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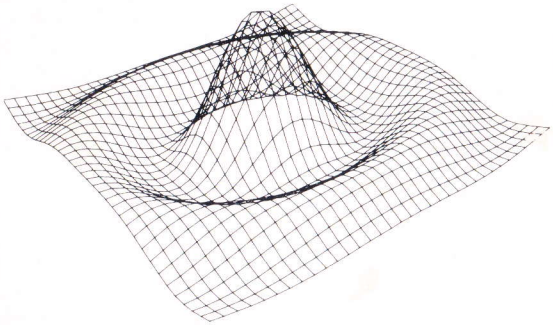

4050 SERIES BASIC

REFERENCE GUIDE

PART NO. 070-2142-02
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- FONT
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- INIT
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BASIC COMMANDS

The 4050 Series Graphic System BASIC commands are listed alphabetically. Commands shown with a gray tint are available only on the 4052A and 4054A.

Syntax Form

( ) " " ; : ,	Enter each exactly as shown
{ }	Enter one of items shown; do not enter braces.
[ ]	Optional entry; do not enter brackets. Default values are shown if they exist.
. . .	Variable number of items may be entered in the same form as the preceding item (single parameter or group of parameters).

All commands can be preceded by line numbers. For further details, refer to the 4050 Series Graphic System Reference Manual.

ABS (numeric expression)

T2 = ABS (X−4)
Sets T2 to the absolute value of X−4.

{ACOS / ACS} (numeric expression)

B = ACS (V2)
Sets B to the arc cosine of V2. (See SET.)

"Alpharotate"

PRINT @ device address ,25: rotation angle

PRI@12,25:22

Sets alphanumeric character rotation on device 12 to 22 trigonometric units (see SET).

"Alphascale"

PRINT @ device address , 17:

horizontal scale factor, vertical scale factor

PRI@5,17:2.5,2

Sets horizontal and vertical scale factors 2.5 and 2 on GPIB device at address 5.

ALTER {**string constant**}**, string variable**
{**string variable** }

ALT Name$,New_name$

Prints Name$ to the screen, allows it to be edited with the line editor and puts the edited line back into New_name$.

ANGLE (numeric expression, numeric expression)

Theta = ANGLE (x,y)

Sets Theta to the angle between the positive x axis and a vector from (0,0) to (x,y).

APPEND [I/O address:] target line number in current program [,increment between line numbers]

APP@ 4:160,20

Adds the ASCII program from the current file on device at address 4 to the file currently in memory. The first line of the added program replaces line 160 in memory. Successive lines are renumbered in increments of 20.

Default device is internal tape drive; default increment is 10.

AREA (array variable, array variable)

xxx = AREA (x, y)

Sets xxx to the area of the polygon defined by the x and y arrays.

ASC ({**string constant**} **[,numeric expression]**)
{**string variable**}

ASC ("A")

Returns 65, the decimal value of A.

D2 = ASC ("ABCD",2)

Sets D2 to the decimal equivalent of the ASCII character "B" (66). See CHR.

{**ASIN**} **(numeric expression)**
{**ASN**}

P0 = ASN (B3)

Sets P0 to the arc sine of B3 (see SET).

{**ATAN**} **(numeric expression)**
{**ATN**}

T = ATN (T1—1)

Sets T to the arc tangent of T1—1 (see SET).

AXIS [I/O address] [X axis tic interval, Y axis tic interval [, X axis intercept, Y axis intercept]]

Express intervals and intercepts in user data units.

AX1 10, 5, 1935, 0

Draws axes on the GS display with the following characteristics:

X tic interval = 10
Y tic interval = 5
X axis intercept = 1935
Y axis intercept = 0

Default device is GS display; default parameters are all 0.

CALL { **"BAPPEN",** / **string variable,** } [**I/O address;**] **target line number in current program** [**line number ,increment**]

(4051 requires Binary ROM Pack for this routine.)

CAL "BAPPEN", 24; 415,5

Adds the binary program from the current file on device at address 24 to the file currently in memory. The first line of the added program replaces line 415 in memory. Successive lines are renumbered in increments of 5.

Default device is internal tape drive; default increment is 10.

CALL "BITAND", simple string, simple string, string variable

CALL "BITAND", In1$, In2$, Result$

Performs a bit by bit logical AND of IN1$ and In2$ and places the result into Result$ (which can be either In1$ or In2$).

CALL "BITCMP", simple string, string variable

CALL "BITCMP", In0$, Result$

Complements every bit in the string In0$ and places the result in Result$.

CALL "BITOR", simple string, simple string, string variable

CALL "BITOR", In1$, In2$, Result$

Performs a logical inclusive OR of In1$ and In2$ and places the result in Result$.

CALL "BITROTATE", simple string, numeric expression, string variable

CALL "BITROT", In0$, distance, Result$

Rotates the entire sequence of bits in In0$ by the specified number of bits in the distance argument. A distance greater than zero causes a left rotate, and a distance less than zero causes a right rotate.

CALL "BITSET", string variable, numeric expression, numeric expression

CALL "BITSET", Inout$, bit number, bit value to set

Allows you to set any bit in the string to 0 or 1. The numeric value passed in is treated as logically true or false, just as in the IF statement and NOT function.

CALL "BITSHIFT", simple string, numeric expression, string variable

CALL "BITSHI", In0$, distance, Result$

Shifts (with zero fill) an entire sequence of bits by the specified number of bits. This works the same as "BITROTATE", except there is zero fill.

CALL "BITTEST", simple string, numeric expression, numeric variable

CALL "BITTES", In0$, bit number, bit value returned

Allows you to examine the value of any bit in the string. A numeric value of 0 or 1 is returned.

CALL "BITXOR", simple string, simple string, string variable

CALL "BITXOR", In1$, In2$, Result$

Performs a logical exclusive or (XOR) of In$ and In2$.

CALL { **"BOLD",** / **string variable,** } [**I/O address**]

(4051 requires Binary ROM Pack for this routine.)

CAL "BOLD", 7

Loads binary program from current file on device at address 7.

Default device is internal tape drive.

BRIGHTNESS display code

(not available on 4051 or 4052)

Sets display parameters for 19 inch display as follows:

Display Code	Intensity	Focus
0	Normal	Defocused
1	Normal	Focused
2	Bright	Defocused
3	Bright	Focused

Power-up default is 1.

CALL { **"BSAVE",** / **string variable,** } [**I/O address**]

(4051 requires Binary ROM Pack for this routine.)

CAL "BSAVE"

Stores the current program on the internal tape drive in binary format.

CALL { **"routine name"** / **string variable** } [{ **;** / **,** } **data item to be passed to firmware routine**]...

```
A$ = "BOLD"
CAL A$
```

Loads the binary program from the current file of the internal tape drive.

```
CAL "TIME", T$
```

Accesses the 4907 File Manager firmware routine named TIME. T$ is passed to the routine as it executes.

CALL Subprogram-Name [(expression and reference variables to be passed to the subprogram — separated by , or ;)].

```
CALL G_report (File, Day, Name; G_orders, Info)
```

Calls the BASIC subprogram G_report and passes five parameters. See the SUB statement.

CCINPUT string variable

```
CCINPUT C$
```

Places the first character of the type-ahead buffer (or null if no character exists) into C$. The character returned is eliminated from the input buffer.

CENTROID array variable, array variable, numeric identifier, numeric identifier

```
CEN Xarray, Yarray, Xcen, Ycen
```

Sets Xcen and Ycen variables to the X and Y coordinates of the center of mass of the polygon defined by Xarray and Yarray.

CALL "CONFIGURE" [,timeout],code;address[es]

CALL "CONFIG",E;A

E gets a value which indicates whether any devices responded, and A is an array with the addresses of all devices that responded.

CHARSIZE size code

(not available on 4051 or 4052)

Specifies character size on 19 inch display as follows:

Size Code	Characters/Line	Lines/Page
1	132	64
2	119	58
3	79	38
4	72	35

Powerup default is 4.

CHA 2

Sets the display format to 119 characters per line, 58 lines per page.

CHR (numeric expression)

D$ = CHR (90)

Assigns the ASCII character equivalent of 90 ("Z") to B$. Expression must be between 0 and 127 (4051, 4052, 4054) or between 0 and 255 (4052A/4054A). See ASC.

CLOSE [logical file number]

Closes all currently open data files, or the file specified.

COPY

Duplicates current contents of GS display on an external hard copy unit if one is attached.

COS (numeric expression)

S8 = COS (20-B)

Sets S8 to the cosine of 20—B. (See SET.)

CSUM (array variable)

Cols = CSUM (Xarray)

Sets Cols to the sum of all the columns of the two-dimensional array, Xarray.

DASH dash mask

(available on 4052A, 4054 and 4054A)

Sets dash pattern for displayed vectors; mask is (or is converted to) an integer between 0 and 255. Binary equivalent of mask specifies 8-bit pattern; if bit is 0, vector is drawn. Default mask is 0.

DAS 240

Sets the dash pattern to 4 bits on followed by 4 bits off ($240_{10} = 11110000_2$).

DATA data item [, data item] ...

DAT "1979", 83.5, 846.18, "m/sec"

Stores two string constants and two numeric constants in the program (see READ statement).

line number DEF FN any letter (numeric variable) = function to be defined

100 DEF FNA (X) = X ↑ 2
110 J = FNA (5)

Defines FNA (function A) as X ↑ 2, evaluates FNA with X = 5, and assigns the result (25) to J.

DELETE { **ALL** | **variables to be deleted** | **line number starting** [, **line number ending**] }

DEL ALL

Deletes all program lines and variable from memory.

DEL 200,

Deletes line 200.

DEL 200,310

Deletes lines 200 to 310, inclusive.

DEL C5, M$

Deletes C5 and M$.

array variable = INV array variable

numeric variable = **DET**

(4051 requires Matrix ROM Pack for this command.)

U3 = INV(G2)

K = DET

Sets K to the determinant of G2.

NOTE

INV must be used before DET.

DIM { **string variable** | **array variable** }

(maximum number of characters)
(first dimension [, **second dimension**] **)** } ...

DIM F9(20,12), T(28), V$(168)

Defines F9 as a 20 by 12 array, T as a 28 by 1 array, and V$ as a string 168 characters long.

DISTANCE (array variable, array variable)

Perimeter = DIS (Xarray, Yarray)

Sets Perimeter to the distance around a polygon defined by Xarray and Yarray.

DO

Marks the beginning of a loop. See also the EXIT IF and LOOP statements.

```
200 DO
      .
      .
      .
230 EXIT IF X > 10
      .
      .
      .
250 LOOP
```

DRAW [I/O address] X coordinate in user data units , Y coordinate in user data units

DRA 35,50

Draws a vector on the GS display from the present position of the cursor to the coordinates (35,50).

Default device is GS display.

ELSE

Transfers program control to the statement following the END IF, preserving all nesting levels of IF statements.

END

Ends program execution, closes all open files, and returns control to the GS keyboard.

END IF

Marks the end of a compound IF statement.

END SUB

Transfers program control back to the statement which follows the most recent CALL.

EXCLUDE numeric expression

EXC N

Sets a flag which affects comments in subsequent OLDs and APPENDs:

N= 0 Leaves all comments alone
N= 1 Deletes comment tails and text on all REMs
N= 2 Deletes comment tails and all REM statements

EXIT IF numeric expression

EXIT IF A > 7

If A > 7 is true then program control passes to the statement after the LOOP statement. If the condition is false, the next statement is executed.

EXP (numeric expression)

H4 = EXP (1+ P5)

Sets H4 to the exponential base e raised to the 1+ P5 power (e≈2.71828182846).

FIND [I/O address] tape file number

FIND@ 30:14

Locates the beginning of file 14 on device at address 30.

Default address is internal tape drive.

FONT font code

FON 4

Sets the 4052/4054 character font for alphanumeric output to font 4 (Spanish). Power-up default is 0.

NOTE

For the 4051 Graphic System, you must use:

PRINT @32,18: font code

See character font tables at back of this guide for a list of available fonts and codes.

line number FOR index = starting value TO ending value [STEP increment for each loop]

340 FOR J = 1 TO 10
.
.
.
410 NEXT J

Executes line 340 to 410 10 times. The final value of J is 11.

340 FOR F = 40 TO 0 STEP −2.5
.
.
.
410 NEXT F

Executes lines 340 through 410 16 times. The final value of F is −2.5.
Default increment is 1.

FUZZ number of digits for comparisons not involving zero [, numeric value of closeness for comparisons with zero]

FUZZ 5, 1E−6

Sets the non-zero comparison standard to 5 digits, and the zero comparison standard to 1E−6.

Power-up defaults are 12 and 1E−64.

GIN [I/O address] target variable for X-coordinate, target variable for Y-coordinate

GIN A3,A4

Sets A3 to the X-coordinate and A4 to the Y-coordinate of the graphic cursor on the GS display.

GOSUB {line number / line number selector OF line number list}

GOS 540

Transfers control to line 540. When a RETURN statement is executed, control returns to the next line after the GOSUB.

{GO TO / GOTO} {line number / line number selector OF line number list}

GO TO X OF 200, 500, 650

Transfers control to line 200 if X = 1, to line 500 if X = 2, to line 650 if X = 3, and to the line number after the GO TO statement if X = 0 or X > 3.

HATCH { **[I/O address] array name, array name** | **ALIGN numeric expression** | **ROTATE numeric expression** | **SPACE numeric expression** }

HAT SPA 2
HAT ROT PI/2
HAT ALI 65,50
HATCH Xarray, Yarray

The polygon defined by Xarray and Yarray is hatched vertically (direction of PI/2) with one hatch line every 2 GDUs and one of the hatch lines passing through 65,50.

The default values are:
ALIGN = (0,0)
ROTATE angle = 0
SPACE = 1 GDU

CALL "HEADER"

Reads and displays the header of the current mag tape file. The header includes the current file description, and the file number, type, and size.

HOME [I/O address]

HOM @14:

Moves the display cursor on the device at address 14 to the home position of the display area. Default device is the GS display.

CALL { "IDN" | string variable } , target array variable

(4051 requires Matrix ROM Pack for this routine.)

CAL "IDN", O

Loads the previously dimensioned array O with 1's along the major diagonal, and 0's elsewhere.

IF numeric expression THEN

```
100 IF A THEN
110    PRINT "A is TRUE";
120    IF B THEN
130       PRINT "B is also TRUE"
140    END IF     !"matches" IF in line 120
150 ELSE     !"matches" IF in line 100
160    PRINT "A is FALSE"
170 END IF     !"matches" IF in line 100
180 REM
```

If A is true and B is false, then the lines executed are: 100, 110, 120, 150, 180.

For A true and B true, then the lines executed are: 100, 110, 120, 130, 140, 150, 180.

For A false, then the lines executed are: 100, 160, 170, 180.

IF numeric expression THEN line number

```
IF  G<=Z1  THE  660
```

If G is less than or equal to Z1, control is transferred to line 660.

CALL "IFC"

Clears the GPIB (asserts IFC for 5 ms).

IMAGE format string for the print using statement

See PRINT USING.

INIT

Returns the system environmental parameters to a known state.

(See 4050 Series Graphic System Reference Manual for a list of parameters that are reset.)

INPUT [I/O address] target variables for incoming data items which are formatted in ASCII code

INP @11:B(4,5),B(4,6),J2,P$

Inputs two array variables, one numeric variable, and one string variable from device at address 11. Default address is GS keyboard.

INSIDE (array name, array name, numeric expression, numeric expression)

Place = INSIDE (Xarray, Yarray, Xcoord, Ycoord)

If the coordinate defined by Xcoord, Ycoord is inside the polygon defined by Xarray, Yarray then Place gets the value 2. If it is on the polygon, Place gets the value 1, and if it is outside Place gets the value 0.

INT (numeric expression)

E = INT (3.9)

Sets E to 3, the largest integer possible without exceeding 3.9.

target array = INV (parameter array)

(4051 requires Matrix ROM Pack for this command)

H = INV (L)

Sets the square part of H to the inverse of the square part of L. If L has more columns than rows, the extra columns at H are set to the linear transforms of the extra columns of L.

KILL [I/O address] tape file number

KIL @1:16

Kills file 16 on device at address 1. Default device is internal tape drive.

LEN ({**string constant** / **string variable**})

U = LEN (Y$)

Sets U to the length (number of characters) of Y$.

[**LET**] { **array variable = numeric expression** / **string variable = string expression** / **numeric variable = numeric expression** }

LET M3(1) = 4

Sets M3(1) to 4. The keyword LET is optional.

ABC$ = ABC$ & "***" & CHR(13)

Sets ABC$ to its value with the characters *** and CR concatenated onto it.

LGT **(numeric expression)**

S7 = LGT (2* W1+ C)

Sets S7 to the common logarithm of 2*W1+ C.

CALL {**"LINK",** / **string variable,**} [**I/O address;**]**line number of entry point**

(4051 requires Binary ROM Pack for this routine.)

CAL "LINK", 21;1200

Loads current program on device at address 21 into memory. No variable assignments or dimensions are changed. Execution starts at line 1200. Default device is internal tape drive.

LIST [I/O address] [line number starting [, line number ending]]

LIS 240

Lists line 240 on the GS display. Default address is GS display. If no line numbers are specified, entire program is listed.

LIS

The program is listed in a structured indented fashion with the default indent of three spaces. IF, FOR, DO, and SUB cause indenting; END SUB, END IF, NEXT, and LOOP each cancel an indent. The indent spacing may be changed with the PRI@37,19:n statement.

LOCAL name list

LOC X,Id$

Defines the variables X and Id$ to be local to the subprogram in which the LOCAL statement executes.

LOG (numeric expression)

R = LOG (R2)

Sets R to the natural logarithm of R2.

LOOP

Transfers control back to the statement following its DO statement. (Repeat the loop.)

MARK [I/O address] number of files , number of bytes per file

MAR 3, 2560

Creates three 2560-byte files on the internal tape, starting at the current position of the tape head.

MEMORY

MEM

Returns the number of unused bytes remaining in memory.

Q4 = MEM

Sets Q4 to the number of unused bytes remaining in memory.

MOD

X = A MOD 107

The remainder of A divided by 107 is assigned to X.

MOVE [I/O address] X coordinate in user data units, Y coordinate in user data units

MOV 3:10,—5

Moves the cursor on device at address 3 to coordinates 10,—5. Default device is GS display.

target array = parameter array MPY parameter array

(4051 requires Matrix ROM Pack for this command)

M5 = Z MPY D1

Sets M5 to the matrix product of Z and D1.

CALL "MTPACK"

(Not available on 4051.)

Adjusts tension and alignment on magnetic tape in internal tape drive.

line number NEXT index

300 NEXT N

Transfers control to the previous FOR N statement until the index exceeds the ending value. See FOR.

OFF { **SRQ** / **TIMEOUT** }

OFF SRQ

Disables the system's response to an SRQ interrupt. See ON.

OFF TIM

Disables trapping of GPIB timeouts.

OLD [**I/O address**]

OLD @17:

Loads the ASCII program from the current file on the device at address 17 into memory. All previous variable assignments and dimensions are deleted from GS memory. Default address is internal tape drive.

line number ON { **EOF (numeric constant)** / **EOI** / **SIZE** / **SRQ** / **TIMEOUT** } **THEN line number**

420 ON SIZE THE 700

Enables system response so that, if SIZE interrupt is encountered, control is transferred to line 700.

PAGE [**I/O address**]

PAG

Erases the GS display and moves the graphic cursor to the upper left corner of the display.

"Page Full"

The following PRINT statements set the "PAGE FULL" environmental parameter. Default is 0 (blinking "F").

PRI@32,26:0 Blinking "F"

PRI@32,26:1 HOME

PRI@32,26:2 PAGE

PRI@32,26:3 COPY and PAGE

PI

O2 = P1

Sets O2 to 3.14159265359.

POINTER target variable for X coordinate of graphic point in user data units , target variable for Y coordinate of graphic point in user data units , target variable to record the key which is pressed to end the entry

POI J2, J4, G$

When a keyboard character is entered, sets J2 and J4 to the X- and Y-coordinates of the Joystick (for the 4054 GS, the crosshairs) and sets G$ to the entered character.

POLL target variable for device identifier , target variable for return status information ; address list

POL C3,P0;4;10;6

Executes a serial poll of devices at addresses 4, 10, and 6, in that order. Sets C3 to 1 if device 4 is requesting service, 2 if device 10 is requesting service, or 3 if device 6 is requesting service. P0 receives the peripheral status byte.

POS (string to be searched , substring to be found , starting location for search)

X1 = POS (C$,"Y&",12)

Assigns to X1 the number of the position of the first occurrence in C$ of Y&, starting at position 12. If Y& is not found, X1 is set to 0.

PRINT [I/O address] [USING {format string / format string variable / IMAGE line number} :] [item to be printed [{, / ;} item to be printed] ... [;]

PRI "HI THERE"

Outputs the string HI THERE to the GS display.

PRI A,B$

Outputs the values of A and B$ to the GS display.

PRI @19:USI 210:P
210 IMA 2X,"P= ",3D

Prints on device at address 19 two spaces, the literal string P= , and a three digit value of P.

PRI@ 2:USI "4A,3X,2D,3D":G$,90,H6;

Outputs G$, 90, and H6 on device at address 2, using format string of 4 string characters, 3 spaces, a two-digit number, and a three-digit number. The semicolon suppresses Carriage Return. The format string can be specified in an IMAGE statement. Format string operators and modifiers are listed at the back of this guide.

Default address is GS display. See "Page Full" for more PRINT examples.

RBYTE target variable for incoming data byte [, target variable for incoming data byte] ...

RBY B(2),B(3),B(4)

Assigns the decimal equivalent of three data bytes on the GPIB to B(2), B(3), and B(4).

RDRAW [**I/O address**] **X increment in user data units , Y increment in user data units**

RDR@13:14,−27

Draws to the point 14 user data units on the X-axis and −27 user data units on the Y-axis from the present location of the graphic cursor on device at address 13. Default device is GS display.

READ [**I/O address**] **target variables for incoming data items in binary format**

REA@33:E,D$

Reads two variables from a binary data file on the internal tape drive. Default address is DATA statement in program.

REM **program documentation comments**

REM THIS STATEMENT IS NOT EXECUTED

Adds a line of documentation to the current program.

! program documentation comment

100 XLEN = 0 !Initialize the X length

CALL "RENOFF"

Unasserts the remote enable (REN) line.

CALL "RENON"

Asserts the remote enable (REN) line.

RENUMBER [**new starting line number**
[, **increment between new line numbers**
[, **starting line number in current program**
[, **final line number**]]]

REN 200,5,190,300

Renumbers all program lines in memory greater than 190 (4051, 4052, and 4054) or between 190 and 300 (4052A and 4054A). New line numbers start at 200 with increment of 5. (Default parameters are 100, 10, 100.)

target string = REP (characters to be inserted , starting character position , number of characters to be deleted before insertion)

H$ = REP ("ORD",13,4)

Replaces the 13th through 16th position of H$ with "ORD".

RESTORE [**line number**]

RES 190

Sets the internal data pointer to the first item in DATA statement at line 190. Default line number is lowest-numbered DATA statement in memory.

RETURN

Transfers control to the statement immediately after the last executed GOSUB statement.

RMOVE [**I/O address**] **X increment in user data units , Y increment in user data units**

RMO@30; 60,0

Moves the graphic cursor on the device at address 30 to the location 60 units on the X-axis and 0 units on the Y-axis from the current cursor location. Default device is the GS display.

RND (numeric expression)

Returns a random number between 0 and 1.

For RND(X),

$X > 0$	Return next one in chain.
$-1 < X \leq 0$	Selectable starting point.
$X \leq -1$	Random starting point.

RND (0) returns the following value:

4051	0.1...
4052	0.70...
4054	0.88...
4054 Opt. 30	0.50...
4052A	0.79...
4054A	0.89...
4054A Opt. 30	0.59...

ROTATE rotation angle measured in the current trigonometric units

ROT 40

Rotates execution of subsequent RMOVE and RDRAW statements 40 trigonometric units (see SET).

RSUM (array variable)

Rows = RSUM (Xarray)

Sets Rows to the sum of all the rows of the two dimensional array Xarray.

RUN [**starting line number**]

RUN 420

Starts program execution at line 420. Default line number is lowest line in current program.

SAVE [**I/O address**] [**line number starting [, line number ending]**]

SAV@20:400,600

Saves a copy of lines 400 through 600 of the current program in current file on device at address 20. Default device is internal tape drive. If line numbers are not specified, entire program is saved.

SCALE **horizontal scale factor , vertical scale factor**

SCA 2,3

Sets the horizontal scale factor to 2 and the vertical scale factor to 3. Scale Factor = UDU's/GDU's (User data units/Graphic display units).

SEARCH **(string to be searched, rules for search, starting location for search)**

Index = SEARCH (Source$,"09",J)

Start at location J in Source$ and return the index of the first numeric character — the character in the range 0 to 9.

SECRET [**I/O address**]

SEC

Marks the program currently in memory secret. Default device is GS memory.

string variable = SEG (source string , starting location of substring , number of characters in substring)

J$ = SEG(U$,20,7)

Sets J$ to the seven-character substring of U$, starting at position 20.

SET environmental condition

SET {CAS / NOC} — Sets case equivalents or inequalities for string comparisons. Default is CAS.

SET {DEG / RAD / GRA} — Sets trigonometric units to degrees, radians, or grads. Default is RAD.

SET {KEY / NOK} — Enables or disables user-definable key interrupts. Default is NOK.

SET {TRA / NOR} — Enable or disables the TRACE debugging feature. Default is NOR.

{SIGN / SGN} (numeric expression)

W = SGN(3−X)

Sets W to 1 if 3−X>0,0 if 3−X= 0, or −1 if 3−X<0.

SIN (numeric expression)

E3 = SIN(L0)

Sets E3 to the sine of L0 in current trigonometric units (see SET).

SPACE

SPA

Returns the number of lines in the current program times 72.

J5 = SPA/72

Sets J5 to the number of lines in the current program.

SQR (numeric expression)

M7 = SQR(B1+ B2)

Sets M7 to the square root of B1+ B2.

STOP

Stops program execution and indicates present position of line counter.

string variable = STR (numeric expression)

S$ = STR(1211)

Converts the number 1211 to the string " 1211" and assigns it to S$.

SUB name (expressions; reference variable)

SUB G-report (File, Day, Name; G-orders, Info)

Defines a BASIC subprogram named Sort with five parameters. See also CALL and LOCAL.

SUM (array variable)

A4 = SUM(J9)

Sets A4 to the sum of the elements of J9.

CALL "SYMREUSE",[numeric variable]

Used after deleting a program subroutine, so that symbol table space can be recovered when APPEND is done. The number of bytes freed is returned in the numeric variable if it is present.

TABLE (source string, translate table)

B$ = TABLE$ (A$, "0123456789ABCDEF")

B$ is assigned hex equivalents of unpacked numbers contained in A$.

TAN (numeric expression)

Y = TAN(14)

Sets Y to the tangent of 14 trigonometric units (see SET).

"Tape Status"

PRI @33,0:0,0,0

256 byte physical record, checksum, header format.

PRI@33,0:1,1,1

128 byte physical record, no checksum, non-header format.

CALL "TIMSET" ,I/O time threshold [,poll time threshold]

CALL "TIMSET",1.5,90E−3

Set I/O timeout to 1.5 seconds and poll timeout to 90 ms

TLIST [I/O address]

TLI@41:

Lists the contents of the magnetic tape on device at address 41. Default device is GS display.

TRIM (string variable)

B$ = TRIM (" A cat in the house ")

Assigns "A cat in the house" to B$ with leading and trailing blanks eliminated.

target array = TRN(parameter array)

(4051 requires Matrix ROM Pack for this command.)

K = TRN(H0)

Sets K to the transpose of array H0.

TYP (logical unit number)

B = TYP(0)

Returns the data type of the next item in logical unit 0 (the current magnetic tape file).
Data types:

0 = Empty file or file not open.
1 = End of File.
2 = ASCII data.
3 = Binary numeric data.
4 = Binary character string.

UBOUND ({numeric variable / string variable}, numeric expression)

X = UBO (A$,−1)

Sets X to the current DIM length of A$.

Identifier	Request	Result
Numeric Scalar	1 or 2	0 if undefined −1 if defined
1 dimension array	1	Dimensioned length
2 dimension array	1	First dimension (rows)
	2	Second dimension (columns)
1 or 2 dimension array	−1	Number of elements in array
	−2	Maximum number of elements
String	−1, −2, 1, 2	0 if undefined
	1,2	−0.2 if defined
	−1	Current DIM
	−2	Original DIM

VAL {**string constant**} {**string variable**}

L = VAL"WENT 12*20"

Sets L to 12, the first number in the given string.

See STR.

VIEWPORT **minimum horizontal value in GDUs , maximum horizontal value in GDUs , minimum vertical value in GDUs , maximum vertical value in GDUs**

VIE 0,40,50,100

Sets the viewport parameters to 0 to 40 on the X-axis, and 50 to 100 on the Y-axis. Power-up default is 0, 130, 0, 100.

WAIT

Halts program execution until an interrupt is received.

CALL "WAIT" [**, number of seconds**]

(Not available on 4051.)

CAL "WAIT", 12

Halts program execution for 12 seconds. If no delay is specified, behaves like WAIT statement.

WBYTE [**@absolute address** [**, absolute address**] . . . :] [**data bytes to be sent out over the General Purpose Interface Bus**]

WBY@42:65,—66

Issues the primary address for device 10 (decimal 42) over the GPIB with ATN activated; the colon deactivates the ATN signal. Data bytes 65 and 66 are then sent to device 10; the minus sign activates the EOI signal line, telling device 10 that no more data will be sent.

WINDOW **minimum horizontal (X) value in user data units , maximum horizontal (X) value in user data units , minimum vertical (Y) value in user data units , maximum vertical (Y) value in user data units**

WIN 1970,1985,600,1100

Sets the window parameters to 1970 to 1985 on the X-axis, and 600 to 1100 on the Y-axis. Power-up default setting is 0, 130, 0, 100.

WRITE **[I/O address] data item to be written in binary format [, data item to be written in binary format] . . .**

WRI@ 3:"DATA",11,"1492",A9,H$

Writes three character strings (DATA, 1492, and H$), one number, and the contents of A9 to the current file on the device at address 3. Default device in the internal tape drive.

ASCII CODE CHART

B7 B6 B5 / B4 B3 B2 B1	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
	CONTROL		NUMBERS & SYMBOLS		UPPERCASE		LOWERCASE	
0 0 0 0	NUL 0	DLE 16	SP 32	0 48	@ 64	P 80	\ 96	p 112
0 0 0 1	SOH 1	DC1 17	! 33	1 49	A 65	Q 81	a 97	q 113
0 0 1 0	STX 2	DC2 18	" 34	2 50	B 66	R 82	b 98	r 114
0 0 1 1	ETX 3	DC3 19	# 35	3 51	C 67	S 83	c 99	s 115
0 1 0 0	EOT 4	DC4 20	$ 36	4 52	D 68	T 84	d 100	t 116
0 1 0 1	ENQ 5	NAK 21	% 37	5 53	E 69	U 85	e 101	u 117
0 1 1 0	ACK 6	SYN 22	& 38	6 54	F 70	V 86	f 102	v 118
0 1 1 1	BEL 7	ETB 23	' 39	7 55	G 71	W 87	g 103	w 119
1 0 0 0	BS 8	CAN 24	(40	8 56	H 72	X 88	h 104	x 120
1 0 0 1	HT 9	EM 25	) 41	9 57	I 73	Y 89	i 105	y 121
1 0 1 0	LF 10	SUB 26	* 42	: 58	J 74	Z 90	j 106	z 122
1 0 1 1	VT 11	ESC 27	+ 43	; 59	K 75	[91	k 107	{ 123
1 1 0 0	FF 12	FS 28	, 44	< 60	L 76	\ 92	l 108	| 124
1 1 0 1	CR 13	GS 29	- 45	= 61	M 77	] 93	m 109	} 125
1 1 1 0	SO 14	RS 30	. 46	> 62	N 78	↑ 94	n 110	~ 126
1 1 1 1	SI 15	US 31	/ 47	? 63	O 79	_ 95	o 111	↓ 127

DISPLAY CONTROL CHARACTERS

Control Character	Keyboard Input	Displayed Character	Function Performed
BEL (BELL)	CTRL G	G	Rings bell
BS (Backspace)	CTRL H	H	Backspaces the cursor
HT (Horizontal tab)	CTRL I	I	Tabs cursor to next tab stop
LF (Linefeed)	CTRL J	J	Moves cursor down one line
VT (Vertical tab)	CTRL K	K	Moves cursor up one line
FF (Form feed)	CTRL L	L	Erases screen and moves cursor up to Home
CR (Carriage Return)	CTRL M	Does not display character	Performs same function as RETURN key
RS (Record Separator)	CTRL ↑	↑	Returns the cursor to the HOME position
US	CTRL RUBOUT	_	Moves cursor to the left margin and down one line
Refresh	PRI @32,24: "X"	X	Displays X on screen in refresh for about 1/5 second

EXECUTION PRIORITY

The following list specifies the execution priority the BASIC interpreter follows when executing a BASIC statement. The highest priority is 1; the lowest priority is 14.

Priority	Operators
1	Left Paren (
2	Functions
3	Monadic Operators + , —, and NOT
4	Exponentiations Operators
5	Dyadic Operators * and /
6	Dyadic Operators + and —
7	The Arithmetic Operators MIN, MAX and MOD
8	Relational Operators = , < > , < ,> , < = , and > =
9	The Logical Operators AND and OR
10	The Keyword USING and comma (,)
11	Right Paren) and semicolon (;)
12	The Keywords OF,THEN,STEP,TO, and the symbols @ # % =
13	All other Keywords
14	Carriage Return

GPIB DEVICE ADDRESSES

Device Number	Peripheral Device
1-30	External peripheral devices on the General Purpose Interface Bus
31	GS keyboard
32	GS display
33	Magnetic Tape Unit
34	DATA Statement
35-36	Unassigned
37	Processor Status
38-40	Unassigned
41	Left ROM slot
42-50	Reserved for 4050E01
51	2nd-from-left ROM slot
52-60	Reserved for 4050E01
61	3rd-from-left ROM slot
62-70	Reserved for 4050E01
71	4th-from-left ROM slot
72-80	Reserved for 4050E01
81-255	Reserved for future use

GPIB PRIMARY ADDRESSES

Peripheral Device Number	Primary Listen Address (Decimal Value)	Primary Talk Address (Decimal Value)
Device 0	32	64
Device 1	33	65
Device 2	34	66
Device 3	35	67
Device 4	36	68
Device 5	37	69
Device 6	38	70
Device 7	39	71
Device 8	40	72
Device 9	41	73
Device 10	42	74
Device 11	43	75
Device 12	44	76
Device 13	45	77
Device 14	46	78
Device 15	47	79
Device 16	48	80
Device 17	49	81
Device 18	50	82
Device 19	51	83
Device 20	52	84
Device 21	53	85
Device 22	54	86
Device 23	55	87
Device 24	56	88
Device 25	57	89
Device 26	58	90
Device 27	59	91
Device 28	60	92
Device 29	61	93
Device 30	62	94
UNLISTEN/ UNTALK	63	95

GPIB SECONDARY ADDRESSES

Secondary Address	Predefined Meaning	Decimal Value
0	"STATUS"	96
1	SAVE	97
2	CLOSE	98
3	OPEN	99
4	OLD/APPEND	100
5	CREATE	101
6	TYPE	102
7	KILL	103
8	UNIT	104
9	DIRECTORY	105
10	COPY	106
11	RELABEL	107
12	PRINT	108
13	INPUT	109
14	READ	110
15	WRITE	111
16	ASSIGN	112
17	"ALPHASCALE"	113
18	FONT	114
19	LIST/TLIST	115
20	DRAW/RDRAW	116
21	MOVE/RMOVE	117
22	PAGE	118
23	HOME	119
24	GIN	120
25	"ALPHAROTATE"	121
26	COMMAND	122
27	FIND	123
28	MARK	124
29	SECRET	125
30	"ERROR"	126
31	undefined	127

GENERAL INFORMATION

Numeric Accuracy = 14 digits

Numeric Range = ±8.988E±307

Numeric Variables and Array Variables	A,A0 — A9 . . . Z,Z0 — Z9	4052A/4054A: up to 31 characters (first character must be a letter or underscore)
String Variables	A$ — Z$	4052A/4054A: up to 31 characters (first character must be a letter or underscore, last character must be $)

Memory Allocation

Numeric variable = 13 bytes (+ 1 byte for each character of name for identifiers greater than 2 characters)

String variable = (string dimension + 18) bytes (+ 1 byte for each character of name for identifiers greater than 2 characters)

Array variable = ((no. of rows x no. of columns x 8) + 18) bytes (+ 1 byte for each character of name for identifiers greater than 2 characters)

4051 GRAPHIC SYSTEM CHARACTER FONTS

ASCII Value	91	123	93	125	35	36	92	124	64	
ASCII	Ä	Ä	Å	Å	£	¤	Ö	Ö	§	PRINT @ 32,18:0
Scandinavian	Æ	Æ	Ø	Ø	£	¤	Ø	Ø	§	PRINT @ 32,18:1
German	Ä	Ä	Ü	Ü	£	¤	Ö	Ö	§	PRINT @ 32,18:2
General European	Ä	Ä	Å	Å	£	¤	Ö	Ö	§	PRINT @ 32,18:3
Spanish	¡	Ä	¿	Å	£	¤	Ñ	Ö	§	PRINT @ 32,18:4
Graphic	Ä	←	Å	→	▒	$	Ö	↓	§	PRINT @ 32,18:5

4052 AND 4054 GRAPHIC SYSTEM CHARACTER FONTS

(The 4052 uses dot matrix characters; the 4054 uses stroke characters.)

CODE	ASCII DECIMAL EQUIVALENT	35	48	64	91	92	93	123	124	125
0	ASCII									
1	Swedish									
2	German									
3	British									
4	Spanish									
5	Graphic									
6	Reserved	Same as FONT 0								
7	Reserved	Font 7 is the same as Font 0 except that keywords are listed with an initial capital letter followed by lowercase letters.								
8	Business									
9	Danish									

NOTE

The character fonts are arranged in the above table according to ASCII equivalent values and not according to the actual key pressed to print a character.

ASCII CHARACTER PRIORITY FOR STRING COMPARISONS WITH SET CASE

HIGHEST PRIORITY

↓ (Down Arrow)
~ (Tilde)
| (Vertical Bar)
' (Accent Grave)
_ (Underscore)
↑ (Up Arrow)
\ (Reverse Slash)
Z or z
Y or y
X or x
W or w
V or v
U or u
T or t
S or s
R or r
Q or q
P or p
O or o
N or n
M or m
L or l
K or k
J or j
I or i
H or h
G or g
F or f
E or e
D or d
C or c
B or b
A or a

(cont in next column)

(continued)

@
?
=
;
:
9
8
7
6
5
4
3
2
1
0 (Zero)
/
.
—
,
+
*
) or] or }
(or [or {
'
&
%
$
#
"
!

(cont in next column)

(continued)

SP (Space, Blank)
US (Unit Separator)
RS (Record Separator)
GS (Group Separator)
FS (File Separator)
ESC (Escape)
SUB (Substitute)
EM (End of Medium)
CAN (Cancel)
ETB (End of Transmission Block)
SYN (Synchronous Idle)
NAK (Negative Acknowledge)
DC4 (Device Control 4)
DC3 (Device Control 3)
DC2 (Device Control 2)
DC1 (Device Control 1)
DLE (Data Link Escape)
SI (Shift In)
SO (Shift Out)
CR (Carriage Return)
FF (Form Feed)
VT (Vertical Tab)
LF (Line Feed)
HT (Horizontal Tab)
BS (Backspace)
BEL (Bell)
ACK (Acknowledge)
ENQ (Enquire, also known as Who-Are-You)
EOT (End of Transmission)
ETX (End of Text)
STX (Start of Text)
SOH (Start of Heading)
NUL (Null)

LOWEST PRIORITY

NOTE

If NOCASE is set, priority is determined by the decimal value of the ASCII characters. The character with the higher decimal value has higher priority.

DEFAULT I/O ADDRESSES

APPEND	@ 33,4:
BRIGHTNESS	@ 32,30:
CHARSIZE	@ 32,17:
CLOSE	@ 33,2:
COPY	@ 32,10:
DASH	@ 32,31:
DRAW	@ 32,20:
FIND	@ 33,27:
FONT	@ 32,18:
GIN	@ 32,24:
HOME	@ 32,23:
INPUT	@ 31,13:
KILL	@ 33,7:
LIST	@ 32,19:
MARK	@ 33,28:
MOVE	@ 32,21:
OLD	@ 33,4:
PAGE	@ 32,22:
PRINT	@ 32,12:
RDRAW	@ 32,20:
READ	@ 34,14:
RMOVE	@ 32,21:
SAVE	@ 33,1:
SECRET	@ 37,29:
TLIST	@ 32,19:
WRITE	@ 33,15:

DELIMITERS

ASCII I/O Delimiters

PRI @37,26:0

Sets Carriage Return (CR) as the delimiter for all ASCII Input/Output operations except OLD. An "at" sign (@) must be specified in the I/O address.

PRI @37,26:1

Sets Carriage Return/Line Feed (CR/LF) as the delimiter for all ASCII Input/Output operations. An @ or #, as appropriate, must be specified in the I/O address.

Alternate Delimiters for INPUT, OLD, and APPEND

PRI @37,0:3,4,7

Sets the alternate record separator to decimal 3 (ETX End of Text), the alternate End of File mark to decimal 4 (EOT End of Transmission), and the character to be deleted to decimal 7 (BEL Bell). These delimiters are used in INPUT, OLD, and APPEND operations when a percent sign (%) is specified in the I/O address.

Formatted List Indenting

PRI @37,19:n

Sets indent spacing on formatted lists to n, where n is between 0 and 10 (default is 3).

PRINT FORMAT OPERATORS AND MODIFIERS

Operators

Operators are special characters in the format string that define a print field or a special function. Format strings are specified in PRINT USING or IMAGE statements.

Operator	Description
A	Defines a print field for alphanumeric character strings.
D	Defines a print field for numeric data written in standard notation.
E	Defines a print field for numeric data written in scientific notation.
L	Specifies the insertion of a Line Feed character (CTRL J) into the ASCII data string at the specified point.
P	Specifies the insertion of a PAGE command (CTRL L) into the ASCII data string at a specified point.
S	Specifies the suppression of the Carriage Return character at the end of the ASCII data string. This operator can only appear at the end of the format string.
T	Specifies a move to a character position in the ASCII data string.
X	Specifies that space characters be inserted into the ASCII data string at the specified point.
"	Defines an alphanumeric string to be inserted into the ASCII data string.
/	Specifies the insertion of a Carriage Return character at the specified point in the ASCII data string.
(	Specifies the beginning point for repeat instructions on field format.
)	Specifies the ending point for repeat instructions on field format.

Modifiers

Modifiers are special symbols used in combination with operators to define the length of the field and to enhance the field.

Modifier	Purpose
n	Specifies the number of character positions in a print field or specifies the number of times a field operator is repeated. n must be an integer from 1 through 255, except when used with the E operator. When used with the E operator, n must be an integer from 1 through 11.
F	Specifies a print field large enough to accommodate the data item associated with the field.
+	Specifies that a plus sign (+) be placed in front of the numeric value in the print field if the number is positive, and a minus sign (—) if the number is negative. Used with D field operators only.
—	Specifies that a space be placed in front of a numeric value if the number is positive, and a minus sign if the number is negative. Used with D field operators only.
.	Specifies that a decimal point character be placed at a specified location in the ASCII data string. Used with D field operators only.
$	Specifies that a dollar sign ($) be placed in front of the numeric value in the print field. If a plus or minus field modifier is used with the D operator, then the dollar sign is placed to the left of the plus or minus sign. Used with D field operators only.
C	Specifies that commas be inserted into a numeric print field to the left of the decimal point to break the integer part into thousands, millions, etc. Each comma takes up one character position in the field. Used with D field operators only.

ERROR MESSAGES

Message Number	Error Message
0	A firmware failure has occurred. Turn OFF the power switch and wait five seconds before turning it ON again. Example: Loading into the 4051 a program which contains commands available only in the 4052/4054 Graphic Systems.
1[a]	An arithmetic operation has resulted in an out of range number. Example: 1/1.0E−308
2[a]	A divide by zero operation has resulted in an out of range number. Example: 4/0 Or an attempt was made to do MOD 0 (4052A/4054A only).
3[a]	An exponentiation operation has resulted in an out of range number. Example: 5↑1.0E+300
4[a]	An exponentiation operation involving the base e has resulted in an out of range number. Example: EXP (1.0E+234)
5[a]	The parameter of a trigonometric function is too large; that is, the variable N in the statement A= SIN(N*2*PI) is greater than 65536. Example: A= SIN(4.2E+5) when the trigonometric units are set to RADIANS.
6[a]	An attempt has been made to take the square root of a negative number. The positive square root is returned by default. Example: SQR (−4)

[a] **This error is caused by a math operation which produces a predefined out of range number. This error condition can be handled by the BASIC program without terminating program execution. Refer to the ON. . .THEN. . . statement in the 4050 Series Graphic System Reference Manual for details.**

Message Number	Error Message
7	The line number in the program line is not an integer within the range 1 to 65535. Example: 0 REM THIS IS AN INVALID LINE NUMBER
8	The matrix arrays are not conformable in the current math operation; that is, they are not of the same dimension and/or do not have the same number of elements. Example: INIT DIM A(2),B(2),C(3) A= 1 B= 2 C= A+ B Or an illegal operation was attempted in CSUM or RSUM which resulted in a shape error (4052A/4054A only).
9	A previously defined numeric variable can not be dimensioned as an array variable without deleting the numeric variable first. Example: INIT B= 3 DIM B(2,2)
10	There is an error in the subscript of a variable due to one of the following: 1. A numeric variable can't be subscripted. 2. A subscript is out of range. Example 1: INIT DIM A(2,2) A(2,3)= 5 Example 2: INIT B= 3 PRINT B(4)
11	An attempt has been made to use an undefined DEF FN function.
12	There is a parameter error in the CALL statement to a ROM pack. Or the target string is the same as the string to be rotated in BITROTATE, or the absolute value of the bit number to rotate or shift is greater than (2.0E+ 16)−1 (4052A/4054A only).

Message Number	Error Message
13	A WBYTE parameter is not within the range −255 through + 255. Example: WBYTE 300
14	A parameter for the APPEND statement is invalid.
15	An attempt has been made to APPEND to a nonexistent line number.
16	There is an invalid parameter in the FUZZ statement. Example: FUZZ −10
17	There is an invalid parameter in a RENUMBER operation due to one of the following: 1. The first or third parameter is not a line number within the range 1 through 65535. 2. The increment (second parameter) is not within the range 1 through 65535 or is so large that out of range line numbers are generated during the RENUMBER operation. 3. Statement replacement or statement interlacing will occur if the RENUMBER operation is attempted. This error may occur during an APPEND operation.
18	Not used.
19	There is an invalid parameter in a GO TO, FOR, or NEXT statement. Example: 500 FOR I= 1 to 20 where I has been previously defined as an array variable.
20	The logical unit number specified in the statement is not within the range 0 through 9. 100 ON EOF (10) THEN 500

Message Number	Error Message
21	The assignment statement is invalid because of one of the following: 1. An attempt has been made to assign an array to a numeric variable. 2. Two arrays in the statement are not conformable (not of the same dimension and/or do not have the same number of elements). 3. An attempt has been made to assign a character string to a string variable and the character string is larger than the dimensioned size of the variable.
22	There is an error in an exponentiation operation because the base is less than 0 and the exponent is not an integer less than 256. Example: −10↑257.5
23	An attempt has been made to take the LOG or LGT of a number which is equal to or less than 0. Example: LOG (−1)
24	The parameter of the ASN function or the ACS function is not within the range −1 to + 1. Example: ASN (2)
25	The parameter of the CHR function is not within the range 0 through 127 (4051/4052/4054) or within the range 0 through 255 (4052A/4054A). Example: A$= CHR(257)
26	Not used.

Message Number	Error Message
27	The parameter is out of the domain of the function. Example: A$= STR(X) where X has been previously defined as an array variable. Or an illegal operation was attempted in CSUM or RSUM which resulted in a size error (4052A/4054A only).
28	A REP function parameter is invalid.
29	The parameter in the VAL function is not a character string containing a valid number. Example: A= VAL("Hi")
30	The matrix multiplication operation failed because the arrays are not conformable.
31	[a]The matrix inversion failed because the determinant was 0. This error is treated as a SIZE error.
32	The routine name specified in the CALL statement can not be found. Example: CALL "FIX IT" where the routine "FIX IT" resides in a ROM pack which is not plugged into the System.
33	Not used.
34	The DATA statement is invalid because of one of the following: 1. There isn't a DATA statement in the current BASIC program. 2. There is not enough data in the DATA statement from the present position of the pointer to the end of the statement. 3. An attempt has been made to RESTORE the data statement pointer to a nonexistent DATA statement.

[a] **This error is caused by a math operation which produces a predefined out of range number. This error condition can be handled by the BASIC program without terminating program execution. Refer to the ON. . .THEN. . . statement in the 4050 Series Graphic System Reference Manual for details.**

Message Number	Error Message
35	The statements DEF FN, FOR, and ON . . . THEN . . . can not be entered without a line number.
36	There is an undefined variable in the specified line. A numeric variable has not been assigned a value or an array element has not been assigned a value. Example: INIT DIM A(2,2) A(1,2) = 4 PRINT A
37	An extended function ROM (Read Only Memory) is required to perform this operation.
38	This output operation cannot be executed because the current BASIC program is marked SECRET.
39	This operation can not be executed because the Random Access Memory is full. Some program lines or variables must be deleted.
40	Not used.
41	A SIZE interrupt condition has occurred and an ON SIZE THEN statement has not been executed in the current BASIC program.
42	A PAGE FULL interrupt condition has occurred.
43	A peripheral device on the General Purpose Interface Bus is requesting service and an ON SRQ THEN . . . statement has not been executed in the current BASIC program.
44	The EOI signal line on the General Purpose Interface Bus has been activated and an ON EOI THEN . . . statement has not been activated in the current BASIC program.
45	A ROM pack is requesting service and the ON UNIT for external interrupt number 1 has not been activated in the current BASIC program.

Message Number	Error Message
46	A ROM pack is requesting service and the ON UNIT for external interrupt number 2 has not been activated in the current BASIC program.
47	A ROM pack is requesting service and the ON UNIT for external interrupt number 3 has not been activated in the current BASIC program.
48	The end of the current file has been reached on an I/O device and an ON EOF THEN . . . statement has not been executed in the current BASIC program.
49	The statement in the specified line is too long. This error situation occurs if an attempt is made to LIST or SAVE a BASIC program which contains a line with more than 72 characters. Sometimes a RENUMBER operation can make a line longer than 72 characters.
50	The incoming BASIC program contains a line with more than 72 characters.
51	The line number specified in this statement cannot be found or is invalid. Example: GO TO 500 where the line 500 doesn't exist or PRINT USING 100: where line 100 isn't an IMAGE statement.
52	Either the specified magnetic tape file doesn't exist or an attempt has just been made to KILL the LAST (dummy) file.
53	After 10 attempts, the internal magnetic tape unit has been unable to read a portion of the current magnetic tape. The tape head has been positioned after the bad portion in the file to allow the rest of the file to be read.
54	The end of the magnetic tape medium has been detected. Marking a file longer than the remaining portion of the tape can cause this error.

Message Number	Error Message
55	An attempt has been made to incorrectly access a magnetic tape file. Example: Executing an OLD statement when the tape head is positioned in the middle of a file.
56	An attempt has been made to send information to a write-protected tape. Remove the tape cartridge, rotate the write-protect cylinder until the black arrow points away from SAFE, insert the tape cartridge, and try the operation again.
57	An attempt has been made to read to or write to a nonexistent tape cartridge. Insert a tape cartridge into the tape slot and try the operation again.
58	An attempt has been made to read data which is stored in an invalid magnetic tape format. The tape format must be compatible with the Graphic System.
59	A program was not found when the OLD statement was executed.
60	Not used.
61	An attempt has been made to execute an invalid operation on an open magnetic tape file. Example: Executing a MARK statement with the tape head positioned in the middle of an open data file.
62	There is a disc file system parameter error.
63	There is an error in a binary data header, most likely caused by a machine malfunction.
64	The character string is too long to output in binary format. The length is limited to 8192 characters.

Message Number	Error Message
65	A parity error has occurred in the 4052 or 4054 RAM memory. Although the error is nonfatal (and the message will not be repeated), further operations are unreliable until power has been turned off and back on. In the 4051 this error is not used.
66	The primary address in the specified line is not within the range 1 through 255.
67	An attempt has been made to execute an illegal I/O operation on an internal peripheral device. Example: DRAW 33:50,50
68	The diagnostic loader failed.
69	An input error or an output error has occurred on the General Purpose Interface Bus. Both the NDAC and NRFD signal lines are inactive high, which is an illegal GPIB state. This usually means that there are no peripheral devices connected to the GPIB.
70	There is an incomplete literal string specification in the format string. Example: 100 IMAGE 6D,5("MARK
71	A format string is not specified for the PRINT USING operation.
72	A format string is too short or not enough matching data is specified. Example: 100 IMAGE 6D 110 PRINT USING 100: 23,24,25 Line 100 should be: 100 IMAGE 3(6D)
73	There is an invalid character in the format string specified in the PRINT USING statement.

Message Number	Error Message
74	An n modifier in the format string is out of range or is incorrectly used. When used with the E field operator, n modifiers must be positive integers within the range 1 through 11; they must be within the range 1 through 255 when used with the A,D,L,P,T,X, " , (, and / field operators.
75	The format string specified in the PRINT USING statement is too long (that is, there are too many data specifiers for the PRINT statement). Example: 100 IMAGE 3(6D) 110 PRINT USING 100:A,B Line 100 should be: 100 IMAGE 2(6D)
76	Parentheses are incorrectly used in the format string which is specified in the PRINT USING statement. Example: 100 IMAGE 2(6D 110 PRINT USING 100:A,B Line 100 should be: 100 IMAGE 2(6D)
77	There is an invalid modifier to a field operator in the format string which is specified in the PRINT USING statement. Example: 100 IMAGE 2(6D),2S 110 PRINT USING 100:A,B Line 100 should be: 100 IMAGE 2(6D),S An n modifier is not allowed.
78	An S modifier is incorrectly positioned in the format string which is specified in the PRINT USING statement. The S modifier must always be positioned at the end of the format string. Example: 100 IMAGE 4D,S,8A Line 100 should be: 100 IMAGE 4D,8A,S

Message Number	Error Message
79	A comma is incorrectly used in the format string which is specified in the PRINT USING statement. Example: 100 IMAGE 6,D,S Line 100 should be: 100 IMAGE 6D,S
80	A decimal point is incorrectly used in the format string which is specified in the PRINT USING statement. Example: 100 IMAGE .3D 110 PRINT USING 100:812.345 Line 100 should be: 100 IMAGE FD.3D
81	A data type mismatch has occurred in the PRINT USING statement. Example: 100 IMAGE 6D,6A 110 PRINT USING 100: "MARY",26 Line 100 should be : 100 IMAGE 6A,6D
82	A tabbing error has occurred in the format string which is specified in the PRINT USING statement. Example: 100 IMAGE 10A,2T,FD 110 PRINT USING 100: "ENTER DATA",D The absolute tab to position 2 specified by 2T in line 100 cannot occur because the cursor has already advanced beyond position 2. The tab specification must be at least 11T in this case.
83	A number specified in the PRINT USING statement contains an exponent outside the range ± 127. Example: 100 IMAGE FD.3D 110 PRINT USING 100:8.5E+ 200
84	The IMAGE format string was deleted during the PAGE FULL interrupt routine.
85	A portion of the IMAGE format string was deleted or altered during the PAGE FULL interrupt routine.

Message Number	Error Message
86	A portion of the data specified in the PRINT statement was deleted during the PAGE FULL interrupt routine.
87	A data item specified in the PRINT USING statement is too large to fit into the print field specified in the format string. Example: 100 IMAGE 5A 110 PRINT USING 100: "HORSE FEATHERS" In this example, the string constant "HORSE FEATHERS" is too large to fit into the 5 character field which is specified in line 100.
88	Not used.
89	A ROM pack has issued an error message.
90	Not used.
91	Not used.
92	Not used.
93	Not used.
94	Not used.
95	An internal conversion error has occurred because a parameter in the specified statement is negative.
96	An internal conversion error has occurred because a parameter in the specified statement is greater than 65535.
	NOTE *Messages numbered 97 through 109 apply to the 4052A and 4054A only.*
97	The Hatch Space has a non positive argument.
98	The defined polygon cannot be hatched due to insufficient coordinates, or the polygon is insufficient for AREA, INSIDE, or CENTROID.

Message Number	Error Message
99	The parameters to SEARCH are invalid; the rule string is null or not of even length or its values are not incrementing.
100	The parameter to EXCLUDE is out of range.
101	The parameter to ASC is not in the range 1 ≤ parameter ≤ length of source string.
102	An error was made in attempting to translate; a character in the source string tried to index outside the translate table.
103	There is an invalid parameter in the TABLE function. You cannot assign to the translate table while using it.
104	An assignment has been made to an invalid structure (trying to store a scalar into an array).
105	An attempt was made to access an undefined subprogram in a CALL statement.
106	An attempt was made to execute a SUB statement when it was not called.
107	There was no CALL on the stack when an END SUB was executed.
108	No END IF can be found to exit an IF due to an ELSE, or no LOOP can be found to exit a DO due to an EXIT IF, or no DO can be found to iterate to from a LOOP, or no ELSE or END IF can be found to exit a false IF condition.
109	The formal argument in a CALL statement is not compatible with the actual argument in the SUB statement. (For example, trying to pass a string to a numeric variable.)