent in quadrants 1 or 4.
ATN2	Arctangent in quadrants 1, 2, 3, or 4.
COS	Cosine.
COT	Cotangent.
CSC	Cosecant.
DEG	Sets BASIC to degrees mode.
DTR	Converts angle in degrees to radians.
GRAD	Sets BASIC to grads mode.
RAD	Sets BASIC to radians mode.
RTD	Converts angle in radians to degrees.
SEC	Secant.
SIN	Sine.
TAN	Tangent.

Logical Operators

AND	Logical and of two values.
EXOR	Logical exclusive-or of two values.
NOT	Logical complement of a value.
OR	Logical inclusive-or of two values.

Binary Functions

BINAND	Bit-by-bit logical and of two values.
BINCMP	Bit-by-bit complement of a value.
BINEOR	Bit-by-bit exclusive-or of two values.
BINIOR	Bit-by-bit inclusive-or of two values.
BIT	Value of the specified bit.
BTD	Converts string containing 0's and 1's to a decimal number.
DTB$	Converts decimal value to a string containing its binary representation.
DTH$	Converts decimal value to a string containing its hexadecimal representation.
DTO$	Converts decimal value to a string containing its octal representation.
HTD	Converts a string contains digits and/or letters A through F to a decimal number.
OTD	Converts a string containing digits 1 through 8 to a decimal number.

String Operations

CHR$	Interprets a numeric value as a character code and returns the character.
FLAG$	Returns an 8-character string showing status of 64 flags.
HMS	Converts a string (HH:MM:SS) to seconds.
HMS$	Converts seconds to a string (HH:MM:SS).
LEN	Length of a string.
LWC$	Converts all uppercase characters to lowercase.
MDY	Converts a string (MM/DD/YYYY) to the Julian day.
MDY$	Converts the Julian day to a string (MM/DD/YYYY).
NUM	Returns decimal code of first character in string.
POS	Position of a character in a string.
REV$	Returns a string in which characters are in reversed order.
ROTATE$	Shifts characters left or right.
RPT$	Repeats the character sequence in the string.
TRIM$	Removes leading and trailing blanks.
UPC$	Converts all lowercase characters to uppercase.
VAL	Returns the numeric equivalent of a string.
VAL$	Returns the string equivalent of a value.

Clock and Time Functions

DATE	Julian date (YYDDD).
DATE$	Date in the form YY/MM/DD.
HMS	Converts a string (HH:MM:SS) to seconds.
HMS$	Converts seconds to a string (HH:MM:SS).
MDY	Converts a string (MM/DD/YYYY) to the Julian day.
MDY$	Converts the Julian day to a string (MM/DD/YYYY).
READTIM	Number of seconds elapsed since setting a timer.
TIME	Number of seconds elapsed since midnight.
TIME$	Converts number of seconds past midnight to HH:MM:SS format.

Program Entry and Editing

AUTO	Starts automatic line numbering.
DELETE	Deletes program line(s).
INIT	Initializes the program.
LIST	Lists program lines to the display (CRT IS device).
MERGE	Merges a program in mass storage with one in BASIC memory.
PLIST	Lists program lines to the system (PRINTER IS) printer.
REN	Renumbers program lines.
REPLACEVAR	Changes the name of a variable throughout the program.
SCAN	Searches for all occurances of a character string.
XREF L	Cross-references program lines.
XREF V	Cross-references program variables.

Debugging

ERRL	Line number of most recent error.
ERRM	Error message of most recent error.
ERRN	Error number of most recent error.
ERROM	Module number of most recent error.
ERRSC	Select code of most recent interface error.
NORMAL	Stops tracing.
SINGLESTEP	Executes the current program line.
TRACE	Traces branches.
TRACE VAR	Traces specified variables.
TRACE ALL	Traces branching and all variables.

Variable Allocation

COM	Reserves memory for common variables.
DIM	Reserves memory for REAL arrays and strings.
INIT	Initializes the program.
INTEGER	Reserves memory for INTEGER variables.
OPTION BASE	Declares lower bound of 0 or 1 for array variables..
REAL	Reserves memory for REAL variables.
SCRATCH	Erases program, subprograms, and variables from memory.
SCRATCHSUB	Erases specified subprogram from memory.
SHORT	Reserves memory for SHORT precision variables.

Display Control

ALPHA	Displays alpha display.
AREAD	Reads contents of alpha display memory into a string variable.
AWRIT	Writes value of a string variable to the alpha display.
CLEAR (no parameter)	Clears the alpha display.
CRT IS	Declares device to receive displayed output.
CURSCOL	Returns column location of cursor.
CURSROW	Returns row location of the cursor.
DISP	Outputs items to the CRT IS device.
GCLEAR	Clears all or portions of the graphics display.
GRAPHICS	Displays the graphics display.
OFF CURSOR	Turns the cursor off.
ON CURSOR	Turns the cursor on.
TAB	Defines column position for DISP, LABEL, and PRINT.

Program Control

AREAD	Reads contents of alpha display memory into a string variable.
AWRIT	Writes value of a string variable to the alpha display.
BEEP	Produces an audible tone.
CALLBIN	Calls the specified binary entry point.
CFLAG	Clears the specified flag.
CHAIN	Chains a program into memory.
CONT	Continues a paused program.
CRT IS	Designates the display device.
CURSCOL	Returns column location of cursor.
CURSROW	Returns row location of the cursor.
DATA	Specifies data items for READ.
DEF FN	Defines a user-defined function.
DEFAULT OFF	Turns off default for math errors.
DEFAULT ON	Turns on default for math errors.
DISP	Outputs items to the CRT IS device.
END	Stops program execution.
FLAG	Returns status of specified flag.
FLAG$	Returns 8-character string showing status of 64 flags.
FLIP	Switches keyboard between BASIC and typewriter modes.
FN	User-defined function call.
FOR...TO	Defines the beginning of a FOR...NEXT loop.
GOSUB	Causes branching to a subroutine.
GOTO	Causes branching to the specified statement.

Program Control (continued)

IF...THEN	Causes conditional branching.
IMAGE	Provides formats for DISP, PRINT, LABEL, ENTER, and OUTPUT.
INPUT	Inputs data from the keyboard into program variables.
KEY LABEL	Displays key labels for user-defined keys.
LINPUT	Inputs a character string from the keyboard.
PAUSE	Pauses the program.
PRINT	Outputs items to the PRINTER IS printer.
PRINT ALL	Sets system to print-all mode.
PRINTER IS	Specifies device as the system printer.
READ	Reads items from DATA statements.
REM	Program comment.
RESTORE	Provides for reusing data statements.
RETURN	Transfers program from a subroutine to the statement following the invoking GOSUB.
RUN	Begins program execution.
SCRATCHBIN	Scratches the specified binary program.
SFLAG	Sets the specified flag(s).
STOP	Stops program execution.
TAB	Defines column position for DISP, LABEL, and PRINT.
WAIT	Causes execution to wait the specified number of seconds.

Subprogram Control

CALL	Calls a subprogram and optionally passes in parameters.
DIRECTORY	Displays a directory of the program and subprograms in memory.
FINDPROG	Makes a subprogram available for listing and editing.
NPAR	Returns the number of parameters passed into a subprogram.
SCRATCHSUB	Scratches the specified subprogram.
SUB	First statement of a subprogam; defines the formal parameters.
SUBEND	Returns execution to the invoking (sub)program.
SUBEXIT	Returns execution to the invoking (sub)program.

Mass Storage

ASSIGN#	Opens a data file.
CAT	Displays the specified directory.
CHAIN	Chains a program into BASIC memory.
CHECK READ ON/OFF	Turns on and off data verification during PRINT# operations.
COPY	Copies the specified file(s).
CREATE	Creates a data file.
GET	Retrieves a text file and enters its contents into memory as program lines.
GLOAD	Load a BASIC/GRAF file into the graphics display.
GSTORE	Store the current graphics display into a BASIC/GRAF file.

Mass Storage (continued)

LOAD	Load a BASIC/PROG file.
LOADBIN	Loads the specified binary program.
MASS STORAGE IS	Changes the current working directory
PRINT#	Writes items to a data file.
PURGE	Removes a BASIC file from its directory.
READ#	Retrieves items from a data file.
RENAME	Changes the name of a BASIC, non-directory file.
SAVE	Saves the program in memory as a text file.
SECURE	Protects BASIC files against listing, editing, and being overwritten.
STORE	Stores the program in memory.
UNSECURE	Removes file security previously established by SECURE.
TYP	Returns the data type of the next item in a data file.
VOLUME IS	Changes the volume label of a disc.

Graphics Boundaries, Scaling, and Control

CLIP	Specifies plotting boundaries in current scale units.
DUMP GRAPHICS	Outputs the graphics display to the system printer.
GCLEAR	Clears all or portions of the graphics display.
GRAPHICS	Displays the graphics display.
LIMIT	Specifies graphics limits in millimeter units.
LOCATE	Specifies the plotting boundaries in GUs.
MSCALE	Scales the plotting area in millimeter user units.

Graphics Boundaries, Scaling, and Control (continued)	PLOTTER IS	Specifies the plotting device.
	RATIO	Returns the ratio of the graphics limits—horizontal/vertical.
	SCALE	Scales the plotting area by the specified user units.
	SETGU	Sets the system to graphics units mode.
	SETUU	Sets the system to user units mode.
	SHOW	Scales the plotting area with equal x and y user units.
	UNCLIP	Sets the plotting boundaries equal to the graphics limits.
Graphics Plotting	AXES	Plots x- and y-axes.
	BPLOT	Plots groups of dots on the display.
	BREAD	Reads the on/off status of dots on the display.
	CURSOR	Reads the location and status of the physical pen.
	DIGITIZE	Halts program execution until the physical pen position and status is entered from the plotting device.
	DRAW	Draws a line to the specified point.
	FRAME	Draws a frame around the plotting area.
	GCLEAR	Clears all or portions of the graphics display.
	GRID	Draws grid lines.
	IDRAW	Draws a line incrementally to the specified point.
	IMOVE	Lifts the pen and moves it incrementally to the specified point.
	IPLOT	Moves the pen incrementally to the specified point with pen control.

Graphics Plotting (continued)

LAXES	Draws and labels x- and y-axes.
LGRID	Draws and labels a grid.
LINE TYPE	Specifies the line type used for lines, axes, and grids.
MOVE	Lifts the pen and moves it to the specified point.
PDIR	Establishes plotting direction for relative and incremental plotting.
PEN	Specifies the pen number.
PENUP	Lifts the pen.
PLOT	Moves the pen to the specified point with pen control.
RPLOT	Moves the pen with pen control to a point specified relative to a movable origin.
WHERE	Assigns the pen logical position to variables.
XAXIS	Draws an x-axis.
YAXIS	Draws a y-axis

Graphics Labeling

CSIZE	Establishes character size and shape for labels.
FXD	Formats labels for LAXES and LGRID.
LABEL	Plots a label at the current pen position.
LAXES	Draw and labels x- and y-axes.
LDIR	Specifies label directtion.
LGRID	Draws and labels a grid.
LORG	Defines the position of labels relative to the current pen position.

Event-Initiated Branching

ON ERROR	Establishes an event-initiated branch to be taken when an error occurs.
OFF ERROR	Cancels ON ERROR branching.
ON EOT	Establishes an end-of-line branch to be taken when a transfer terminates.
OFF EOT	Cancels ON EOT branching.
ENABLE INTR	Enables and disables interrupts specified by ON INTR.
ON INTR	Establishes end-of-line branching for interrupts at the specified interface.
OFF INTR	Cancels ON INTR branching for the specified interface..
ENABLE KBD	Enables and disables portions of the keyboard.
ON KEY#	Establishes end-of-line branching for the specified user-defined key.
OFF KEY#	Cancels ON KEY# branching for the specified user-defined key.
ON KYBD	Establishes end-of-line branching for the specified key(s).
OFF KYBD	Cancels ON KYBD branching for the specified keys.
ON TIMEOUT	Establishes end-of-line branching for timeouts at the specified interface.
OFF TIMEOUT	Cancels ON TIMEOUT branching for the specified interface.
ON TIMER#	Establishes end-of-line branching to be taken when the designated interval elapses on the timer.
OFF TIMER#	Cancels ON TIMER# branching for the specified timer.

Input/Output

ABORTIO	Terminates an active transfer.
ASSERT	Sets and clears interface control lines.
ASSIGN	Assigns a device/file selector to a device or file.
CLEAR (with device selector)	Clears the interface or resets the device.
CONTROL	Writes one or more control bytes to control registers.
CONVERT	Establishes a conversion table for OUTPUT or ENTER data.
CRT IS	Designates the system display device.
DISP	Displays the specified items.
ENTER	Enters data from the specified buffer or device.
HALT	Stops I/O operations at the specified interface.
IMAGE	Defines the format for formatted (with USING) DISP, PRINT, OUTPUT, ENTER, and LABEL.
IOBUFFER	Declares a string variable an I/O buffer.
LOCAL	Returns devices to manual control.
LOCAL LOCKOUT	Prevents an instrument from being placed under manual control.
OUTPUT	Outputs data to the specified buffer or device.
PASS CONTROL	Passes active controller status to a device.
PPOLL	Returns the parallel poll response byte.
PRINTER IS	Designates the system printer.
REMOTE	Places devices under remote control of the active controller.

Input/Output (continued)

REQUEST	Used by the non-active contoller to send a response byte to the active controller.
RESET	Performs a hardware reset of the interface.
RESUME	Re-enables I/O operations after they have been disabled.
SEND	Sends the specified commands or data to devices.
SET I/O	Writes a byte to a control register.
SET TIMEOUT	Sets the amount of time an inteface will wait to complete a handshake.
SPOLL	Returns the serial poll response byte.
STATUS	Returns the contents of a status register.
TAB	Defines column position for DISP, OUTPUT, and PRINT output.
TRANSFER	Moves data from a buffer to a device, or from device to a buffer, using interrupt or fast handshaking.
TRIGGER	Sends Group Execute Trigger to a device.

Numeric Array Functions

ABSUM	Sum of the absolute value of the elements.
AMAX	Largest element.
AMAXCOL	Column containing the largest element.
AMAXROW	Row containing the largest element.
AMIN	Smallest element.
AMINCOL	Column containing the smallest element.
AMINROW	Row containing the smallest element.
CNORM	Column norm.
CNORMCOL	Column containing the column norm.

Numeric Array Functions (continued)

DET	Determinant of a matrix.
DETL	Determinant of last matrix specified in MAT...INV or MAT...SYS.
DOT	Dot product of two vectors.
FNORM	Euclidean (Frobenius) norm.
LBND	The lower bound (option base).
MAXAB	Largest absolute value.
MAXABCOL	Column number of element with largest absolute value.
MAXABROW	Row number of element with largest absolute value.
RNORM	Row norm.
RNORMROW	Row containing the row norm.
SUM	Sum of the elements.
UBND	Upper bound of a subscript.

Numeric Array Operations

MAT=	Arithmetic and scalar operations;
	Matrix multiplication;
	Array initialization;
	Computation of identity, inverse, and transpose;
	Copying arrays;
	Solving linear equations;
	Cross product.

MAT DISP	Displays elements of the specified array(s).
MAT INPUT	Inputs values into the specified array(s).
MAT PRINT	Prints elements of the specified array(s).
MAT READ	Reads DATA statement items and enters them into the specified array(s).
REDIM	Redimension an array.

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