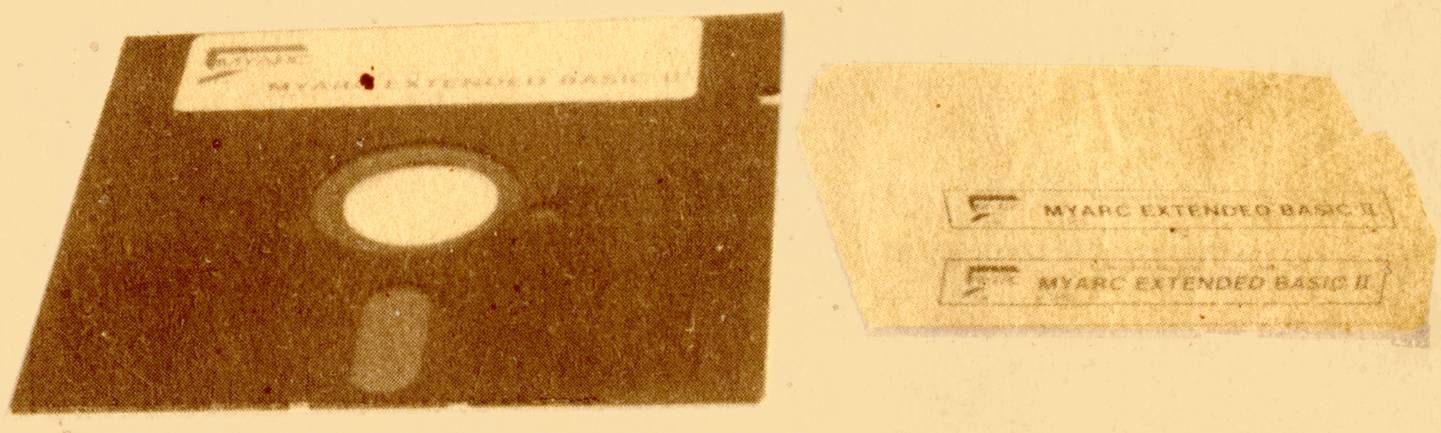
MYARC

T.M.

MYARC

128K.OS

EXTENDED BASIC LEVEL IV



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- Execution up to three times faster!
- 40 Character display text mode.
- Vastly improved error handling support!
- Integer Variables! Now you can achieve full support of integer variables.
- Windowing!
- Hi Resolution Graphics! With commands such as DRAW, FILL, CIRCLE, RECT., and many more, you can perform tasks with precision and speed never possible before!

- CALL MARGIN
- CALL POINT
- CALL POINTSTAT
- CALL DRAWTO
- CALL WRITE
- CALL GRAPHICS
- and many more

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MYARC Extended BASIC II

For The
TI 99/4a Home Computer

IMPORTANT

MYARC Extended BASIC II performs with more power, speed and sophistication than TI Extended BASIC, and therefore requires a larger random access memory (RAM) than does TI Extended BASIC.

A high-performance memory expansion with a minimum of 128 Kbytes of RAM such as MYARC's 128, or 512 Kbyte MEXP-1 Memory Expansion must be used with this advanced programming system. MYARC's high-performance Cards* have been especially designed for maximum speed and trouble-free operation with MYARC Extended BASIC II.

PLEASE NOTE

NOT ALL LARGE-CAPACITY MEMORY EXPANSION CARDS
ARE ADEQUATELY DESIGNED TO FULLY FUNCTION
WITH MYARC EXTENDED BASIC II.

* MYARC's 128, and 512 Kbyte MEXP-1 Memory Expansion Cards also provide RAM-disk and Print Spooler functions.

MYARC EXTENDED BASIC II

This computer language is supplied as:

A module which provides the system with 8k of RAM and a loader for the disk based code.

A floppy disk containing the files for the 128k OS which is transferred to the Myarc expansion memory card.

An EPROM for the MYARC 512k Expansion Memory Card for the TI Peripheral Expansion Box.

The Myarc 512k memory card REQUIRES the revised EPROM in order to function with Myarc Extended Basic.

Myarc Extended Basic will permit virtually all program in TI Basic to run without amendment as all character sets are available.

Programs written for TI Extended Basic may encounter problems if they make use of embedded machine code or links to machine code or any direct access to VDP memory as Myarc Extended Basic uses memory somewhat differently to TI Extended Basic.

Programs written in machine code, to load with the Editor Assembler Option 5, will usually run without modification, although there are some problem cases involving VDP mapping and interrupts.

Programs in Myarc XBII may be much larger than programs for TI Extended Basic.

Myarc XBII has many extra commands and functions and supports bit map graphics and 40 column text mode.

This modified manual prepared by Stephen Shaw in 2020 incorporates the amendments to TI Extended Basic from Version 100 to 110, and the changes to Myarc XBII as it moved from Version 2 to 2.1 to 2.11 to 2.12.

Some material has been deleted as no longer supported, much material has been added or modified.

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INTRODUCTION

In this manual we assume that you have a working knowledge of TI Extended BASIC and that you are experienced in programming.

Since there are numerous additions to, and improvements over TI Extended BASIC, we recommend that you read this entire manual before using MYARC Extended BASIC II. The many examples, programs, and appendices can be very useful for practice and review.

MYARC's Extended BASIC II is an improved programming language. Its new features add significant capabilities and power to TI Extended BASIC. Program operation and execution is up to four times faster.

MYARC Extended BASIC II improvements include the following:

DEFINT--A new instruction enabling you to declare the data-type of specified numeric variables as DEFINT. DEFINT variables are processed faster and require less memory than do real, or double precision floating point numbers. If DEFINT is not specified, double precision floating point variables will be used. These variables have a greater range of values than DEFINT variables and may contain decimal portions. A numeric variable of the DEFINT data-type is a whole number greater than or equal to -32768 and less than or equal to 32767.

CALL GRAPHICS--A subprogram which gives you the option of having either a 32 or 40 column mode. With a 32 column mode, there will be 2 columns of margin on each side and 28 columns between. With the 40 column mode, the margins remain the same, but with 36 columns between.

CALL MARGINS--This subprogram allows the margins to be removed and screen windows to be specified.

TERMCHAR--This function returns the character code of the key pressed to exit from the previously executed statement. If TERMCHAR is used as part of a command, the value returned depends upon which key was pressed to enter the command (ENTER, UP ARROW, or DOWN ARROW).

FEATURES OF MYARC EXTENDED BASIC II

EXPANDED AND ENHANCED GRAPHIC COMMAND SET.

MYARC EXTENDED BASIC II dramatically increases the graphics capabilities of your computer. By enhancing already existing extended BASIC commands and allowing programmer access to standard, text, and bitmap (high-resolution) modes you now have the capabilities of a professional graphics development system.

NEW GRAPHIC MODES.

Previously, you could create and run your extended basic programs only in the standard "pattern" mode. This provided you with sprites, color sets, and a 28/32 column by 24 row screen display.

TEXT MODE differs from pattern mode by giving you a 40 column by 24 row screen display to work with. If you are using a standard t.v. for display, you will note that all 40 columns are visible. (In the standard mode usually the first and last 1 or 2 columns are lost.)

> Text mode is most useful in data/word processing, text manipulation, and utility programs not requiring exotic graphics. (Sprites and color sets do not exist in text mode.)

HIGH-RESOLUTION MODE (Bit Map Mode) is a high resolution graphics mode which allows placing or locating individual pixels. In contrast, Pattern Mode only allows you to control screen display by placing characters on the screen. If you've used the command "CALL CHAR" to define your own characters before, you know that each character is made up of many dots that are on or off. A standard character is made up of 64 of these dots. In High-Resolution Mode, each of these dots (referred to as pixels), can be directly placed on the screen. Any group of 4 pixels can be made to be any one of the available colors. The screen dispay is now 256 columns by 192 rows. Add to this the ability to use sprites, and you begin to see the potential.

ADDITIONAL GRAPHIC COMMANDS

Additional commands are provided to most effectively utilize these new capabilities. For example, in High-Resolution Mode - CALL DRAW, CALL DRAWTO, CALL FILL, CALL CIRCLE CALL RECTANGLE, CALL POINT, CALL GCHAR (in High Resolution Mode), and CALL WRITE, along with most of the already existing extended basic commands, provide a medium previously found only in the most complex assembly language programs.

The summary provided below highlights the capabilities of the new graphic commands:

CALL DRAW - draws, erases or inverts a line from a user defined point to another user-defined point.

CALL DRAWTO - draws, erases or inverts a line from the last point

drawn to a user-defined point.

CALL CIRCLE - draws, erases or inverts a circle around a specified point with a radius of up to 340 pixels.

CALL POINT - draws, erases or inverts a simple user-defined point (pixel).

CALL RECTANGLE - draws, erases or inverts squares or rectangles, solid or hollow, from a 1 dot square to a 256 by 192 pixel rectangle.

CALL FILL - fills in a shape of any dimensions (within the screen boundaries, with a user-defined pattern.

CALL GCHAR - returns a value indicating whether the point specified was turned off or turned on.

CALL WRITE - allows text and predefined characters to be placed on the screen at a specified point.

CALL DCOLOR - defines the current foreground and background colors used in the special High -Resolution Mode graphic commands.

CALL GRAPHIC - allows access to and from the 3 graphic modes.

GRAPHIC ENHANCEMENTS

ENLARGED CHARACTER SET.
The predefined and user defined character set has been enlarged from 112 characters (32 - 143), to 256 characters (0 - 255).

INCREASED NUMBER OF COLOR SETS.
The number of character color sets has been proportionately increased from 15 sets to match the increased size of the character set. This gives a total of 33 color sets.

NUMBER OF SPRITES.
The number of sprites available for use is increased to 32.

SPRITE CONTROL.
CALL COINC, CALL POSITION and CALL DISTANCE all show vastly improved characteristics due to the high speed of MYARC EXTENDED BASIC II. This provides arcade-like animation and response in a basic language.

SET-UP INSTRUCTIONS

A. Memory Expansion

1. Carefully following instructions in your Peripheral Expansion System User Manual, remove the 32K Memory Expansion Card from you PEB if there is one. The 32K Memory Card MUST NOT be installed in your PEB when using MYARC Extended BASIC II or when the 128K Memory Expansion Card is in place in your PEB.

2. Insert a high-performance 128K (or larger) Memory Expansion Card into your PEB. You can use same slot previously occupied by the 32K Card or any other convenient slot.

B. Powering Up

Follow standard procedure for powering up peripherals and console and for inserting the MYARC Extended BASIC II module into the module slot of the console.

After each powering up insert the supplied MYARC Extended BASIC II diskette into drive #1 and select "128KOS" from the selection menu on your screen. The MYARC Extended BASIC II program will then load into RAM.

As in TI Extended BASIC, the program will look for DSK1.LOAD and execute accordingly.

If a DSK1.LOAD program is not found, the screen will show "MYARC Extended BASIC II READY" with a blinking cursor. You may then remove the MYARC Extended BASIC II diskette from drive #1.

PLEASE NOTE- If you have the late model 99/4A (2.2 version) console, the following additional step is required:

After inserting the MYARC Extended BASIC II diskette into drive #1, select TI BASIC from the selection menu of your screen and type in:

CALL 128KOS

Execution will then proceed as above.

REFERENCE SECTION

This reference section is an alphabetical listing of all MYARC Extended BASIC II commands, statements, and functions, with detailed explanations on each.

MYARC Extended BASIC II is totally upward compatible with TI Extended BASIC so that you are already familiar with nearly all the referenced commands, statements, and functions.

Nevertheless, we suggest that you carefully review this entire section.

In addition to newly-added commands, statements and functions, additional details and explanations have been expanded and/or added to the original TI Extended BASIC in the many places where MYARC Extended BASIC II provides additional power, flexibility, and/or sophistication.

Extended Basic programs which have embedded machine code will usually fail to run in Myarc XBII - these are often produced using third party utilities such as Systex or Ace.

NOTE that Myarc XBII will run all TI BASIC programs even where Character Sets 15 and 16 have been used.

There is an appendix dealing with Machine Code programs and Myarc disk utility "TIVDP".

Extended Basic programs that use CALL PEEK or CALL LOAD will probably fail to run in Myarc XBII due to essential remapping of memory locations. In particular, any programs supplied with Extended Basic "PROTECTION" may check to see if it has been removed and will fail as they will not receive the value they expect with a CALL PEEK.

Format
ABS(numeric-expression)

Type
Numeric (REAL or DEFINT)

Description
The ABS function gives the absolute value of the numeric-expression.

If the value of the numeric-expression is positive or zero, ABS returns its value.

If the value of the numeric-expression is negative, ABS returns its negative (a positive number).

ABS always returns a non-negative number.

Examples

```
100 PRINT ABS(45.2)
PRINT ABS(45.2)
Prints 45.2

100 VV=ABS(-7.345)
VV=ABS(-7.345)
Sets VV equal to 7.345
```

Format
[[AT(row,column)] [BEEP] [ERASE ALL] [SIZE(numeric-expression)]
[VALIDATE(type[,...])]:]variable

Cross Reference
GRAPHICS, INPUT, LINPUT, MARGINS, TERMCHAR

Description
The ACCEPT instruction suspends program execution to enable you to enter data from the keyboard.

The options available with ACCEPT make it more versatile for keyboard input than the input statement. You can accept up to one line of input from any position within the screen window, sound a tone when the computer is ready to accept input, clear the screen window before accepting input, limit input to a specified number of characters, and define the types of valid input.

ACCEPT can be used as either a program statement or a command.

The data value entered from the keyboard is assigned to the variable you specify. If you specify a numeric variable, the data value entered from the keyboard must be a valid representation of a number. If you specify a string variable, the data value entered from the keyboard can be either a string or a number. Trailing spaces are removed.

A string value entered from the keyboard can optionally be enclosed in quotation marks. However, a string containing a comma, a quotation mark, or leading or trailing spaces must be enclosed in quotation marks. A quotation mark within a string is represented by two adjacent quotation marks.

You normally press ENTER to complete keyboard input; however, you can also use AID, BACK, BEGIN, CLEAR, PROC'D, DOWN ARROW, or UP ARROW. You can use the TERMCHAR function to determine which of those keys was pressed to exit from the previous ACCEPT, INPUT, or LINPUT instruction.

Note that pressing CLEAR during keyboard input normally causes a break in the program. However, if your program includes an ON BREAK NEXT statement, you can use CLEAR to exit from an input field.

In High-Resolution Mode, ACCEPT has no effect. See Appendix K.

Options
You can enter the following options, separated by a space in any order.

AT--enables you to specify the location of the beginning of the input field. Row and column are relative to the upper-left corner of the screen window defined by the margins. The upper-left corner of the window defined by the margins is considered to be the intersection of row 1 and column 1 by an ACCEPT instruction that uses the AT option. If you do not use the AT option, the input field begins in the far left

Continued -->

column of the bottom row of the window.

BEEP--sounds a short tone to signal that the computer is ready to accept input.

ERASE ALL--places a space character (ASCII code 32) in every character position in the screen window before accepting input.

SIZE--enables you to specify a limit to the number of characters that can be entered as input. The limit is the absolute value of the numeric-expression. If the algebraic sign of the numeric-expression is positive, or if you do not use the SIZE option, the input field is cleared before input is accepted. If the numeric-expression is negative, the input field is not cleared, enabling you to place a value in the input field that may be accepted by pressing ENTER. If you do not use the SIZE option, or if the absolute value of the numeric-expression is greater than the number of characters remaining in the row (from the beginning of the input field to the right margin), the input field extends to the right margin.

VALIDATE--enables you to specify the characters or the types of characters that are valid input. If you specify more than one type, a character from any of the specified types is valid. The types are as follows:

TYPE	VALID INPUT
ALPHA	All alphabetic characters.
UALPHA	All upper-case alphabetic characters.
LALPHA	All lower-case alphabetic characters.
DIGIT	All digits (0-9).
NUMERIC	All digits (0-9), the decimal point (.), the plus sign (+), the minus sign (-), and the upper-case letter E.

You can also use one or more string expressions as types. The characters contained in the strings specified by the string expressions are valid input.

The VALIDATE option only verifies data entered from the keyboard. If there is a default value in the input field (entered with DISPLAY, for example, the validate option has no effect on that value.

Examples

```
100 ACCEPT AT(3,5):Y
```
Accepts data at the third row, fifth column of the screen window into the variable Y.

100 ACCEPT VALIDATE("YN"):R$
Accepts data containing Y and/or N into the variable R$. (YYNN would be a valid entry.)

100 ACCEPT ERASE ALL:B
Accepts data into the variable B after putting the blank character into all positions in the screen window.

100 ACCEPT AT(R,C)SIZE(FIELDLEN)BEEP VALIDATE(DIGIT,"AYN"):X$
Accepts a digit or the letters A, Y, or N into the variable X$. The length of the input may be up to FIELDLEN characters. A field the length of FIELDLEN is filled with blank characters, and then the data value is accepted at row R, column C. A beep is sounded before acceptance of data.

Program

```
100 DIM NAME$(20),ADDR$(20)
110 DISPLAY AT (5,1)ERASE AL
L:"NAME:"
120 DISPLAY AT(7,1):"ADDRES
S:"
130 DISPLAY AT(23,1):"TYPE
A ? TO END ENTRY."
140 FOR S=1 TO 20
150 ACCEPT AT(5,7)VALIDATE(
ALPHA,"?")BEEP SIZE(13):NAME
$(S)
160 IF NAME$(S)="?" THEN 200
170 ACCEPT AT(7,10)SIZE(12)
:ADDR$(S)
180 DISPLAY AT(7,10):" "
190 NEXT S
200 CALL CLEAR
210 DISPLAY AT(1,1):"NAME",
"ADDRESS"
220 FOR T=1 TO S-1
230 DISPLAY AT(T+2,1):NAME$
(T),ADDR$(T)
240 NEXT T
250 GOTO 250
```
(Press CLEAR to stop the program.)

Format
ASC(string-expression)

Cross Reference
CHR$

Description
The ASC function returns the ASCII character code corresponding to the first character of the string-expression.

ASC is the inverse of the CHR$ function.

The string-expression cannot be a null string.

Examples

```
100 PRINT ASC("A")
```
Prints 65 (the ASCII character code for the letter A).

```
100 B=ASC("1")
```
Sets B equal to 49 (the ASCII character code for the character 1).

```
100 DISPLAY ASC("HELLO")
```
Displays 72 (the ASCII character code for the letter H).

```
100 A$="DAVID"
110 PRINT ASC(A$)
```
Prints 68 in line 110.

Format
ATN(numeric-expression)

Cross Reference
COS, SIN, TAN

Description
The ATN function returns the angle (in radians) whose tangent is the value of the numeric-expression.

The value returned by ATN is always greater than -pi/2 and less than pi/2.

To convert radians to degrees, multiply by 180/pi.

Examples

```
100 PRINT 4*ATN(-1)
Prints -3.141592654.

100 Q=PI/ATN(1.732)
Sets Q equal to 3.0000363894830.
```

Format
BREAK(line-number-list)

Cross Reference
CONTINUE, ON BREAK, UNBREAK

Description
The BREAK instruction sets a breakpoint at each program statement you specify. When the computer encounters a line at which you have set a breakpoint, your program stops running before that statement is executed.

BREAK is a valuable debugging aid. You can use BREAK to stop your program at a specific program line, so that you can check the values of variables at that point.

You can use BREAK line-number-list as either a program statement or a command.

The line-number-list consists of one or more line numbers, separated by commas. When a BREAK instruction is executed, breakpoints are set at the specified program lines. If you use BREAK as a program statement, line-number-list is optional. When a BREAK statement with no line-number-list is encountered, the computer stops running the program at that point.

If you use BREAK as a command, you must include a line-number-list.

Breakpoints

When your program stops at a breakpoint, the message Breakpoint in line number is displayed. While your program is stopped at a breakpoint, you can enter any valid command.

To resume program execution starting with the line at which the break occured, enter the CONTINUE command. However, if you edit your program (add, delete, or change a program statement) you cannot use CONTINUE. (This prevents errors that could result from resuming execution in the middle of a revised program.) You also cannot use CONTINUE if you enter a MERGE or SAVE command or a LIST command with the file-specification option. Note that pressing CLEAR (FCTN 4) also causes a breakpoint to occur before the execution of the next program statement. When your program stops at a breakpoint, the computer performs the following operations:

It restores the default character definitions of all characters.

If the computer is in High-Resolution Mode, it restores the default graphics mode (Pattern) and margin settings (3,30,1,24)

It restores the default foreground color (black) and background color (transparent) to all characters.

Continued--->

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It restores the default screen color (cyan).

It deletes all sprites.

It resets the sprite magnification level to 1.

The graphics colors (see DCOLOR) and current position (see DRAWTO) are not affected. If the computer is in Pattern or Text Mode, the graphics mode and margin settings remain unchanged.

Removing Breakpoints

You can remove a breakpoint by using the UNBREAK instruction or by editing or deleting the line at which the breakpoint is set. When your program stops at a breakpoint, that breakpoint is automatically removed.

All breakpoints are removed when you use the NEW or SAVE command.

BREAK Errors

If the line-number-list includes an invalid line number (0 or a value greater than 32767), the message Bad line number is displayed. If the line-number-list includes a fractional or negative line number, the message Syntax error is displayed. In both cases, the BREAK instruction is ignored; that is, breakpoints are not set even at valid line numbers in the line-number-list. If you were entering BREAK as a program statement it is not entered into your program.

If the line-number-list includes a line number that is valid (1-32767) but is not the number of a line in your program, or a fractional number greater than 1, the message

```
WARNING
LINE NOT FOUND
```

is displayed. (If you were entering BREAK as a program statement, the line number is included in the warning message.) A breakpoint is, however, set at any valid line in the line-number-list preceding the line number which caused the warning.

If your program is operating in the High-Resolution Mode, no message is displayed. See Appendix K.

Examples
150 BREAK
BREAK as a statement causes a breakpoint before execution of the next line in the program.

100 BREAK 120,130
Causes breakpoints before execution of lines 120 and 130.

BREAK 10,400,130
As a command, causes breakpoints before execution of lines 10, 400, and 130.

Format
BYE

Description
The BYE command resets the computer. Always use BYE to exit from MYARC Extended BASIC II. The BYE command causes the computer to do the following:

Close all open files.

Erase the program and all variable values in memory.

Exit from MYARC Extended BASIC II.

Display the master title screen.

Although you can exit from MYARC Extended BASIC II also by pressing QUIT (FCTN=), pressing QUIT does not close open files and may result in the loss of data in those files.

Format
CALL subprogram-name[(parameter-list)]

Cross Reference
SUB

Description
The CALL instruction transfers program control to the specified subprogram.

You can use CALL as either a program statement or a command.

The CALL instruction transfers program control to the subprogram specified by the subprogram-name.

The optional parameter-list consists of one or more parameters separated by commas. Use of a parameter-list is determined by the subprogram you are calling. Some subprograms require a parameter-list, some do not use a parameter-list, and with some a parameter-list is optional.

You can use CALL as a program statement to call either a built-in MYARC Extended BASIC II subprogram or to call a subprogram that you write. After the subprogram is executed, program control returns to the statement immediately folowing the CALL statement.

You can use CALL as a command only to call a built-in MYARC Extended BASIC II subprogram, not to call a subprogram that you write.

Each of the following built-in subprograms is discussed separately in this manual.

CHAR	GCHAR	PEEKV
CHARPAT	GRAPHICS	POINT
CHARSET	HCHAR	POKEV
CIRCLE	INIT	POSITON
CLEAR	JOYST	RDDIR
COINC	KEY	RECTANGLE
COLOR	LINK	SAY
DELSPRITE	LOAD	SCREEN
DISTANCE	LOCATE	SOUND
DRAW	MAGNIFY	SPGET
DRAWTO	MOTION	SPRITE
DCOLOR	MARGINS	VCHAR
EMDK	PART	VERSION
ERR	PATTERN	VOL
FILL	PEEK	WRITE

When using CALL with your own subprograms, you may optionally pass a variable value to the subprogram with or without parenthesis () which controls whether the variable value is changed. This is dealt with more fully in the entry for SUB on Page 197.

Continued-->

Program

The following program illustrates the use of CALL with a built-in subprogram (CLEAR) in line 100 and the use of a user-written subprogram (TIMES) in line 120.

```
100 CALL CLEAR
110 X=4
120 CALL TIMES(X)
130 PRINT X
140 STOP
200 SUB TIMES(Z)
210 Z=Z*PI
220 SUBEND
RUN
(SCREEN CLEARS)
12.56637061
```

CHAR subprogram

Format
CALL CHAR(character-code,pattern-string[,...])

Cross Reference
CHARPAT, CHARSET, COLOR, DCOLOR, GRAPHICS, HCHAR, SCREEN, SPRITE, VCHAR, WRITE

Description
The CHAR subprogram enables you to define your own characters so that you can create graphics on the screen.

CHAR is the inverse of the CHARPAT subprogram.

Character-code is a numeric expression with a value from 0 to 255, specifying the number of the character (codes 0-255). You can define any of the 256 characters and display them as characters and/or sprites.

The pattern-string specifies the definition of the character. The pattern-string, which may be up to 64 digits long, is a coded representation of the pixels that define up to four characters on the screen, as explained below. Any letters entered as part of a pattern-string must be upper case.

You can use the CHARSET subprogram to restore default character definitions of characters 32-95 inclusive. Also, when your program ends (either normally or because of an error), stops at a breakpoint, or changes graphics mode, all default character definitions (0-255) are restored.

The instructions that you can use to display characters on the screen vary according to the graphics mode. In all modes except Text Mode, you can use the SPRITE subprogram to display sprites on the screen.

If you use HCHAR or VCHAR to display a character on the screen and then later use CHAR to change the definition of that character, the result depends on the graphics mode.

In Pattern and Text Modes, the displayed character changes to the newly defined pattern.

In High-Resolution Mode, the displayed character remains unchanged.

Pattern and High-Resolution Modes
In Pattern and High-Resolution Modes, each character is composed of 64 pixels in a grid eight pixels high and eight pixels wide, as explained below.

In Pattern Mode, you can use the DISPLAY, DISPLAY USING, PRINT, and PRINT USING instructions and the HCHAR and VCHAR subprograms to display characters on the screen.

Continued--->

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In High-Resolution Mode, you can use the HCHAR, VCHAR, and WRITE subprograms to display characters on the screen. Only characters 0-215 are available. See Appendix K.

Text Mode

In Text Mode, each character is composed of 48 pixels in a grid eight pixels high and six pixels wide. The eight by eight grid described below is used to define characters; however, the last two pixels in each pixel-row are ignored.

In Text Mode, you can use the DISPLAY, DISPLAY USING, PRINT, and PRINT USING instructions and the HCHAR and VCHAR subprograms to display characters on the screen. You cannot display sprites in Text Mode.

Character Definition--The Pattern String

Characters are defined by turning some pixels on and leaving others off. The space character (ASCII code 32) is a character with all the pixels turned off. Turning all the pixels on produces a solid block, eight pixels high and eight pixels wide.

The foreground color is the color of the pixels that are on. The background color is the color of the pixels that are off. (For more information see COLOR, DCOLOR, and SCREEN.)

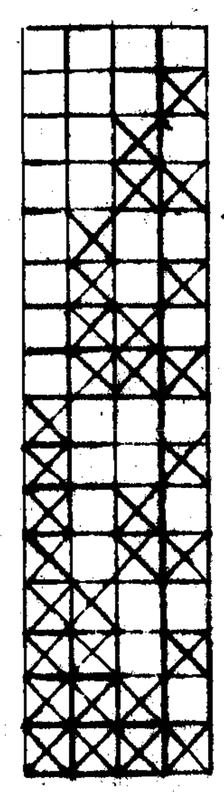
When you enter MYARC Extended BASIC II, the characters are predefined with the appropriate pixels turned on. To redefine a character, you specify which pixels to turn on and which pixels to turn off.

For the purpose of defining characters, each pixel-row (eight pixels) is divided into two blocks (four pixels each). Each digit in the pattern-string is a code specifying the pattern of the four pixels in one block.

You define a character by describing the blocks from left to right and from top to bottom. The first two digits in the pattern-string describe the pattern for the first two blocks (pixel-row 1) of the grid, the next two digits define the next two blocks (pixelrow 2), and so on.

The computer uses a binary (base 2) code to represent the status of each pixel; you use hexadecimal (base 16) notation of the binary code to specify which pixels in a box are turned on and which pixels turned off.

The following table shows all the possible on/off combinations of the four pixel in a block and the binary code and hexadecimal notation representing each combination.

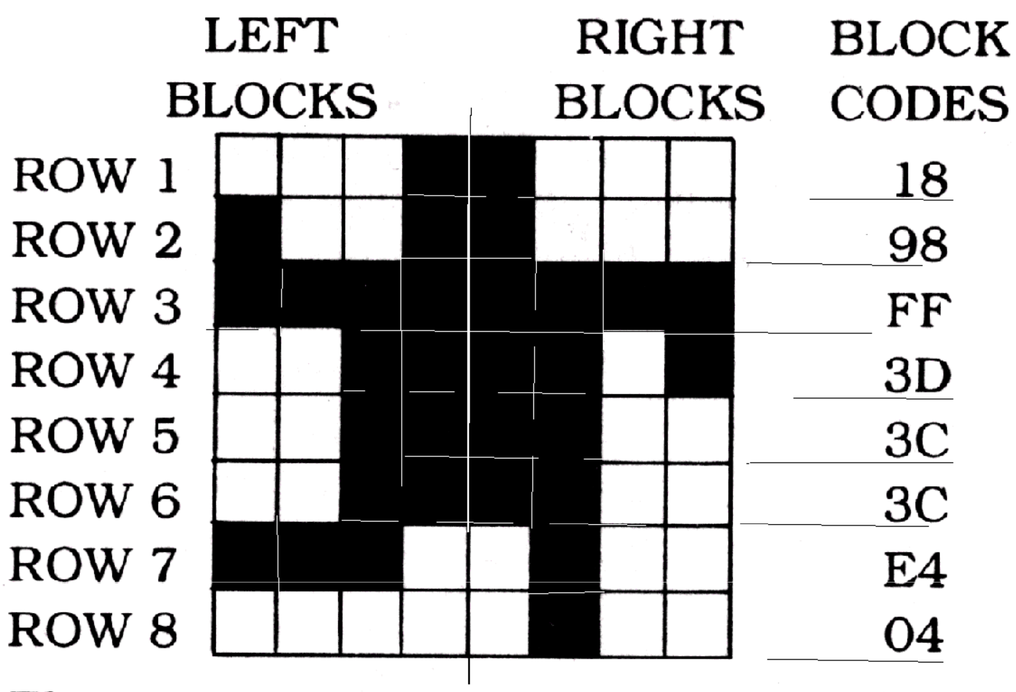
BLOCK	BINARY CODE (0=OFF; 1=ON)	HEXADECIMAL NOTATION
	0000	0
	0001	1
	0010	2
	0011	3
	0100	4
	0101	5
	0110	6
	0111	7
	1000	8
	1001	9
	1010	A
	1011	B
	1100	C
	1101	D
	1110	E
	1111	F

A character definition consists of 16 hexadecimal digits; each digit represents one of the 16 blocks that comprise a character. As the pattern-string may be up to 64 digits long, you can define as many as four consecutive characters with one pattern-string.

If the length of the pattern-string is not a multiple of 16, the computer fills the pattern-string with zeros until its length is a multiple of 16.

To describe the dot pattern pictured below, you code this string for CALL CHAR:

"1898FF3D3C3CE404"



The program on the following page uses this and one other string to make a figure "dance."

Continued--->

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```
100 CALL CLEAR
110 A$="1898FF3D3C3CE404"
120 B$="1819FFBC3C3C2720"
130 CALL COLOR(27,7,12)
140 CALL VCHAR(12,16,244)
150 CALL CHAR(244,A$)
160 GOSUB 200
170 CALL CHAR(244,B$)
180 GOSUB 200
190 GOTO 150
200 FOR DELAY=1 TO 150
210 NEXT DELAY
220 RETURN
RUN
(screen clears)
(character moves)
(Press CLEAR to stop the program.)
```

To make this example work in the High-Resolution Mode, make the following changes.

```
105 CALL GRAPHICS(3)


130 CALL DCOLOR(7,12)
140 CALL CHAR(144,A$,145,B$)
150 CALL VCHAR(12,16,144)
170 CALL VCHAR(12,16,145)
```

If a program stops for a breakpoint, all characters are reset to their standard patterns. When the program ends normally or because of an error, all characters are reset.

Exiting High-Resolution Mode resets all characters.

The following example works in all graphics modes.

```
100 CALL CLEAR
110 CALL GRAPHICS(X)
120 CALL CHAR(144,"FFFFFFFFFFFF]
130 CALL CHAR(42,"0F0F0F0F0F0F0]
140 CALL HCHAR(12,17,42)
150 CALL VCHAR(14,17,144)
160 FOR DELAY=1 TO 500
170 NEXT DELAY
RUN
```

The X in line 110 must be replaced with the number of the graphics mode to be designated.

CHARPAT subprogram

Format
CALL CHARPAT(character-code,string-variable[,...])

Cross Reference
CHAR

Description
The CHARPAT subprogram enables you to ascertain the current character definitions of specified characters.

Character-code is a numeric expression with a value from 0 to 255, specifying the number of the character of which you want the current definition.

The pattern describing the character definition is returned in the specified string-variable. The pattern is in the form of a 16-digit hexadecimal code. See CHAR for an explanation of the pattern used for character definition.

See Appendix B for a list of the available characters.

Example

```
100 CALL CHARPAT(33,C$)
```
Sets C$ equal to "0010101010001000", the pattern identifier for character 33, the exclamation point.

Format
CALL CHARSET

Cross Reference
CHAR, COLOR

Description
The CHARSET subprogram restores default character definitions and colors.

CHARSET restores the default character definitions to characters 32-95, inclusive. CHARSET restores the default colors to all 256 characters.

See Appendix B for a list of the available characters.

CALL GRAPHICS(1) and CALL GRAPHICS(2) will restore all predefined characters where appropriate.

CHDIR CHDIR

Format
CHDIR ["] devicename ["]

Cross Reference
PWD

Description
The Working Directory is used with OLD, SAVE and RUN from Command Mode.

When specifying a file for any of these commands if no period is specified in the name the Working Directory name is prefixed to the file name.

If the working directory is DSK1. and you specify SAVE PROGRAM then XBII will try to save the current program to DSK1.PROGRAM.

Upon power up the working directory is DSK1..

The working directory can be changed to any name up to 15 characters.

CHDIR DSK1.
CHDIR "DSK2."
CHDIR MYDEVICE.
CHDIR RD.
CHDIR DSK.ME.
Note: The device name MUST end with a period .
(Introduced in Version 2.00)

CHR$ function--Character

Format
CHR$(character-code)

Type
String

Cross Reference
ASC

Description
The CHR$ function returns the character corresponding to the ASCII character code specified by the value of the character-code.

CHR$ is the inverse of the ASC function.

Character-code is a numeric expression with a value from 0 to 32767 inclusive, specifying the number of the character you wish to use. If the value of character-code is greater than 255, it is repeatedly reduced by 256 until it is less than 256. If the value of the character-code is not an integer, it is rounded to the nearest integer.

Examples

```
100 PRINT CHR$(72)
```
Prints H.

```
100 X$=CHR$(33)
```
Sets X$ equal to !.

Program

For a complete listing of all ASCII characters and their corresponding ASCII values, run the following program.

```
100 CALL CLEAR
110 IMAGE ### ## ### ##
120 FOR A=32 TO 127
130 PRINT USING 110:A,CHR$(A);
140 NEXT A
150 GOTO 150
```
(Press CLEAR to stop the program.)

CIRCLE subprogram

Format
CALL CIRCLE(line-type,pixel-row,pixel-column,radius
[,pixel-row2,pixel-column2, radius 2[,...]])

Cross reference
DCOLOR, DRAW, DRAWTO, FILL, GRAPHICS, POINT, RECTANGLE, WRITE

Description
The CIRCLE subprogram enables you to draw or erase circles around a specified point.

Note that CIRCLE draws and erases the outside edges (perimeter) of a circle, not the area it encircles.

Line-type is a numeric-expression whose value specifies the action taken by the CIRCLE subprogram.

TYPE	ACTION
2	Reverses the status of each pixel of the circle. (If a pixel is on, it is turned off; if a pixel is off, it is turned on). This effectively reverses the color of the circle.
1	Draws a circle of the foreground color specified by the DCOLOR subprogram. This is accomplished by turning on each pixel of the specified circle.
0	Erases a circle. This is accomplished by turning off each pixel of the specified circle.

Pixel-row and pixel-column are numeric expressions whose values represent the screen portion of the point the circle is drawn around (center-point). Radius is a numeric expression whose value represents the distance from the center-point of the circle to it's outer edge.

You can optionally draw more circles by specifying additional sets of pixels (center-points), and additional radii.

Pixel-row must have a value from 1 to 192, pixel-column must have a value from 1 to 256. Radius must have a value from 1 to 320.

The pixel-row/pixel-column you specify (center-point), becomes the current position used by the DRAWTO subprogram.

CIRCLE can only be used in High-Resolution Mode. An error results if you use CIRCLE in Pattern or Text Modes.

Example

The following program first selects the High/Resolution Mode (which also clears the screen). Next it uses a FOR-NEXT loop to create and subsequently erase a series of circles from one side of the screen to the other side of the screen, giving the illusion of a rolling ball.

```
100 CALL GRAPHICS(3)
110 FOR T=24 to 216 STEP 4
120 CALL CIRCLE(1, 166, 28+T, 24)
130 CALL CIRCLE(0, 166, 26+T, 24)
140 CALL CIRCLE(1, 166, 30+T, 24)
150 CALL CIRCLE(0, 166, 28+T, 24)
160 NEXT T
170 END
```

Format
CALL CLEAR

Cross Reference
DCOLOR, DELSPRITE

Description
The CLEAR subprogram erases the screen.

In Pattern and Text Modes, CLEAR places a space character (ASCII code 32) in every screen position.

In High-Resolution Mode, CLEAR erases the screen by turning off all pixels and restoring the default graphics colors (black on transparent).

The CLEAR subprogram has no effect on sprites. Use the DELSPRITE subprogram to remove sprites.

Programs

When the following program is run, the screen is cleared before the PRINT statements are performed.

```
100 CALL CLEAR
110 PRINT "HELLO THERE!"
120 PRINT "HOW ARE YOU?"
RUN
--screen clears
HELLO THERE!
HOW ARE YOU?
```

If the space character (ASCII code 32) has been redefined by the CALL CHAR subprogram, the screen is filled with the new character when CALL CLEAR is performed.

```
100 CALL CHAR(32,"0103070F1F3F7FFF")
110 CALL CLEAR
120 GOTO 120
RUN
--Screen is filled with *
(Press CLEAR to stop the program.)
```

The following program first fills and then clears the entire screen.

```
100 CALL GRAPHICS(3)
110 CALL HCHAR(1,2,72,768)
120 FOR DELAY=1 TO 500::NEXT DELAY
130 CALL CLEAR
140 GOTO 140
RUN
(Press CLEAR to stop the program.)
```

Typing CLS in immediate mode is the same as CALL CLEAR and will cause the display to be cleared..

Format
CLOSE #file-number[:DELETE]

Cross Reference
DELETE, OPEN

Description
The CLOSE instruction closes the specified file. When you close a file, you discontinue the association (between your program and the file) that you established in an OPEN instruction.

You can use CLOSE as either a program statement or a command.

The file-number is a numeric expression whose value specifies the number of the file as assigned in its OPEN instruction.

The DELETE option, which can be used only with certain devices, deletes the file after closing it. DELETE has no effect on a file stored on an audio cassette. For more information about using the DELETE option with a particular device, refer to the owner's manual that comes with that device.

After the CLOSE instruction is performed, the closed file cannot be accessed by an instruction because the computer no longer associates that file with a file-number. You can then reassign the file-number to another file.

When you close a file on a cassette, the computer displays instructions for you to follow.

Closing Files Without the CLOSE Instruction

To protect the data in your files, the computer closes all open files when it reaches the end of your program or when it encounters an error (either in Command or Run mode).

Open files are also closed when you do one of the following:

Edit your program (add, delete, or change a program statement).

Enter the LIST command with the file-specification option.

Enter the BYE, MERGE, NEW, OLD, RUN, or SAVE command.

Always use BYE to exit from Extended BASIC II. Although you can also exit by pressing QUIT (FCTN=), pressing QUIT does not close open files, and may result in the loss of data in those files.

Open files are not closed when you stop program execution by pressing CLEAR (FCTN 4) or when your program stops at a breakpoint set by a BREAK instruction.

Continued--->

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Examples

When the computer performs the CLOSE statement for a cassette tape recorder, you receive instructions for operating the recorder. The following two examples show the difference between closing a cassette file and closing a diskette file.

Cassette File

```
100 OPEN #24:"CS1",INTERNAL,OUTPUT,FIXED
200 CLOSE #24
RUN
REWIND CASSETTE TAPE THEN PRESS ENTER
PRESS CASSETTE RECORD THEN PRESS ENTER
PRESS CASSETTE STOP THEN PRESS ENTER
```

NOTE:
Cassette support was removed from XBII Version 2.00 onwards

Diskette File

```
100 OPEN #24:"DSK1.MYDATA",INTERNAL,UPDATE,FIXED
200 CLOSE #24
RUN
```

The CLOSE statement for a diskette requires no further action on your part.

Format
Two Sprites
CALL COINC(#sprite-numberl,#sprite-number2,tolerance,numeric-variable)
A Sprite and a Screen Pixel
CALL COINC(#sprite-number,pixel-row,pixel-column,tolerance,
numeric-variable)
All Sprites
CALL COINC(ALL,numeric-variable)

Cross Reference
SPRITE

Description
The COINC subprogram enables you to ascertain if sprites are coincident (in conjunction) with each other or with a specified screen pixel.

The exact conditions that constitute a coincidence vary depending on whether you are testing for the coincidence of two sprites, a sprite and a screen pixel, or all sprites.

If the sprites are moving very quickly, COINC may occasionally fail to detect a coincidence.

Two Sprites
Two sprites are considered to be coincident if the upper-left corners of the sprites are within a specified number of pixels (tolerance) of each other.

The values of the numeric expressions sprite-numberl and sprite-number2 specify the numbers of the two sprites as assigned in the SPRITE subprogram.

A coincidence exists if the distance between the pixels in the upper-left corners of the two sprites is less than or equal to the value of the numeric expression tolerance.

The distance between two pixels is said to be within tolerance if the difference between pixel-rows and the difference between pixel-columns are both less than or equal to the specified tolerance. Note that this is not the same as the distance indicated by the DISTANCE subprogram.

COINC returns a value in the numeric-variable indicating whether or not the specified coincidence exists. The value is -1 if there is a coincidence or 0 if there is no coincidence.

A Sprite and a Screen Pixel
A sprite is considered to be coincident with a screen pixel if the upper-left corner of the sprite is within a specified number of pixels (tolerance) of the screen pixel or if any pixel in the sprite occupies the screen pixel location.

Continued -->

The sprite-number is a numeric-expression whose value specifies the number of the sprite assigned in the SPRITE subprogram.

The pixel-row and pixel-column are numeric expressions whose values specify the position of the screen pixel.

A coincidence exists if the distance between the pixel in the upper-left corner of the sprite and the screen pixel is less than or equal to the value of the numeric expression tolerance. (Note that a coincidence also exists if any pixel in the sprite occupies the screen pixel location.)

The distance between two pixels is said to be within tolerance if the difference between pixel-rows and the difference between pixel-columns are both less than or equal to the specified tolerance. Note that this is not the same as the distance indicated by the DISTANCE subprogram.

COINC returns a value in the numeric-variable indicating whether or not the specified coincidence exists. The value is -1 if there is a coincidence or 0 if there is no coincidence.

All Sprites

The ALL option tests for the coincidence of any of the sprites.

For the ALL option, sprites are considered to be coincident if any pixel of any sprite occupies the same screen pixel location as any pixel of any other sprite.

COINC returns a value in the numeric-variable indicating whether or not a coincidence exists. The value is -1 if there is a coincidence or 0 if there is no coincidence.

Program

```
100 CALL CLEAR
110 S$="0103070F1F3F7FFF"
120 CALL CHAR(244,S$)
130 CALL CHAR(250,S$)
140 CALL SPRITE(#1,244,7,50,50)
150 CALL SPRITE(#2,250,5,44,42)
160 CALL COINC(#1,#2,10,C)
170 PRINT C
180 CALL COINC(ALL,C)
190 PRINT C
200 GOTO 200
RUN
-1
 0
(Press CLEAR to stop the program.)
```

Line 160 shows a coincidence because the upper-left corners of the sprites are within 10 pixels of each other.

Line 180 shows no coincidence because the shaded areas of the sprites do not occupy the same screen pixel location. (Shaded areas are compared only if you specify the ALL option.)

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COLOR subprogram

Format
Pattern Mode
CALL COLOR(character-set,foreground-color,background-color[,...])
Sprites
CALL COLOR(#sprite-number,foreground-color[,...])

Cross Reference
CHAR, DCOLOR, GRAPHICS, SCREEN, SPRITE

Description
The COLOR subprogram enables you to specify the colors of characters or sprites.

The types of parameters you specify in a call to the COLOR subprogram depend on whether you are assigning colors to characters or to sprites.

In Pattern Mode, each character has two colors. The color of the pixels that make up the character itself is the foreground-color; the color of the pixels that occupy the rest of the character position on the screen is the background-color.

When you enter MYARC Extended BASIC II, the foreground color of all the characters is black; the background-color of all characters is transparent. These default colors are restored when your program ends (either normally or because of an error), stops at a breakpoint, or changes graphics mode.

If a color is transparent, the color actually displayed is the color specified by the SCREEN subprogram.

See Appendix F for a listing of available colors and their respective codes.

See Appendix K if you are operating in High-Resolution Mode.

COLOR	*CODE*
Transparent	1
Black	2
Medium Green	3
Light Green	4
Dark Blue	5
Light Blue	6
Dark Red	7
Cyan	8
Medium Red	9
Light Red	10
Dark Yellow	11
Light Yellow	12
Dark Green	13
Magenta	14
Gray	15
White	16

COLOR CODES

SET	ASCII CODES
29	0-7
30	8-15
31	16-23
0	24-31
1	32-39
2	40-47
3	48-55
4	56-63
5	64-71
6	72-79
7	80-87
8	88-95
9	96-103
10	104-111
11	112-119
12	120-127
13	128-135
14	136-143
15	144-151
16	152-159
17	160-167
18	168-175
19	176-183
20	184-191
21	192-199
22	200-207
23	208-215
24	216-223
25	224-231
26	232-239
27	240-247
28	248-255

CHARACTER SETS in Pattern Mode

Pattern Mode

In Pattern Mode, the 256 available characters are divided into 32 sets of 8 characters each. When you assign a color combination to a particular set, you specify the colors of all 8 characters in that set.

The character-set is a numeric-expression whose value specifies the number (0-31) of the 8-character set.

Foreground-color and background-color are numeric expressions whose values specify colors that can be assigned from among the 16 available colors.

See Appendix D for available characters and character sets in Pattern Mode.

Continued-->

Text Mode
An error occurs if you use the COLOR subprogram to assign character colors in Text Mode. Use the SCREEN subprogram to assign character colors in Text Mode.

In Text Mode, using the COLOR program to assign colors to sprites has no effect (Text Mode does not display sprites).

High-Resolution Mode

In High-Resolution Mode, you can use COLOR only to assign colors to sprites; any other use of the COLOR subprogram causes an error. Use the DCOLOR subprogram to specify character and graphics colors in High-Resolution Mode.

Sprites

A sprite is assigned a foreground-color when it is created with the SPRITE subprogram. The background-color of a sprite is always transparent.

To re-assign colors to sprites you must use the sprite parameters, no matter what graphics mode the computer is in.

> The sprite-number is a numeric expression whose value specifies the number of a sprite as assigned by the SPRITE subprogram.
>
> Foreground-color is a numeric expression whose value specifies a color that can be assigned from among the 16 available colors.

Examples

100 CALL COLOR(#5,16)
Sets sprite number 5 to have a foreground-color of 16 (white). The background- color is always 1 (transparent).

This example is valid in all graphics modes. (Remember that sprites have no effect in Text Mode.)

100 CALL COLOR(#7,INT(RND* 16+1))
Sets sprite number 7 to have a foreground-color chosen randomly from the 16 colors available. The background color is 1 (transparent).

This example is valid in all graphics modes.

Program
This program sets the foreground-color of characters 48-55 to 5 (dark blue) and the background-color to 12 (light yellow).

```
100 CALL CLEAR
110 CALL GRAPHICS(1)
120 CALL COLOR(3,5,12)
130 DISPLAY AT(12,16):CHR$(48)
140 GOTO 140
(PRESS CLEAR TO STOP THE PROGRAM.)
```

This program will set the colours of three character sets:

```
100 PRINT "THE CAT AND THE Dog"
110 CALL COLOR(5,5,12,6,5,12,7,5,12)
120 GOTO 120
(Press CLEAR to stop the program)
```

Format
CONTINUE
CON

Cross Reference
BREAK

Description
The CONTINUE command restarts a program which has been stopped by a breakpoint. It may be entered whenever a program has stopped running because of a breakpoint caused by the BREAK command or statement or SHIFT C (CLEAR). However, you cannot use the CONTINUE command if you have edited a program line. CONTINUE may be abbreviated as CON.

When a breakpoint occurs, the standard character set and standard colors are restored. Sprites cease to exist. CONTINUE does not restore standard characters that have been reset or any colors. Otherwise, the program continues as if no breakpoint had occured.

Note: If you BREAK a running program, and then type something in command mode that causes an error, it is not possible to CONTINUE.
eg
100 A=8
110 BREAK
120 PRINT A
[RUN]
[CON]
8

but

[RUN]
[CALL OOPS]
SUBPROGRAM NOT FOUND
[CONTINUE]
CAN'T CONTINUE

COS function--Cosine

Format
COS(numeric-expression)

Type
REAL

Cross Reference
ATN, SIN, TAN

Description
The COS function returns the cosine of the angle whose measurement in radians is the value of the numeric-expression.

The value of the numeric-expression cannot be less than -1.570796326951 4E10 or greater than 1.570796326637 4E10.

If the angle is known in degrees rather than radians, multiply the angle in degrees by pi/180 so that the Cosine of an angle of 30 degrees would be COS(30*PI/180)

Program

The following program gives the cosine for each of several angles.

```
100 A=1.047197551196
110 B=60
120 C=45*PI/180
130 PRINT COS(A);COS(B)
140 PRINT COS(B*PI/180)
150 PRINT COS(C)
RUN
.5 -.9524129804
.5
.7071067812
```

Format
DATA data-list

Cross Reference
READ, RESTORE

Description
The DATA statement enables you to store constants within your program. You can assign the constants to variables by using a READ statement.

> The data-list consists of one or more constants separated by commas. The constants can be assigned to the variables specified in the variable-list of a READ statement. The assignment is made when the READ statement is executed.

If a numeric variable is specified in the variable-list of a READ statement, a numeric constant must be in the corresponding position in the data-list of the DATA statement. If a string variable is specified in a READ statement, either a string or a numeric constant may be in the corresponding position in the DATA statement. A string constant in a data-list may optionally be enclosed in quotation marks. However, if the string constant contains a comma, a quotation mark, or leading or trailing spaces, it must be enclosed in quotation marks.

A quotation mark within a string constant is represented by two adjacent quotation marks. A null string is represented in a data-list by two adjacent commas, or two commas separated by two adjacent quotation marks.

The order in which the data values appear within the data-list and the order of the DATA statements within a program normally determine the order in which the values are read. Values from each data-list are read sequentially, beginning with the first item in the first DATA statement. If your program includes more than one DATA statement, the DATA statements are read in ascending line-number order (unless you use a RESTORE statement to specify otherwise).

A DATA statement encountered during program execution is ignored.

A DATA statement cannot be part of a multiple-statement line, nor can it include a trailing remark.

Continued--->

Program

The following program reads and prints several numeric and string constants.

```
100 FOR A=1 TO 5
110 READ B,C
120 PRINT B;C
130 NEXT A
140 DATA 2,4,6,7,8
150 DATA 1,2,3,4,5
160 DATA """THIS HAS QUOTES"""
170 DATA NO QUOTES HERE
180 DATA " NO QUOTES HERE,EITHER"
190 FOR A=1 TO 6
200 READ B$
210 PRINT B$
220 NEXT A
230 DATA 1,NUMBER,MYARC
RUN
2  4
6  7
8  1
2  3
4  5
"THIS HAS QUOTES"
NO QUOTES HERE
  NO QUOTES HERE,EITHER
 1
NUMBER
MYARC
```

Lines 100 through 130 read five sets of data and print their values, two to a line.

Lines 190 through 220 read six data elements and print each on its own line.

Format
CALL DCOLOR(foreground-color,background-color)

Cross Reference
CIRCLE, COLOR, DRAW, DRAWTO, FILL, GRAPHICS, HCHAR, POINT, RECTANGLE, VCHAR, WRITE

Description
The DCOLOR subprogram enables you to set the graphics colors.

The graphics colors are used by the CIRCLE, DRAW, DRAWTO, FILL, HCHAR, POINT, RECTANGLE, VCHAR, and WRITE subprograms in High-Resolution Mode.

Foreground-color and background-color are numeric expressions whose values specify colors that can be assigned from among the 16 available colors. See Appendix F for a list of the available colors.

When you enter MYARC Extended BASIC II, the foreground-color is set to black and the background-color is set to transparent. These default graphics colors are restored only when you change graphics mode. They are not restored when you enter RUN.

DCOLOR is effective only in High-Resolution Mode. DCOLOR has no effect in Pattern or Text mode.

COLOR	*CODE*	*COLOR*	*CODE*
Transparent	1	Medium Red	9
Black	2	Light Red	10
Medium Green	3	Dark Yellow	11
Light Green	4	Light Yellow	12
Dark Blue	5	Dark Green	13
Light Blue	6	Magenta	14
Dark Red	7	Gray	15
Cyan	8	White	16

Continued --->

Programs

The following program sets the foreground-color of graphics to 5 (dark blue) and the background-color to 8 (cyan).

```
100 CALL CLEAR
110 CALL GRAPHICS(3)
120 CALL DCOLOR(5,8)
130 CALL HCHAR(8,20,72,3)
140 GOTO 140
(Press CLEAR to stop the program.)
```

In the following program, the letters "HHH" are displayed on the screen.

```
100 CALL CLEAR
110 CALL GRAPHICS(3)
120 RANDOMIZE
130 CALL DCOLOR(INT(RND*8+1)*2,INT(RND*8+1)*2-1)
140 CALL HCHAR(8,20,72,3)
150 FOR X=1 TO 400
160 NEXT X
170 GOTO 120
(Press CLEAR to stop the program.)
```

Line 130 changes the foreground-color (chosen randomly from the even-numbered colors available) and the background-color (chosen randomly from the odd-numbered colors).

Format
DEF [data-type]function-name=expression

Description
The DEF statement enables you to define your own functions. These user-defined functions can then be used in the same way as built-in functions.

The function-name can be any valid variable name that does not appear as a variable name elsewhere in your program.

If the function-name is a numeric variable, the value of the expression must be a number. If the function-name is a string variable, the value of the expression must be a string.

If the function-name is a numeric variable, you can optionally specify its data-type (DEFINT or REAL).

You can use ONE parameter to pass values to a function.
Parameters must be valid variable names. A variable name used as a parameter cannot be the name of an array. You can use an array element in the expression if the array does not have the same name as a parameter in that statement. The variable names used as parameters in a DEF statement are local to that statement; that is, even if a parameter has the same name as a variable in your program, the value of that variable is not affected.

If a parameter is a numeric variable, you can optionally specify its data-type (DEFINT or DEFREAL).

A DEF statement must have a lower line number than that of any use of the function-name it defines. A DEF statement is not executed.

A DEF statement can appear anywhere in your program, except that it cannot be part of an IF THEN statement.

DEF without parameters

When your program encounters a statement containing a previously defined function-name with no parameters, the expression is evaluated, and the function is assigned the value of the expression at that time.

If you define a function-name without parameters, it must appear without parameters when you use it in your program.

Continued-->

Historical Note: It was intended to amend this function to allow several parameters to be passed, however this was not possible and the function is now identical to TI XB.

DEF with Parameters

When your program encounters a statement containing a previously defined function-name with parameter , the parameter value is passed to the function The expression is evaluated using the value , and the function is assigned the value of the expression at that time. String values can be passed only to string parameters. Numeric values can be passed only to numeric parameters.

Recursive Definitions

A DEF statement may reference other defined functions (the expression may include previously defined function-names). However, a DEF statement may not be either directly or indirectly recursive (self-referencing).

Direct recursion occurs when you use the function-name in the expression of the same DEF statement. (This would be similar to writing a dictionary definition that included the word you were trying to define.)

Indirect recursion occurs when the expression contains a function-name, and in turn the expression in the DEF statement of that function (or other function subsequently referenced) includes the original function-name. (This would be similar to looking up the dictionary definition of a word, finding that the definition included other words that you needed to look up, and then discovering that the definitions led you directly back to your original word.)

Examples

```
100 DEF PAY(OT)=40*RATE+1.5*RATE*OT
110 RATE=4.00
120 PRINT PAY(3)
RUN
178
```

Defines PAY so that each time it is encountered in a program the pay is figured using the RATE of pay times 40 plus 1.5 times the rate of pay times the overtime hours.

```
100 DEF RND20=INT(RND* 20+1)
```
Defines RND20 so that each time it is encountered in a program an integer from 1 through 20 is given.

```
100 DEF FIRSTWORD$(NAME$)=SEG$(NAME$,1,POS(NAME$," ",1)-1)
```
Defines FIRSTWORD$ to be the part of NAME$ that precedes a space.

Continued-->

The content of this page has been deleted as the program examples listed did not run on any released version of MXBII.

Replacement Content: Using a variable defined as an INTeger in a DEF statement:

```
100 DEFINT B
110 DEF A(B)=SQR(B)*5
120 PRINT A(4)
130 PRINT A(3.8)
140 PRINT A(4.4)
150 PRINT A(5)
RUN
```

The parameter used in the DEF statement is local to the DEF statement in which it is used. This means that it is distinct from any variable with the same name which is used in other statements in the program. Thus, evaluating the function does not affect the value of a variable which has the same name as the parameter.

Example

```
>100 DEF FUNC(A)=A*(A+B-5)
>110 A=6.9
>120 B=13
>130 PRINT "B= ";B:"FUNC(3)=
 ";FUNC(3):"A= ";A
>140 END
>RUN
 B= 13
 FUNC(3)= 33
 A= 6.9
```

A DEF statement is only performed when the function it defines is referenced in an expression. When the computer encounters a DEF statement while running a program, it takes no action but proceeds to the next statement. A DEF statement may appear anywhere in a program and need not logically precede a reference to the function, but the function definition must have a lower line number than any statement which references the function. A DEF statement can reference other defined functions (Line 170).

```
>100 REM FIND F'(X) USING
 NUMERICAL APPROXIMATION
>110 INPUT "X=? ":X
>120 IF ABS(X)>.01 THEN 150
>130 H=.00001
>140 GOTO 180
>150 H=.001*ABS(X)
>160 DEF F(Z)=3*Z^3-2*Z+1
>170 DEF DER(X)=(F(X+H)-F(X-H
 ))/(2*H)
>180 PRINT "F'(";STR$(X);")=
 ";DER(X)
>190 END
>RUN
 X=? .1
 F'(.1)= -1.90999997
```

Format
DEFINT numeric-variable-list
DEFINT ALL

Cross Reference
DEF, DIM, OPTION BASE, REAL, SUB

Description
The DEFINT instruction enables you to declare the data-type of specified numeric variables as DEFINT.

DEFINT variables are processed faster and require less memory than do REAL variables.

You can use DEFINT as either a program statement or a command.

The numeric-variable-list consists of one or more numeric variables separated by commas. The variables are all assigned the DEFINT date-type. A DEFINT statement with a numeric-variable-list must have a lower line number than any program reference to any variable in that list.

If you enter the ALL option, all numeric variables in your program are assigned the DEFINT data-type unless specifically declared as REAL. A DEFINT statement with the ALL option must have a lower line number than any program reference to any numeric variable or array.

A DEFINT ALL statement in your main program does not affect the data-type of a numeric variable in a subprogram.

A numeric variable of the DEFINT data-type is a whole number greater than or equal to -32768 and less than or equal to 32767.

To specify an array of integers use the format:
100 DEFINT DIM(20)

NOTE that inside User written sub programs all variables are REAL -
Please see the second program on Page 200

DEFREAL **DEFREAL**

DEFREAL was introduced in Version 2.10. In this manual details are recorded under the name REAL on pages 161 and 162.

The DEFREAL instruction enables you to declare the data type of specified numeric variables as REAL. By default all numeric variables are REAL.

Please refer to pages 161 and 162 for further details and examples.

Format
DELETE file-specification

Cross Reference
CLOSE

Description
The DELETE instruction removes a file from an external storage device. Although the file is not physically erased, the space it occupies becomes available for you to store another file in the future.

You can use DELETE as either a program statement or a command.

> The file-specification indicates the name of the file to be deleted. The file-specification is a string expression; if you use a string constant, you must enclose it in quotation marks.

You can also remove files stored on some external devices by using the DELETE option in the CLOSE instruction.

For more information about the options available with a particular device, refer to the owner's manual that comes with that device.

Example

```
DELETE "DSK1.MYFILE"
```
Deletes the file named MYFILE from the diskette in disk drive 1.

Program
The following program illustrates a use of DELETE.

```
100 INPUT "NAME OF FILE TO BE DELETED: ":X$
110 DELETE X$
```

DELSPRITE subprogram--Delete Sprite

Format
Delete Specified Sprite
```
     CALL DELSPRITE(#sprite-number[,...])
```
Delete All Sprites
```
     CALL DELSPRITE(ALL)
```

Cross Reference
CLEAR, SPRITE

Description
The DELSPRITE subprogram enables you to delete one or more sprites. All sprites are deleted when your program ends (either normally or because of an error), stops at a breakpoint, or changes graphics mode.

Delete Specific Sprites

Sprite-number is a numeric expression whose value specifies the number of the sprite as assigned in the SPRITE subprogram. The sprite can reappear if it is redefined by the SPRITE subprogram, or if the LOCATE subprogram is called.

Delete All Sprites

If you enter the ALL option, all sprites are deleted, and can reappear only if redefined by the SPRITE subprogram.

Examples

```
100 CALL DELSPRITE(#3)
```
Deletes sprite number 3.

```
100 CALL DELSPRITE(#4,#3*C)
```
Deletes sprite number 4 and the sprite whose number is found by multiplying 3 by C.

```
100 CALL DELSPRITE(ALL)
```
Deletes all sprites.

Format
DIM array-name(integer1[,... integer7])[,array-name...]data-types

Cross Reference
DEFINT, OPTION BASE, REAL

Description
The DIM instruction enables you to dimension (reserve space for) arrays with one to seven dimensions.

You can use DIM as either a program statement or a command.

The array-name must be a valid variable name. It cannot be used as the name of a variable or as the name of another array. An array is either numeric or string, depending on the array-name.

The integer is the upper limit of element numbers in a dimension.

If a program includes an OPTION BASE 1 statement, the first element is element 1, so the number of elements is equal to the integer plus 1.

A string array cannot have more than 16383 elements. For numeric arrays, an DEFINT array cannot have more than 32767 elements, and a REAL array cannot have more than 8191 elements. The number of integers in parentheses following the array-name determines the number of dimensions (1-7) in the array.

An array of INTeger values is established like this: 100 DEFINT DIM A(20)

An error occurs if you try to dimension a particular array more than once.

You cannot use OPTION BASE as a command.

You can dimension as many arrays with one DIM instruction as you can fit in one input line.

If you reference an array without first using a DIM instruction to dimension it, each dimension is assumed to have 11 elements (elements 0-10), or 10 elements (elements 1-10) if your program includes an OPTION BASE 1 statement.

If you use a DIM statement to dimension an array, the DIM statement must have a line number lower than that of any reference to that array. DIM statements are interpreted during pre-scan and are not executed.

A DIM statement can appear anywhere in your program, except as part of an IF THEN statement.

Referencing an Array

To reference a specific element of an array, you must use subscripts. Subscripts are numeric expressions enclosed in parentheses immediately following the reference to the array-name. An array reference must include one subscript for each dimension in the array. If necessary, the value of a subscript is rounded to the nearest integer.

Reserving Space for Arrays

When you use DIM as a program statement, the computer reserves space for arrays when you enter the RUN instruction, before your program is actually run. If the computer cannot reserve space for an array with the dimensions you specify, the message Memory full in line-number is displayed, and the command does not execute.

When you use DIM as a command, if the computer cannot reserve space for an array with the dimensions you specify, the message Memory Full is displayed and the command does not execute.

Until you place values in an array, each element in a string array is a null string and each element in a numeric array has a value of zero.

Examples

100 DIM X$(30)
Reserves space in the computer's memory for 31 members of the array called X$.

100 DIM D(100),B(10,9)
Reserves space in the computer's memory for 101 members of the array called D and 110 (11 times 10) members of the array called B.

100 DEFINT DIM B(10)
Reserves space in the computer's memory for 11 members of the array called B. However, DEFINT specifies that the members can only be integers.

```
100  DEFINT DIM B(10)
110 B(2)=3.75
120 PRINT B(2)
```
will print the value in B(2), 4,
4 is INT(3.75)

Format
DISPLAY [print-list]
DISPLAY [AT(row,column)] [BEEP] [ERASE ALL]
[SIZE(numeric-expression)][:print-list]

Cross Reference
DISPLAY USING, GRAPHICS, MARGINS, PRINT

Description
The DISPLAY instruction enables you to display numbers and strings on the screen. The numeric and/or string expressions in the print-list can be constants and/or variables.

The options available with the DISPLAY instruction make it more versatile for screen output than is the PRINT instruction. You can display data at any screen position, sound a tone when data items are displayed, and clear the screen or a portion of the display row before displaying data.

You can use DISPLAY as either a program statement or a command.

The print-list consists of one or more print-items (items to be displayed on the screen) separated by print-separators. See PRINT for an explanation of the print-items and print-separators that make up a print-list.

In High-Resolution Mode, DISPLAY has no effect. See Appendix K.

Options

You can enter the following options, separated by a space, in any order.

AT--The AT option enables you to specify the beginning of the display field. Row and column are relative to the upper-left corner of the screen window defined by the margins. If you do not use the AT option, the display field begins in the far left column of the bottom row of the current screen window. Before a new line is displayed at the bottom of the window, the entire contents of the window (excluding sprites) scroll up one line to make room for the new line. The contents of the top line of the window scroll off the screen and are discarded. If you use the AT option and your print-list includes a TAB function, the TAB location is relative to the beginning of the display field. If you use the AT option and a print-item is too long to fit in the display field, either the extra characters are discarded (if you use the SIZE option) or the print-item is moved to the beginning of the next screen line (if you do not use the SIZE option).

BEEP--The BEEP option sounds a short tone when the data items are displayed.

ERASE ALL--The ERASE ALL option places a space character (ASCII code 32)

Continued-->

in every character position in the screen window defore displaying the data.

SIZE--The SIZE option is a numeric-expression whose value specifies the number of character positions to be cleared, starting from the beginning of the display field, before the data is displayed. If the numeric-expression is greater than the number of characters remaining in the row (from the beginning of the display field to the right margin), or if you do not use the SIZE option, the display row is cleared from the beginning of the display field to the right margin.

Examples

100 DISPLAY AT(5,7):Y
Displays the value of Y at the fifth row, seventh column of the screen. It first clears row 5 from column 7 to the right margin.

100 DISPLAY ERASE ALL:B
Puts the blank character into all positions within the current screen window before displaying the value of B.

100 DISPLAY AT(R,C) SIZE(FIELDLEN)BEEP:X$
Displays the value of X$ at row R, column C. First it beeps and blanks FIELDLEN characters.

Program
The following program illustrates a use of DISPLAY. It enables you to position blocks at any screen position to draw a figure or design.

Numbers must be entered as two digits (e.g., 1 would be "01", etc.). Do not press ENTER; the information is accepted as soon as the keys are pressed.

This example is valid only in Pattern Mode.

```
100 CALL CLEAR
110 CALL COLOR(27,5,5)
120 DISPLAY AT(23,1):"ENTER ROW AND COLUMN:"
130 DISPLAY AT (24,1):"ROW:COLUMN:"
140 FOR COUNT=1 TO 2
150 CALL KEY(0,ROW(COUNT),S)
160 IF S =0 THEN 150
170 DISPLAY AT(24,5+COUNT)SIZE(1):STR$(ROW(COUNT)-48)
180 NEXT COUNT
190 FOR COUNT=1 TO 2
200 CALL KEY(0,COLUMN(COUNT),S)
210 IF S =0 THEN 200
220 DISPLAY AT(24,16+COUNT)SIZE(1):STR$(COLUMN(COUNT)-48)
230 NEXT COUNT
240 ROW1=10*(ROW(1)-48)+ROW(2)-48
250 COLUMN1=10*(COLUMN(1)-48)+COLUMN(2)-48
260 DISPLAY AT(ROW1,COLUMN1)SIZE(1):CHR$(244)
270 GOTO 130
(Press CLEAR to stop the program.)
```

Format
DISPLAY [option-list:]USING ;format-string;[:print-list]; line-number;

Cross Reference
DISPLAY, IMAGE, PRINT

Description
The DISPLAY USING instruction enables you to define specific formats for numbers and strings you display.

You can use DISPLAY USING as either a program statement or a command.

The format-string specifies the display format. The format-string is a string expression; if you use a string constant, you must enclose it in quotation marks. See IMAGE for an explanation of format-strings. (Page 86)

You can optionally define a format-string in an IMAGE statement, as specified by the line-number.

See DISPLAY under "Options" for an explanation of the options AT, BEEP, ERASE ALL, and SIZE.

See PRINT for an explanation of the print-list and print-options.

The DISPLAY USING instruction is identical to the DISPLAY instruction with the addition of the USING option, except that:

You cannot use the TAB function.

You cannot use any print-separator other than a comma(,), except that the print-list can end with a semicolon (;).

Examples

```
100 N=23.43
110 DISPLAY AT(10,4):USING"##.##":N
```
Displays the value of N at the tenth row and fourth column, with the format "##.##", after first clearing row 10 from column 4 to the right margin.

```
100 DISPLAY USING "##.##":N
```
Displays the value of N at the 24th row and first column, with the format "##.##".

```
100 IMAGE ###.##
110 DISPLAY USING 100:4.5
120 DISPLAY USING "##.##":3
130 DISPLAY AT(23,12):USING "##.##":12
140 DISPLAY AT(23,20):USING 100: .7

        4.50
3.00      12.00    .70
```

DISTANCE subprogram

Format
Two Sprites
CALL DISTANCE(#sprite-numberl,#sprite-number2,numeric-variable)
A Sprite and a Screen Pixel
CALL DISTANCE(#sprite-number,pixel-row,pixel-column,numeric-variable)

Cross Reference
COINC, SPRITE

Description
The DISTANCE subprogram enables you to ascertain the distance between two sprites or between a sprite and a specified screen pixel.

The DISTANCE subprogram returns the square of the distance sought. (Note that this is not the same as the distance specified by the "tolerance" in the COINC subprogram.)

The square of the distance is the sum of the square of the difference between pixel-rows and the square of the difference between pixel-columns. The distance between the two sprites (or the sprite and the screen pixel) is the square root of the number returned.

If the square of the distance is greater than 32767, the number returned is 32767.

Two Sprites

The distance between two sprites is considered to be the distance between the upper-left corners of the sprites.

Sprite-numberl and sprite-number2 are numeric expressions whose values specify the numbers of the two sprites as assigned in the SPRITE subprogram.

The number returned to the numeric-variable equals the square of the distance between two sprites.

A Sprite and a Screen Pixel

The distance between a sprite and a screen pixel is considered to be the distance between the upper-left corner of the sprite and the specified pixel.

Sprite-number is a numeric expression whose value specifies the number of the sprite as assigned in the SPRITE subprogram.

The pixel-row and pixel-column are numeric expressions whose values specify the position of the screen pixel.

The number returned to the numeric-variable equals the square of the distance between the sprite and the screen pixel.

Examples

100 CALL DISTANCE(#3,#4,DIST)
Sets DIST equal to the square of the distance between the upper-left corners of sprite #3 and sprite #4.

100 CALL DISTANCE(#4,18,89,D)
Sets D equal to the square of the distance between the upper-left corner of sprite #4 and position 18,89.

DRAW subprogram

Format
CALL DRAW(line-type,pixel-row1,pixel-column1,pixel-row2,pixel-column2
[,pixel-row3,pixel-column3,pixel-row4,pixel-column4[,...]])

Cross Reference
CIRCLE, DCOLOR, DRAWTO, FILL, GRAPHICS, POINT, RECTANGLE, WRITE

Description
The DRAW subprogram enables you to draw or erase lines between specified pixels.

The value of the numeric-expression line-type specifies the action taken by the DRAW subprogram.

TYPE	ACTION
1	Draws a line of the foreground-color specified by the DCOLOR subprogram. This is accomplished by turning on each pixel in the specified line.
0	Erases a line. This is accomplished by turning off each pixel in the specified line.
2	Reverses the status of each pixel on the specified line. (If a pixel is on, it is turned off; if a pixel is off, it is turned on.) This effectively reverses the color of the specified line.

Pixel-row and pixel-column are numeric expressions whose values specify the pixels to be connected by the line. You must specify at least two pixels to define the beginning and end points of a line.

Pixel-row must have a value from 1 to 192. Pixel-column must have a value from 1 to 256.

You can optionally draw more lines by specifying additional pairs of pixels. The lines are not connected; each line extends from the first pixel of the pair to the second pixel of the pair. You must specify an even number of pixels.

The last pixel you specify becomes the current position used by the DRAWTO subprogram.

DRAW can be used only in High-Resolution Mode. An error results if you use DRAW in Pattern or Text Mode.

Continued-->

In High-Resolution Mode the computer divides each pixel-row into 32 groups of 8 pixels each. (This is most obvious when you assign a background color other than cyan or transparent.) The computer can assign 1 foreground color and 1 background color, from among the 16 available colors, to each 8-pixel group.

Programs

The following program draws a large triangle on the right of the screen.

```
100 CALL GRAPHICS(3)
110 CALL CLEAR
120 CALL DRAW(1,19,185,97,115)
130 CALL DRAW(1,19,185,97,255)
140 CALL DRAW(1,97,115,97,255)
150 GOTO 150
(Press CLEAR to stop program.)
```

The next program uses a FOR-NEXT loop to draw a pattern of lines.

```
100 CALL CLEAR
110 CALL GRAPHICS(3)
120 CALL SCREEN(6)
130 FOR X=1 TO 255 STEP 5
140 CALL DRAW(1,1,X,128,256-X)
150 NEXT X
160 GOTO 160
(Press CLEAR to stop the program.)
```

DRAWTO subprogram

Format
CALL
DRAWTO(line-type,pixel-row,pixel-column[,pixel-row2,pixel-column2[,...]])

Cross Reference
CIRCLE, DCOLOR, DRAW, FILL, GRAPHICS, POINT, RECTANGLE, WRITE

Description
The DRAWTO subprogram enables you to draw or erase lines between the current position and the specified pixels.

Line-type is a numeric expression whose value specifies the action taken by the DRAWTO subprogram.

TYPE	ACTION
1	Draws a line of the foreground-color specified by the DCOLOR subprogram. This is accomplished by turning on each pixel in the specified line.
0	Erases a line. This is accomplished by turning off each pixel in the specified line.
2	Reverses the status of each pixel on the specified line. (If a pixel is on, it is turned off; if a pixel is off, it is turned on.) This effectively reverses the color of the specified line.

The line drawn by DRAWTO extends from the pixel in the current position to the pixel specified by the values of the numeric expressions pixel-row and pixel-column, which becomes the new current position.

You can optionally draw more lines by specifying additional sets of pixels. A line is drawn to each specified pixel from the new current position (the previously specified pixel).

Pixel-row must have a value from 1 to 192, pixel-column must have a value from 1 to 256.

The current position is the last pixel specified the last time the DRAW or the DRAWTO subprogram was called. When you enter MYARC Extended BASIC II, the current position is the intersection of pixel-row 1 and pixel-column 1.

This default current position is restored only when you change graphics mode.

DRAWTO can be used only in High-Resolution Mode. An error results if you use DRAWTO in Pattern or Text Mode.

Continued-->

In High-Resolution Mode the computer divides each pixel-row into 32 groups of 8 pixels each. (This is most obvious when you assign a background color other than cyan or transparent.) The computer can assign 1 foreground color and 1 background color (from among the 16 available colors), to each 8-pixel group.

Program

The following program uses DRAWTO to create a pattern across the top of the screen.

```
100 CALL GRAPHICS(3)
110 CALL CLEAR
120 A=20::B=20
130 CALL DRAW(1,A,B,A,B)
140 FOR X=1 TO 10
150 B=B+20
160 CALL DRAWTO(1,A,B)
170 CALL DRAWTO(1,A+20,B-20)
180 CALL DRAWTO(1,A+20,B)
190 CALL DRAWTO(1,A,B-20)
200 NEXT X
210 GOTO 210
(Press CLEAR to stop program.)
```

EMDK subprogram -- Emulate Disk Drive **EMDK**

Format: CALL EMDK(DriveNum)

Cross Reference: PART, VOL

Description: CALL EMDK allocates a drive number to the Myarc RAM disk so that the RAM Disk can be used as eg DSK2.
When a drive number has been allocated to the RAM disk, any physical drive is bypassed so that allocating DRIVE 1 to the RAMdisk will cause the physical DRIVE 1 to no longer be available- and the disk based 128k OS may no longer be able to refresh itself.

If you allocate DSK1 to the ram disk and the 128k OS fails, you can reset the drive in TI Basic (CALL EMDK(2)) Also note that the 128k OS files can be copied to the RAM disk before it emulates DSK1 and will then refresh more quickly.

If the RAM disk is used without allocating a drive number or volume name it is accessed as RD.

NOTE EMDK is supplied by the Myarc Expansion RAM and can be used in both TI Basic and Myarc XBII.

Format
END

Cross Reference
STOP

Description
The END statement stops the execution of your program.

In addition to terminating program execution, END causes the computer to perform the following operations:

It closes all open files.

It restores the default character definitions of all characters.

If the computer is in High-Resolution Mode, it restores the default graphics mode (Pattern) and margin settings (3, 30, 1, 24).

It restores the default foreground color (black) and background color (transparent) to all characters.

It restores the default screen color (cyan).

It deletes all sprites.

It resets the sprite magnification level to 1.

The graphics colors (see DCOLOR) and current position (see DRAWTO) are not affected. If the computer is in Pattern or Text Mode, the graphics mode and margin settings remain unchanged.

An END statement is not necessary to stop your program; the program automatically stops after the highest numbered line is executed.

END can be used interchangeably with the STOP statement, except that you cannot use STOP after a subprogram.

Format
EOF(file-number)

Type
DEFINT

Cross Reference
ON ERROR

Description
The EOF function returns a value indicating whether there are records remaining in a specified file.

The file-number is a numeric expression whose value specifies the number of the file as assigned in its OPEN instruction.

The value returned by the EOF function depends on the current file position. EOF always treats a file as if it were being accessed sequentially, even if it has been opened for relative access.

VALUE	MEANING
0	Not end-of-file.
(+)1	Logical end-of-file: No records remaining.
-1	Physical end-of-file: No records remaining, and no space available for more records (storage medium full).

The EOF function cannot be used with an audio cassette.

For more information about using EOF with a particular device, refer to the owner's manual that comes with that device.

Examples

100 PRINT EOF(3)
Prints a value according to whether you are at the end of the file opened as #3.

100 IF EOF(27)<>0 THEN 1150
Transfers control to line 1150 if you are at the end of the file opened as #27.

100 IF EOF(27) THEN 1150
Transfers control to line 1150 if you are at the end of the file opened as #27.

Format
CALL ERR(error-code,error-type[,error-severity,[line-number]])

Cross Reference
ON ERROR

Description
The ERR subprogram enables you to analyze the conditions that caused a program error.

ERR is normally called from a subroutine accessed by an ON ERROR statement.

The ERR subprogram returns the error-code and error-type, and optionally the error-severity and line-number, of the most recent "uncleared" program error.

An error is "cleared" when another program error occurs or when the program ends. A RETURN statement in a subroutine accessed by an ON ERROR statement also clears the error.

ON ERROR will not trap an error caused by the RUN command.

ERR returns a two- or three-digit number to the numeric variable error-code. See Appendix J for a list of error codes and the conditions that cause them to be displayed.

An error-code of 130 indicates an input/output (I/O) error.

An error-code of 0 indicates that no error has occurred.

The error-type is a numeric variable.

When an I/O error occurs, the value returned in error-type is the number (as assigned in an OPEN instruction) of the file in which the error occurred.

A negative error-type indicates that the error occurred during program execution.

An error-type of 0 indicates that no error has occurred.

Options
The value returned to the numeric variable error-severity is always nine.

The value returned to the numeric variable line-number is the line number of the program statement that was executing when the error occurred.

Continued--->

Examples

100 CALL ERR(A,B)
Sets A equal to the error-code and B equal to the error-type of the most recent error.

100 CALL ERR(W,X,Y,Z)
Sets W equal to the error-code, X equal to the error-type, Y equal to the error-severity, and Z equal to the line-number of the most recent error.

Program

The following program illustrates the use of CALL ERR.

```
100 ON ERROR 130
110 CALL SCREEN(18)
120 STOP
130 CALL ERR(W,X,Y,Z)
140 PRINT W;X;Y;Z
150 RETURN NEXT
RUN
79 -1 9 110
```

An error is caused in line 110 by an improper screen-color number. Because of line 100, control is transferred to line 130. Line 140 prints the values obtained. The 79 indicates that a bad value was provided, the -1 indicates that the error occurred during program execution, the 9 is the error-severity, and the 110 indicates that the error occurred in line 110.

EXP function--Exponential

Format
EXP(numeric-expression)

Type
REAL

Cross Reference
LOG

Description
The EXP function returns the value of e raised to the power of the value of the numeric-expression.

EXP is the inverse of the LOG function.

The value of e is 2.718281828459.

Examples

```
100 Y=EXP(7)
```
Assigns to Y the value of e raised to the seventh power, which yields 1096.6331584290.

```
100 L=EXP(4.394960467)
```
Assigns to L the value of e raised to the 4.394960467 power, which yields 81.0414268887.

Format
CALL FILL(pixel-row,pixel-column)

Cross Reference
CIRCLE, DCOLOR, DRAW, DRAWTO, GRAPHICS, POINT, RECTANGLE, WRITE

Description
The FILL subprogram enables you to fill in the area surrounding a specified pixel with a specified color.

Pixel-row and pixel-column are numeric expressions whose values specify the pixel that you want to surround with a color ~~or pattern~~.

Pixel-row must have a value from 1 to 192, pixel-column must have a value from 1 to 256.

The color that surrounds the specified pixel is the foreground color specified by the DCOLOR subprogram. If you have not called the DCOLOR subprogram, the default fill color is black.

The area surrounding the specified pixel is filled until a screen edge or a foreground pixel (a pixel that is turned on) is encountered.

The boundaries of the area to be filled can be defined by lines drawn with the CIRCLE, DRAW, DRAWTO, POINT, RECTANGLE, WRITE subprograms.

FILL can be used only in High-Resolution Mode. An error results if you use FILL in Pattern or Text Mode.

In High-Resolution Mode the computer divides each pixel-row into 32 groups of 8 pixels each. The computer can assign a foreground color and a background color (from among the 16 available colors) to each 8-pixel group.

Continued-->

Program

The following program divides the upper portion of the screen into four horizontal columns and uses FILL to color them.

```
100 CALL CLEAR
110 CALL GRAPHICS(3)
120 CALL DRAW(1,48,0,48,256)
130 CALL DRAW(1,96,0,96,256)
140 CALL DRAW(1,144,0,144,256)
150 CALL DCOLOR(7,8)
160 CALL FILL(43,1)
170 CALL DCOLOR(11,8)
180 CALL FILL(90,1)
190 CALL DCOLOR(3,8)
200 CALL FILL(138,1)
210 CALL DCOLOR(6,8)
220 CALL FILL(188,1)
230 GOTO 230
(Press CLEAR to stop program.)
```

Format
FOR control-variable=initial-value TO limit[STEP increment]

Cross Reference
NEXT

Description
The FOR TO instruction is used with the NEXT instruction to form a FOR-NEXT loop, which you can use to control a repetitive process.

You can use FOR TO as either a program statement or a command.

FOR-NEXT Loop Execution

When a FOR TO instruction is executed, the initial-value is assigned to the control-variable. The computer executes instructions until it encounters a NEXT instruction (the group of instructions between the FOR TO and NEXT instructions are known as a "FOR-NEXT loop"). However, if the initial-value is greater than the limit (or, if you specify a negative increment, if the initial-value is less than the limit) the FOR-NEXT loop is not executed.

When the NEXT instruction is encountered, the increment is added to the control-variable; if you do not specify an increment, the control-variable is incremented by 1. Note that if the increment is negative, the value of the control-variable is decreased.

The control-variable in the NEXT instruction must be the same as the control-variable in the FOR TO instruction. The new value of the control-variable is then compared to the limit. If you specify a positive increment (or if you do not specify an increment), the FOR-NEXT loop is repeated if the control-variable is less than or equal to the limit. If you specify a negative increment, the FOR-NEXT loop is repeated if the control-variable is greater than or equal to the limit.

If the condition for repeating the FOR-NEXT loop is met, control passes to the instruction immediately following the FOR TO instruction. If the condition is not met, the FOR-NEXT loop terminates (control passes to the statement immediately following the NEXT statement).

Specifications

The value of the numeric expression control-variable is re-evaluated each time the NEXT instruction is executed. If you change its value while a FOR-NEXT loop is executing, you may affect the number of times the loop is repeated. A FOR-NEXT loop executes much faster if the control-variable has been declared as a DEFINT than it does if the control-variable is REAL.

The control-variable cannot be an element of an array.

Continued-->

The initial-value is a numeric expression.

The value of the numeric expression limit is not re-evaluated during the execution of a FOR-NEXT loop. If you change its value while a FOR-NEXT loop is executing, you do not affect the number of times the loop is repeated.

The value of the optional numeric expression increment is not re-evaluated during the execution of a FOR-NEXT loop. If you change its value while a FOR-NEXT loop is executing, you do not affect the number of times the loop is repeated. The increment cannot be zero.

Nested FOR-NEXT Loops

FOR-NEXT loops may be "nested"; that is, one FOR-NEXT loop may be contained wholly within another. You must observe the following conventions:

Each FOR TO instruction must be paired with a NEXT instruction.

Each nested loop must use a different control-variable.

If a FOR-NEXT loop contains any portion of another FOR-NEXT loop, it must contain all of that FOR-NEXT loop. If a FOR-NEXT loop contains only part of another FOR-NEXT loop, an error occurs, and the message NEXT without FOR is displayed. If the FOR-NEXT loop is part of a program, the computer also displays the line-number where the error occurred.

FOR TO as a Program Statement

After you enter the RUN command, but before your program is actually run, the computer verifies that you have equal numbers of FOR TO and NEXT statements. If the numbers are not equal, the message FOR-NEXT nesting is displayed and the program is not run.

You can exit a FOR-NEXT loop by using a GOTO, ON GOTO, or IF THEN statement. If you use one of these statements to enter a loop, you could cause an error or create an infinite loop.

A FOR TO statement cannot be part of an IF THEN statement.

FOR TO as a Command

If you use FOR TO as a command, it must be part of a multiple-statement line. A NEXT instruction must also be part of the same line.

After you press ENTER to execute the command, but before the command is actually executed, the computer verifies that you have equal numbers of FOR TO and NEXT instructions. If the numbers are not equal, the message FOR-NEXT nesting is displayed and the command is not executed.

Continued-->

Examples

```
100 FOR A=1 TO 5 STEP 2
110 PRINT A
120 NEXT A
```

Executes the statements between this FOR and NEXT A three times, with A having values of 1, 3, and 5. After the loop is finished, A has a value of 7.

```
100 FOR J=7 TO -5 STEP -.5
110 PRINT J
120 NEXT J
```

Executes the statements between this FOR and NEXT J 25 times, with J having values of 7, 6.5, 6,..., -4, -4.5, and -5. After the loop is finished, J has a value of -5.5.

Program

The following program illustrates a use of the FOR-TO-STEP statement. There are three FOR-NEXT loops, with control-variables of CHAR, ROW, and COLUMN.

```
100 CALL CLEAR
110 D=0
120 FOR CHAR=33 TO 63 STEP 30
130 FOR ROW=1+D TO 21+D STEP 4
140 FOR COLUMN=1+D TO 29+D STEP 4
150 CALL VCHAR(ROW,COLUMN,CHAR)
160 NEXT COLUMN
170 NEXT ROW
180 D=2
190 NEXT CHAR
200 GOTO 200
(Press CLEAR to stop the program.)
```

This page described a function that was removed from XBII Version 2.12

Revised

GCHAR subprogram--Get Character

Format
Pattern and Text Modes
CALL GCHAR(row,column,numeric-variable)
High-Resolution Mode
CALL GCHAR(pixel-row,pixel-column,numeric-variable)

Cross Reference
GRAPHICS, HCHAR, VCHAR

Description
The GCHAR subprogram enables you to ascertain the character code of a character on the screen or the status of a screen pixel.

The meaning of the value returned to the specified numeric-variable varies according to the graphics mode.

Pattern and Text Modes

Row and column are numeric expressions whose values specify a character position on the screen.

The value of row must be greater than or equal to 1 and less than or equal to 24.

The value of column must be greater than or equal to 1. In Pattern Mode, column must be less than or equal to 32; in Text Mode, column must be less than or equal to 40.

GCHAR is not affected by margin settings. Row and column are relative to the upper-left corner of the screen, not to the corner of the window defined by the margins.

The character code of the character at the specified position is returned to the numeric-variable. See Appendix B for a list of ASCII character codes.

High-Resolution Mode

The pixel-row and pixel-column are numeric-expressions whose values specify a screen pixel position.

The value of the numeric expression pixel-row must be greater than or equal to 1. In High-Resolution Mode, pixel-row must be less than or equal to 192.

The value of the numeric expression pixel-column must be greater than or equal to 1 and less than or equal to 256.

Continued-->

The status of the specified screen pixel is indicated by the value returned to the numeric-variable. If the pixel is on, the value returned is 1; if the pixel is off, the value returned is 0.

Examples

100 CALL GCHAR(12,16,X)
Assigns to X the ASCII code of the character at row 12, column 16 in Pattern and Text Modes.

100 CALL GCHAR(R,C,K)
Assigns to K the ASCII code of the character that is in row R,column C in Pattern and Text Modes.

GOSUB --Go to a Subroutine

Format
GOSUB line-number
GO SUB

Cross Reference
ON GOSUB, RETURN

Description
The GOSUB statement transfers program control to the specified subroutine. A subroutine frequently is used to perform a specific operation several times in the same program.

The line-number is a numeric expression whose value specifies the program statement at which the subroutine begins.

Use a RETURN statement to return program control to the statement immediately following the GOSUB statement that called the subroutine.

To avoid unexpected results, it is recommended that you excercise care if you use GOSUB to transfer control to or from a subprogram or into a FOR- NEXT loop.

Subroutines may be recursive (self-referencing). To avoid constructing infinite loops, it is recommended that you exercise care when using recursive subroutines.

Nested Subroutines

Subroutines may be "nested"; that is, within a subroutine you can use GOSUB to transfer control to another subroutine. Because RETURN restores program control to the statement immediately following the most recently executed GOSUB, it is important to exercise care when using nested subroutines.

For example, you might use GOSUB in your main program to transfer control to a subroutine. When the computer encounters a RETUN in the second subroutine it transfers program control back to the statement immediately following the GOSUB in the first subroutine. Then, when a RETURN is encountered in the first subroutine, program control returns to the statement following the GOSUB in your main program.

Example

```
100 GOSUB 200
```
Transfers control to statement 200. That statement and the ones up to RETURN are executed and then control returns to the statement after the calling statement.

Continued-->

Program

The following program illustrates a use of GOSUB. The subroutine at line 260 figures the factorial of the value of NUMB. The whole program figures the solution to the equation

NUMB = X!/(Y! * (X-Y)!)

where the exclamation point means factorial. This formula is used to figure certain probabilities. For instance, if you enter X as 52 and Y as 5, you'll find that the number of possible five-card poker hands is 2,598,960. Both numbers entered must be positive integers less than or equal to 69.

```
100 CALL CLEAR
110 INPUT "ENTER X AND Y: ":X,Y
120 IF X<Y THEN 110
130 IF X>69 OR Y>69 THEN 110
140 IF X<0 THEN PRINT "NEGATIVE"::GOTO 110 ELSE NUMB=X
150 GOSUB 260
160 NUMERATOR=NUMB
170 IF Y<0 THEN PRINT "NEGATIVE"::GOTO 110 ELSE NUMB=Y
180 GOSUB 260
190 DENOMINATOR=NUMB
200 NUMB=X-Y
210 GOSUB 260
220 DENOMINATOR=DENOMINATOR*NUMB
230 NUMB=NUMERATOR/DENOMINATOR
240 PRINT "NUMBER IS";NUMB
250 STOP
260 REM CALCULATE FACTORIAL
270 IF NUMB<2 THEN NUMB=1::GOTO 320
280 MULT=NUMB-1
290 NUMB=NUMB*MULT
300 MULT=MULT-1
310 IF MULT>1 THEN 290
320 RETURN
```

Format
GOTO line-number
GO TO

Cross Reference
ON GOTO

Description
The GOTO statement unconditionally transfers program control to the specified program statement.

> The line-number is a numeric expression whose value specifies the program statement to which unconditional program control is transferred.

To avoid unexpected results, it is recommended that you exercise care if you use GOTO to transfer control to or from a subroutine or into a FOR-NEXT loop.

Program

The following program shows the use of GOTO in line 160. Anytime that line is reached, the program executes line 130 next and proceeds from that new point.

```
100 REM ADD 1 THROUGH 100
110 ANSWER=0
120 NUMB=1
130 ANSWER=ANSWER+NUMB
140 NUMB=NUMB+1
150 IF NUMB>100 THEN 170
160 GOTO 130
170 PRINT "THE ANSWER IS";ANSWER
RUN
THE ANSWER IS 5050
```

Format
CALL GRAPHICS(graphics-mode)

Cross Reference
CHAR, CIRCLE, COLOR, DCOLOR, DRAW, DRAWTO, FILL, MARGINS, POINT, RECTANGLE, SCREEN, WRITE

Description
The GRAPHICS subprogram enables you to select the graphics-mode that offers you the combination of text and graphics capabilities that best suits the particular needs of your program.

Graphics-mode is a numeric expression whose value is from 1 to 3, specifying one of the three graphics modes available in MYARC Extended BASIC II.

NUMBER	MODE
1	Pattern
2	Text
3	High-Resolution

When you enter MYARC Extended BASIC II, the computer is in Pattern Mode.

Whenever you use the CALL GRAPHICS subprogram, the computer does the following:

Clears the entire screen.

Restores the default character definitions of all characters.

Restores the default foreground color (black) and background color (transparent) to all characters.

Restores the default graphics foreground color (black) and background color (transparent).

Restores the default screen color (cyan).

Deletes all sprites.

Resets all sprites.

Resets the sprite magnification level to 1.

Restores the default screen margins (3, 30, 1, 24)

Restores the default current position (pixel-row 1, pixel-column 1).

Turns off all sound

Continued-->

Pattern Mode

In Pattern Mode, the screen is considered to be a grid 24 characters high and 32 characters wide. Each character is 8 pixels high and 8 pixels wide. The 256 available characters are divided into 32 sets of 8 characters each. You can use the COLOR subprogram to assign a foreground and a background color, from among the 16 available colors, to each character set.

In Pattern Mode, you have access to sprites.

The DCOLOR subprogram has no effect in Pattern Mode. If you use a CIRCLE, DRAW, DRAWTO, FILL, POINT, RECTANGLE, or WRITE subprogram, the error message Graphics mode error in line-number is displayed.

Text Mode

In Text-Mode, the screen is considered to be a grid 24 characters high and 40 characters wide. Each character is 8 pixels high and 6 pixels wide. (Note that a character in Text Mode is two pixels narrower than a character in any other graphics mode.)

You can use the SCREEN subprogram to assign one foreground and one background color from among the 16 available colors. The colors you select are assigned to all 256 characters.

In Text Mode, you do not have access to sprites (the SPRITE subprogram has no effect in Text Mode). Using the COLOR subprogram to assign colors to sprites has no effect.

The DCOLOR subprogram has no effect in Text Mode. If you use a CIRCLE, DRAW, DRAWTO, FILL, POINT, RECTANGLE, or WRITE subprogram, the error message Graphics mode error in line-number is displayed.

High Resolution Mode

In High-Resolution Mode, the screen is considered to be a grid 192 pixels high and 256 pixels wide.

When entering Graphics(3) ALL available VDP RAM is needed, including some of the area used by the floppy disk controller. Therefore upon invoking GRAPHICS(3), XBII will CLOSE all files and perform a CALL FILES(1). In this mode only ONE floppy disk file can be open at a time.

You can use the DCOLOR subprogram to assign colors to the graphics you display.

In high resolution mode the computer divides each pixel-row into 32 groups of 8 pixels. The computer can assign a foreground color and a background color (from among 16 available colors) to each 8-pixel group.

In High-Resolution Mode, you have access to sprites.

Use the COLOR subprogram only to assign colors to sprites; any other use of the COLOR subprogram causes and error.

ACCEPT, DISPLAY, and DISPLAY USING have no effect in High-Resolution Mode. INPUT, LINPUT, PRINT, and PRINT USING are functional only if they are used to access files. Use the command "WRITE" to display messages in High-Resolution Mode. For more information dealing with the restrictions of High-Resolution Mode, see Appendix K.

Continued-->

When a program running in High-Resolution Mode stops running, the computer returns to Pattern Mode.

A Note on High Resolution Graphics

When in Graphics mode 3, the computer can ONLY LOAD another program if it has been saved in Internal Variable 254 format. This is because all available VDP RAM is used both for loading program files and also for displaying bit mapped data.
To SAVE a program in IV254 format append INTERNAL to the save file name:
SAVE DSK1.PROGNAME,INTERNAL

100 CALL GRAPHICS(3)

As a statement, changes the graphics mode to High-Resolution during program execution until execution stops or until another statement changes the Graphics Mode to something else.

REVISED

Format
CALL HCHAR(row,column,character-code[,number of repetitions])

Cross Reference
DCOLOR, GCHAR, GRAPHICS, VCHAR

Description
The HCHAR subprogram enables you to place a character on the screen and repeat it horizontally.

Row and column are numeric expressions whose values specify the position on the screen where the character is displayed.

The value of row must be greater than or equal to 1, row must be less than or equal to 24. The value of column must be greater than or equal to 1. In Pattern or High-Resolution Mode, the column must be less than or equal to 32; in Text Mode, column must be less than or equal to 40.

HCHAR is not affected by margin settings.

Character-code is a numeric expression with a value from 0-255, specifying the number of the character. See Appendix B for a list of ASCII character codes.

The optional number-of-repetitions is a numeric expression whose value specifies the number of times the character is repeated horizontally. If the repetitions extend past the end of a row they continue from the first character of the next row. If the repetitions extend past the end of the last row they continue from the first character of the first row.

If you use HCHAR to display a character on the screen, and then later use CHAR, COLOR, or DCOLOR to change the appearance of that character, the result depends on the Graphics Mode.

In Pattern and Text Modes, the displayed character changes to the newly specified pattern and/or color(s).

In High-Resolution Mode the displayed character remains unchanged.

Examples
```
100 CALL HCHAR(12,16,33)
```
Places character 33 (an exclamation point) in row 12, column 16.

```
100 CALL HCHAR(1,1,ASC("!"),768)
```
Places an exclamation point in row 1, column 1, and repeats it 768 times, which fills the screen in Pattern Mode.

```
100 CALL HCHAR(R,C,K,T)
```
Places the character with an ASCII code specified by the value of K in row R, column C and repeats it T times.

Format
IF relational-expression THEN line-number1 [ELSE line-number2]
numeric-expression statement1 statement2

Description
The IF THEN statement enables you to transfer program control to a specified program statement, or to execute a statement or series of statements, based on the status of a condition you specify.

The condition tested by the IF THEN statement can be either a relational-expression or a numeric-expression.

A relational-expression is "true" if it accurately describes the relationship between the variables it references; otherwise, it is "false."

A numeric-expression is "false" if it has a value of zero; otherwise, it is "true."

The action specified following THEN or ELSE can be either a line-number or a statement.

If the conditional requirement is met and you specify a line-number, program control is transferred to the program statement located at that line-number.

If the conditional requirement is met and you specify a statement, the specified statement is executed. The statement may be either a single program statement or a series of program statements separated by a double colon (::) statement separator symbol.

If the tested condition is "true," the computer performs the action specified following THEN.

If the tested condition is "false" and you use the ELSE option, the computer performs the action specified following ELSE. Note: A statement separator symbol (::) must not immediately precede ELSE, as this causes a syntax error.

If the tested condition is "false" and you do not use the ELSE option, there are three possibilities.

IF THEN is followed by a statement, program execution proceeds with the next program line.

IF THEN is followed by a line-number only, program execution proceeds with the next program line.

Continued-->

IF THEN is followed by a line-number and a statement separator, program execution proceeds with the statements after the statement separator. Note: In this case, the statement separator symbol functions as an implied ELSE.

An IF THEN statement cannot contain a DEF, DIM, FOR, NEXT, OPTION BASE, SUB, or SUBEND instruction.

Examples

```
100 IF X>5 THEN GOSUB 300 ELSE X=X+5
```
If X is greater than 5, then 300 is executed. When the subroutine is ended control returns to the line following this line. If X is 5 or less, X is set equal to X+5 and control passes to the next line.

```
100 IF Q THEN C=C+1::GOTO 500 ELSE L=L/C::GOTO 300
```
If Q is not zero, then C is set equal to C+1 and control is transferred to line 500. If Q is zero, the L is set equal to L/C and control is transferred to line 300.

```
100 IF A$="Y" THEN COUNT=COUNT+1::DISPLAY AT(24,1):"HERE WE GO  AGAIN!"::GOTO
300
```
If A$ is not equal to "Y", then control passes to the next line. If A$ is equal to "Y", then COUNT is incremented by 1, a message is displayed, and control is transferred to line 300.

```
100 IF HOURS =40 THEN PAY=HOURS*WAGE ELSE PAY=HOURS*WAGE+.5*WAGE*
(HOURS-40)::OT=1
```
If HOURS is less than or equal to 40, then PAY is set equal to HOURS*WAGE and control passes to the next line. If HOURS is greater than 40, then PAY is set equal to HOURS*WAGE+.5*WAGE*(HOURS-40), OT is set equal to 1, and control passes to the next line.

```
100 IF A=1 THEN IF B=2 THEN C=3 ELSE D=4 ELSE E=5
```
If A is not equal to 1, then E is set equal to 5 and control passes to the next line. If A is equal to 1 and B is not equal to 2, then D is set equal to 4 and control passes to the next line. If A is equal to 1 and B is equal to 2, then C is set equal to 3 and control passes to the next line.

Continued-->

Program

The following program illustrates a use of IF-THEN-ELSE. It accepts up to 1000 numbers and then prints them in order from smallest to largest.

```
100 CALL CLEAR
110 DIM VALUE(1000)
120 PRINT "ENTER VALUES TO BE SORTED.":"ENTER '9999' TO END ENTRY."
130 FOR COUNT=1 TO 1000
140 INPUT VALUE(COUNT)
150 IF VALUE(COUNT)=9999 THEN 170
160 NEXT COUNT
170 COUNT=COUNT-1
180 PRINT "SORTING."
190 FOR SORT1+1 TO COUNT
200 FOR SORT2=SORT1+1 TO COUNT
210 IF VALUE(SORT1)>VALUE(SORT2) THEN
TEMP=VALUE(SORT1)::VALUE(SORT1)=VALUE(SORT2)::VALUE(SORT2)=TEMP
220 NEXT SORT2
230 NEXT SORT1
240 FOR SORTED=1 TO COUNT
250 PRINT VALUE(SORTED)
260 NEXT SORTED
```

Format
IMAGE format-string

Cross Reference
DISPLAY USING, PRINT USING

Description
The IMAGE statement enables you to specify the format in which numbers or strings are printed or displayed by a PRINT USING or DISPLAY USING statement.

The format-string is a string constant.

A format-string containing a quotation mark or leading or trailing spaces must be enclosed in quotation marks. A format-string included in a PRINT-USING or DISPLAY-USING statement rather than as part of an image statement) must be enclosed in quotation marks.

Any character can be part of a format-string. Certain combinations of characters are interpreted as format-fields, as described below.

An IMAGE statement is not executed.

An IMAGE statement cannot be part of a multiple-statement line.

Format-Fields

A format-string can consist of one or more format-fields, each specifying the format of one print-item. Format-fields can be separated by any character except a decimal point or a pound sign.

A format-field may consist of the following characters:

A PLUS sign (+) indiates that a number (positive or negative) is shown with the - or + sign printed in front of it.

A pound sign (#) is replaced by a character from a print-item in the print-list of a PRINT USING or DISPLAY USING instruction. Allow one pound sign for each digit or character; allow one pound sign for the minus sign if necessary. If you do not allow as many pound signs as are necessary to represent the print-item, each pound sign is replaced by an asterisk (*). If you use more pound signs than are necessary to represent the print-item, each pound sign is replaced by a space. Added spaces precede a number (which right-justifies the number); added spaces follow a string (which left-justifies the string).

To indicate that a number is to be given in scientific notation, circumflexes (^) must be given for the E and power numbers. There must be four or five circumflexes, and 10 or fewer characters (minus sign, pound signs, and decimal point) when using the E format.

The decimal point separates the whole and fractional portions of numbers, and is printed where it appears in the IMAGE statement.

Continued-->

All other letters, numbers, and characters are printed exactly as they appear in the IMAGE statement.

Format-string may be enclosed in quotation marks. If it is not enclosed in quotation marks, leading and trailing spaces are ignored. However, when used directly in PRINT...USING or DISPLAY...USING, it must be enclosed in quotation marks.

Each IMAGE statement may have space for many images, separated by any character except a decimal point. If more values are given in the PRINT...USING or DISPLAY...USING statement than there are images, then the images are reused, starting at the beginning of the statement.

If you wish, you may put format-string directly in the PRINT...USING or DISPLAY...USING statement immediately following USING. However, if a format-string is used often, it is more efficient to refer to an IMAGE statement.

Examples

```
100 IMAGE $####.###
110 PRINT USING 100:A
```

IMAGE $####.### allows printing of any number from -999.999 to 9999.999. The following illustrate how some sample values would be printed or displayed:

VALUE	APPEARANCE
-999.999	$-999.999
-34.5	$ -34.500
0	$ 0.000
12.4565	$ 12.457
6312.991	$6312.999
99999999	$********

```
100 IMAGE ANSWERS ARE ### AND ##.##
110 PRINT USING 100:A,B
```

Allows printing of two numbers. The first may be from -99 to 999 and the second may be from -9.99 to 99.99. The following illustrate how some sample values would be printed or displayed:

VALUES		APPEARANCE
-99	-9.99	ANSWERS ARE -99 AND -9.99
-7	-3.459	ANSWERS ARE -7 AND -3.46
0	0	ANSWERS ARE 0 AND .00
14.8	12.75	ANSWERS ARE 15 AND 12.75
795	852	ANSWERS ARE 795 AND *****
-984	64.7	AMSWERS ARE *** AND 64.70

```
300 IMAGE DEAR ####
310 PRINT USING 300:X$
```

Allows printing a four-character string. The following illustrates how some sample values would be printed or displayed:

Continued-->

VALUES	APPEARANCE
JOHN	DEAR JOHN,
TOM	DEAR TOM ,
RALPH	DEAR ****,

Programs

The following program illustrates a use of IMAGE. It reads and prints seven numbers and their total.

```
100 CALL CLEAR
110 IMAGE $####.##
120 IMAGE " ####.##"
130 DATA 233.45,-147.95,8.4,37.263,-51.299,85.2,464
140 TOTAL=0
150 FOR A=1 TO 7
160 READ AMOUNT
170 TOTAL=TOTAL+AMOUNT
180 IF A=1 THEN PRINT USING 110:AMOUNT ELSE PRINT USING 120:AMOUNT
190 NEXT A
200 PRINT "-------"
210 PRINT USING "$####.##":TOTAL
RUN
$ 233.45
 -147.95
    8.40
   37.26
  -51.30
   85.20
  464.00
-------
$ 629.06
```

Lines 110 and 120 set up the images. They are the same except for the dollar sign in line 110. To keep the blank space where the dollar sign was, the format-string in line 120 is enclosed in quotation marks.

Line 180 prints the values using the IMAGE statements.

Line 210 shows that the format can be put directly in the PRINT USING statement.

The amounts are printed with the decimal points aligned.

The following program shows the effect of using more values in the PRINT USING statement than there are images in the IMAGE statement.

```
100 IMAGE ###.##,###.#
110 PRINT USING 100:50.34,50.34,37.26,37.26
RUN
50.34, 50.3
37.26, 37.3
```

PRINT USING "+###": -5 will print -5

INIT subprogram--Initialize

Format
CALL INIT

Cross Reference
LINK, LOAD

Description
The INIT subprogram initializes the 8k of memory allocated to assembly-language subprograms.

> *INIT loads the linkage vectors to support assembly-language subroutines.*
>
> *INIT removes any assembly-language subprograms that were previously loaded into memory.*
>
> *INIT reserves almost 8K of memory for assembly-language.*

If you do not call INIT before the first time you use the LOAD subprogram to load an assembly-language subprogram from an external device into memory, a call INIT will automatically be performed by the computer.

Although it is not necessary to call INIT in your program, you may wish to do so to remove previously loaded subprograms from memory.

Examples

CALL INIT
Allocates 8K bytes of memory space.

Format
Keyboard Input
INPUT [input-prompt:]variable-list
File Input
INPUT #file-number[,REC record-number]

Cross Reference
ACCEPT, EOF, LINPUT, OPEN, REC, TERMCHAR

Description
The INPUT statement suspends program execution to enable you to enter data from the keyboard. INPUT can be used to retrieve data from an external device.

The variable-list consists of one or more variables separated by commas. Values are assigned to the variables in the variable-list in the order they are input. A value assigned to a numeric variable must be a number; a value assigned to a string variable may be a string or a number.

Variables are assigned values sequentially in the variable-list. A value can be assigned to a variable, and then that variable can be used as a subscript later in the same variable-list.

Input from the keyboard

If you do not specify a file-number, the program pauses to accept input from the keyboard.

If you enter an input-prompt, it appears at the beginning of the input field, followed immediately by the flashing cursor.

The input-prompt is a string expression; if you use a string constant, you must enclose it in quotation marks.

If you do not enter an input-prompt, a question mark (?) appears at the beginning of the input field, followed by a space. The flashing cursor appears in the character position following the space.

The input field begins in the far left column of the bottom row of the screen window defined by the margins. You can enter up to 157 characters from the keyboard; however, an exceptionally long entry may not be processed correctly by the computer.

The values entered to the variable-list of one INPUT statement must be separated by commas. You must enter the same number of values as there are variables in the variable-list.

A string value entered from the keyboard can optionally be enclosed in quotation marks. However, a string containing a comma, a quotation mark, or

Continued-->

leading or trailing spaces must be enclosed in quotation marks. A quotation mark within a string is represented by two adjacent quotation marks.

You normally press ENTER to complete keyboard input; however, you can also use AID, BACK, BEGIN, CLEAR, PROC'D, DOWN ARROW, or UP ARROW. You can use the TERMCHAR function to determine which of these keys was pressed to exit from the previous INPUT, LINPUT, or ACCEPT instruction.

Note that pressing CLEAR during keyboard input normally causes a break in the program. However, if your program includes an ON BREAK NEXT statement, you can use CLEAR to exit from an input field.

The computer sounds a short tone to signal that it is ready to accept keyboard input.

In High-Resolution Mode, keyboard input has no effect. See Appendix K.

Examples

```
100 INPUT X
```
Allows the input of a number.

```
100 INPUT X$,Y
```
Allows the input of a string and a number.

```
100 INPUT "ENTER TWO NUMBERS: ":A,B
```
Displays the prompt ENTER TWO NUMBERS and then allows the entry of two numbers.

```
100 INPUT A(J),J
```
First evaluates the subscript of A and then accepts data into that element of the array A. Then a value is accepted into J.

```
100 INPUT J,A(J)
```
First accepts data into J and then accepts data into the Jth element of the array A.

Program

The following program illustrates a use of INPUT from the keyboard.

```
100 CALL CLEAR
110 INPUT "ENTER YOUR FIRST NAME: ":FNAME$
120 INPUT "ENTER YOUR LAST NAME: ":LNAME$
130 INPUT "ENTER A THREE DIGIT NUMBER: ":DOLLARS
140 INPUT "ENTER A TWO DIGIT NUMBER: ":CENTS
150 IMAGE OF $###.## AND THAT IF YOU
160 CALL CLEAR
170 PRINT "DEAR ";FNAME$;",": :
180 PRINT "     THIS IS TO REMIND YOU"
190 PRINT "THAT YOU OWE US THE AMOUNT"
200 PRINT USING 150:DOLLARS+CENTS/100
210 PRINT "IF YOU DO NOT PAY US, YOU WILL SOON"
```

Continued-->

```
220 PRINT "RECEIVE A LETTER FROM OUR"
230 PRINT "ATTORNEY, ADDRESSED TO"
240 PRINT FNAME$;" ";LNAME$;"!": :
250 PRINT TAB(15);"SINCERELY,": : :TAB(15);"I.  DUN YOU": : : :
260 GOTO 260
(Press CLEAR to stop program.)
```

Lines 110 through 140 allow the person using the program to enter data, as requested with the input-prompts.

Lines 170 through 250 construct a letter based on the input. (Be certain to enter the colons exactly as indicated, because they control line spacing.)

Input from a File
If you include a file-number, input is accepted from the specified device.

> The file-number is a numeric expression whose value specifies the number of the file as assigned in its OPEN instruction.
>
> If necessary, file-number is rounded to the nearest integer.
>
> If you use the REC option, the record-number is a numeric-expression whose value specifies the number of the record from which you want to input to the variable-list. The records in a file are numbered sequentially, starting with zero. The REC option can be used only with a file opened for RELATIVE access.
>
> If necessary, record-number is rounded to the nearest integer.

You can accept input only from files opened in INPUT or UPDATE mode. DISPLAY files must have fewer than 161 characters in each record to be used with an INPUT statement; however, an exceptionally long record may not be processed correctly by the computer.

If there are more variables in the variable-list than there are values in the current record, the computer proceeds as follows:

> In the case of INTERNAL FIXED records, null strings are assigned to the remaining variables, causing a program error if any of the remaining variables are numeric.
>
> For other records, the computer reads the next record in the file, and uses its values to complete the variable-list.

If there are more values in the current record than are necessary to fill the variable-list, the remaining values are discarded. However, if the variable-list ends with a comma, the computer is placed in an input-pending condition. The remaining values are assigned to the variables in the variable-list of the next INPUT statement unless that statement includes the REC option, in which case the remaining values are discarded.

Continued-->

INPUT #file-number[,REC numeric-expression][:variable-list]

This form of the INPUT statement allows you to read data from an accessory device.
The INPUTstatement can be used only with files opened in INPUT or UPDATE mode.
The file-number in the INPUT statement must be the file-number of a currently open file. (See OPEN)
The variable-list contains those variables which are assigned values when the INPUT statement is performed: Variable names in the variable-list are separated by commas and may be numeric and/or string variables.

Filling the variable-list
When the computer reads records from a file, it stores each complete record internally in a temporary storage area called an input/output (I/O) buffer. A separate buffer is provided for each open file-number.
Values are assigned to variables in the variable-list from left to right, using the data in this buffer. Whenever a variable-list has been filled with corresponding values, any data items left in the buffer are discarded unless the INPUT statement ends with a trailing comma. Using a trailing comma creates a "pending" input condition.

If the variable-list in the INPUT statement is longer than the number of data items in the current record being processed, the computer will get the next record from the file and use its data items to complete the variable-list.
When performing the INPUT statement, the computer will take different actions depending on whether the data stored is in DISPLAY or INTERNAL format.

DISPLAY-type data has the same form as data entered from the keyboard.
The computer knows the length of each data item in a DISPLAY-type record by the comma separators placed between items.
Each item in a DISPLAY-type record is checked to ensure that numeric values are placed in numeric variables. If the data-type doesn't match the variable-type an INPUT ERROR will occur and the program will terminate.

The computer knows the length of each INTERNAL-type item by interpreting the one-position length indicator at the beginning of each item.
Limited validation of INTERNAL-type data-items is performed. All numeric items must be 9 positions long (8 digits plus one position which specifies the length) and must be valid representations of floating-point numbers.
Otherwise, an INPUT ERROR will occur. and the program will terminate.

Examples

```
100 INPUT #1:X$
Puts into X$ the next value available in the file that was opened as #1.

100 INPUT #23:X,A,LL$
Puts  into  X, A, and LL$ the next three values from the file that was opened
as #23 with data in INTERNAL format.

100 INPUT #11,REC 44:TAX
Puts into TAX the first value of record number 44 of the file that was opened
as #11 with RELATIVE file organization.

100 INPUT #3:A,B,C,
110 INPUT #3:X,Y,Z
Puts  into A, B, and C the next three values from the file opened as #3.  The
coma after C creates  an  input-pending  condition,  and  because  the  INPUT
statement  in line 110 has no REC clause, the computer assigns to X, Y, and Z
data values beginning where the previous INPUT statement stopped.
```


For more information on external file use please see the TI99/4A Users Reference Guide.

The content of this page has been deleted as it is not appropriate to Myarc XB Version 2.12

INT function--Integer

Format
INT(numeric-expression)

Type
Real

Description
The INT function returns the largest integer not greater than the value of the numeric-expression.

If the value of the numeric-expression is an integer, INT returns the value of the numeric-expression itself. If the numeric-expression is not an integer, INT returns the largest integer not greater than the numeric-expression.

Examples

```
100 PRINT INT(3.4)
```
Prints 3.

```
100 X=INT(3.9)
```
Sets X equal to 3.

```
100 P=INT(3.9999999999)
```
Sets P equal to 3.

```
100 DISPLAY AT(3,7):INT(4.0)
```
Displays 4 at the third row, seventh column of the current screen window.

```
100 N=INT(-3.9)
```
Sets N equal to -4.

```
100 K=INT(-3.00000001)
```
Sets K equal to -4.

Format
CALL JOYST(key-unit,x,y)

Description
The JOYST subprogram enables you to ascertain the position of either of the Joystick Controllers.

The numeric expression key-unit can have a value of 1 or 2, specifying the joystick you are testing.

The position of the specifed joystick is returned in the numeric variables x and y as follows:

POSITION	X	Y
Center	0	0
Up	0	(+)4
Upper Right	(+)4	(+)4
Right	(+)4	0
Lower Right	(+)4	-4
Down	0	-4
Lower Left	-4	-4
Left	-4	0
Upper Left	-4	(+)4

If the specified joystick is not connected to the computer, x and y are both returned as 0.

Example

```
100 CALL JOYST(1,X,Y)
Returns values in X and Y according to the position of joystick number 1.
```

Program

The following program illustrates a use of the JOYST subprogram. It creates a sprite and then moves it around according to the input from a joystick.

```
100 CALL CLEAR
110 CALL SPRITE(#1,33,5,96,128)
120 CALL JOYST(1,X,Y)
130 CALL MOTION(#1,-Y*4,X*4)
140 GOTO 120
(Press CLEAR to stop the program.)
```

JOYSTICK FIRE BUTTONS:
To detect the joystick fire button use CALL KEY(1... for Joystick 1 and CALL KEY(2... for Joystick 2.
Example: CALL KEY(1,K,S).
S will be 0 if the fire button of Joystick 1 is not pressed, 1 if the button is pressed, and if the key is held down, on the second CALL KEY(1,K,S) then S wiull have a value of -1.
The variable K will have a value of 0 if the fire button is not pressed, and a value of 18 if the fire button is pressed.
NOTE: CALL KEY(1... and CALL KEY(2... will scan the left hand and right hand sides of the keyboard and return split keyboard codes (see CALL KEY).
Hence keyboard key Q will also be detected as the fire button of Joystick 1 and keyboard key Y will be detected as the fire button of Joystick 2.

Format
CALL KEY(key-unit,key,status)

Description
The KEY subprogram enables you to transfer one character from the keyboard directly to a program.

The numeric-expression key-unit can have a value from 0 to 5, as explained below.

The character code of the key pressed is returned in the numeric variable key. If no key is pressed, a value of 0 is returned.

The keyboard status is returned in the numeric variable status as explained below.

Because the character represented by the key pressed is not displayed on the screen, the information already on the screen is not disturbed.

Status
The value returned as the status can be interpreted as follows:

-1 means the same key was pressed as was returned the last time KEY was called.

0 means no key was pressed.

(+)1 means a different key was pressed than was returned the last time KEY was called.

KEY UNIT: RESULT:

0 the keyboard is mapped in whichever mode was specified by the previous CALL KEY

1 input is taken from the left side of the keyboard and Joystick 1 fire button.

2 input is taken from the right side of the keyboard and Joystick 2 fire button.

3 TI-99/4 keyboard mode. All characters are returned as CAPITALS regardless of the setting of SHIFT or ALPHA LOCK. Also Function codes 1 to 15 are active, but no control characters are returned.

4 Pascal mode with both upper- and lower-case characters active. The function codes 129 to 143 and the control character codes 1 to 31 are also active.

5 TI-99/4A Basic mode. Returns upper and lower case characters. Also function codes 1 to 15, and control character codes 128 to 159 (and also 187).

Codes are assigned to the function and control keys so that these can be referenced by the CALL KEY subprogram in Extended Basic. The codes assigned depend on the key-unit value specified in a CALL KEY program statement.

ASCII codes for keys are given in Appendix B on Page 220.
See Appendix B on page 221 for the split keyboard codes.
See Appendix B on page 221 for the Control, Function and Pascal codes.
Key codes for the control and function keys are also on the next page
Key codes are also given in your Users Reference Guide for the TI99/4A.

Continued--->

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Function key codes

KEY(3) & KEY(5)	Codes KEY(4)	Function name	Function key
1	129	AID	FCTN 7
2	130	CLEAR	FCTN 4
3	131	DELete	FCTN 1
4	132	INSert	FCTN 2
5	133	QUIT	FCTN =
6	134	REDO	FCTN 8
7	135	ERASE	FCTN 3
8	136	LEFT arrow	FCTN S
9	137	RIGHT arrow	FCTN D
10	138	DOWN arrow	FCTN X
11	139	UP arrow	FCTN E
12	140	PROC'D	FCTN 6
13	141	ENTER	ENTER
14	142	BEGIN	FCTN 5
15	143	BACK	FCTN 9

Control key codes

KEY(5) mode	KEY(4) mode	Mnemonic code	Press	Comments
129	1	SOH	CTRL A	Start of heading
130	2	STX	CTRL B	Start of text
131	3	EXT	CTRL C	End of text
132	4	EOT	CTRL D	End of transmission
133	5	ENQ	CTRL E	Enquiry
134	6	ACK	CTRL F	Acknowledge
135	7	BEL	CTRL G	Bell
136	8	BS	CTRL H	Backspace
137	9	HT	CTRL I	Horizontal tabulation
138	10	LF	CTRL J	Line feed
139	11	VT	CTRL K	Vertical tabulation
140	12	FF	CTRL L	Form feed
141	13	CR	CTRL M	Carriage return
142	14	SO	CTRL N	Shift out
143	15	SI	CTRL O	Shift in
144	16	DLE	CTRL P	Data link escape
145	17	DC1	CTRL Q	Device control 1 (X-ON)
146	18	DC2	CTRL R	Device control 2
147	19	DC3	CTRL S	Device control 3 (X-OFF)
148	20	DC4	CTRL T	Device control 4
149	21	NAK	CTRL U	Negative acknowledge
150	22	SYN	CTRL V	Synchronous idle
151	23	ETB	CTRL W	End of transmission block
152	24	CAN	CTRL X	Cancel
153	25	EM	CTRL Y	End of medium
154	26	SUB	CTRL Z	Substitute
155	27	ESC	CTRL .	Escape
156	28	FS	CTRL ;	File separator
157	29	GS	CTRL =	Group separator
158	30	RS	CTRL 8	Record separator
159	31	US	CTRL 9	Unit separator

Example

```
100 CALL KEY(0,K,S)
```

Returns in K the ASCII code of any key pressed on the keyboard except SHIFT, CTRL, FCTN, and CAPS, and in S a value indicating whether a key was pressed.

Program

The following program illustrates a use of the KEY subprogram. It creates a sprite and then enables you to move it around by using the arrow keys (E, S, D, and X) without pressing FCTN. Note that line 130 returns to line 120 if no key has been pressed.

To stop the sprite's movement, press any key (except the arrow keys) on the left side of the keyboard.

```
100 CALL CLEAR
110 CALL SPRITE(#1,33,5,96,128)
120 CALL KEY(1,K,S)
130 IF S=0 THEN 120
140 IF K=5 THEN Y=-4
150 IF K=0 THEN Y=4 160 IF K=2 THEN Y=-4
170 IF K=3 THEN X=4
180 IF K=1 THEN X,Y=0
190 IF K>5 THEN X,Y=0
200 CALL MOTION(#1,Y,X)
210 GOTO 120
(Press CLEAR to stop the program.)
```

LEN function--Length

Format
LEN(string-expression)

Type
DEFINT

Description
The LEN function returns the number of characters in the string specified by the string-expression.

If the string-expression is a null string, LEN returns a zero.

Remember that a space is a valid character and is considered to be part of the length of a string.

Examples

```
100 PRINT LEN("ABCDE")
```
Prints 5.

```
100 X=LEN("THIS IS A SENTENCE.")
```
Sets X equal to 19.

```
100 DISPLAY LEN("")
```
Displays 0.

```
100 DISPLAY LEN(" ")
```
Displays 1.

```
100 A$="DAVID"
110 DISPLAY LEN(A$)
```
Displays 5 when A$ equals DAVID.

Format
[LET]variable-list=expression

Description
The LET instruction, often called the "assignment" instruction, enables you to assign values to variables.

You can use LET as either a program statement or a command.

The variable-list consists of one or more variables separated by commas. Do not mix numeric and string variables in the same variable-list. However, you can include both DEFINT and REAL numeric variables in the same variable-list.

The value of expression is assigned to all variables in the variable-list. If the variable-list contains numeric variables, the expression must be a numeric expression. If the variable-list contains string variables, the expression must be a string expression.

The word LET can be optionally omitted from instruction.

Examples

100 T=4
Assigns to T the value 4.

100 X,Y,Z=12.4
Assigns to X, Y, and Z the value 12.4.

100 A=3<5
Assigns -1 to A because it is true that 3 is less than 5.

100 B=12<7
Assigns 0 to B because it is not true that 12 is less than 7.

100 L$,D$,B$="B"
Assigns to L$, D$, and B$ the string constant "B".

Continued-->

Program

The following program illustrates a use of LET.

```
100 K=1
110 K,A(K)=3
120 PRINT K;A(1)
130 PRINT A(3);A(K)
RUN
3 3
0 0
```

In line 100, the variable K is assigned the value 1.

In line 110, the variable K and the array element A(K) are assigned the value of 3. Note that when line 110 is executed, the subscript K is not assigned a new value, but has the same value it had before the line was executed. Therefore, A(K) is an expression equivalent to A(1), referring to the same element of the array.

In line 120, the values of K and A(1) are printed.

When line 130 is executed, K has a value of 3; therefore, A(K) is now an expression equivalent to A(3). Both expressions have a value of 0 (the default value) because no value has been assigned to this element of array.

Format
CALL LINK(subprogram-name[,parameter-list])

Cross Reference
INIT, LOAD, SUB

Description
The LINK subprogram enables you to transfer control from a MYARC Extended BASIC II program to an assembly-language subprogram.

The subprogram-name is an entry point in an assembly-language subprogram that you have previously loaded into memory with the LOAD subprogram. The subprogram-name is a string expression; if you use a string constant, it must be enclosed in quotation marks.

The optional parameter-list consists of one or more parameters, separated by commas, that are to be passed to the assembly-language subprogram. The contents of the parameter-list depend on the particular subprogram you are you are accessing.

The rules for passing parameters to an assembly-language subprogram are the same as the rules for passing parameters to MYARC Extended BASIC II subprogram (see SUB).

Example

```
100 CALL LINK("START",1,3)
```

Links the MYARC Extended BASIC II program to the assembly-language subprogram START, and passes the values 1 and 3 to it.

Format
Keyboard Input
LINPUT [input-prompt:]string-variable
File Input
LINPUT #file-number[,REC record-number]:string-variable

Cross Reference
ACCEPT, EOF, INPUT, OPEN, TERMCHAR

Description
The LINPUT statement suspends program execution to enable you to enter a line of unedited data from the keyboard. LINPUT can be used also to retrieve an unedited record from an external device.

> LINPUT assigns an entire line, a file record, or the remaining portion of a file record (if there is an input-pending condition) to the string-variable.
>
> See INPUT for an explanation of keyboard- and file-input, and input options.

No editing is performed on the input data. All characters (including commas, quotation marks, colons, semicolons, and leading and trailing spaces) are assigned to the string-variable as they are encountered.

The maximum value that can be input from the keyboard is 255 characters.

LINPUT is frequently used instead of INPUT when the input data may include a comma. (A comma is not accepted as input by the INPUT statement, except as part of a string enclosed in quotation marks.)

To use LINPUT for file input the file must be in DISPLAY format.

You normally press ENTER to complete keyboard input; however, you can also use AID, BACK, BEGIN, CLEAR, PROC'D, DOWN ARROW, or UP ARROW. You can use the TERMCHAR function to determine which of these keys was pressed to exit from the previous ACCEPT, INPUT, or LINPUT instruction.

Note that pressing CLEAR during keyboard input normally causes a break in the program. However, if your program includes an ON BREAK NEXT statement, you can use CLEAR to exit from an input field.

Examples

```
100 LINPUT L$
```
Assigns to L$ anything typed before ENTER is pressed.

```
100 LINPUT "NAME: "NM$
```
Displays NAME: and assigns to NM$ anything typed before ENTER is pressed.

Continued-->

100 LINPUT #1,REC M:L$(M)
Assigns to L$(M) the value that was in record M of the file that was opened as #1 with RELATIVE DISPLAY file organization.

Program

The following program illustrates the use of LINPUT. It reads a previously existing file and displays only the lines that contain the word "THE."

```
100 OPEN #1:"DSK1.TEXT1",INPUT,FIXED 80,DISPLAY
110 IF EOF(1) THEN CLOSE #1 :: STOP
120 LINPUT #1:A$
130 X=POS(A$,"THE",1)
140 IF X>0 THEN PRINT A$
150 GOTO 110
```

Format
List to the screen
LIST [line-number-range]
List to a File (or Device)
LIST "file-specification"[:line-number-range]

Description
The LIST command displays the program (or a portion of it) currently in memory. You can also use LIST to output the program listing to an external device.

PLEASE NOTE- The use of this command varies from that of Texas Instruments Extended Basic

You can stop the listing at any time by pressing CLEAR (FCTN 4). Pressing any other key (except SHIFT, FCTN, or CTRL) causes the listing to pause until you press a key again.

The Line-Number-Range

The optional line-number-range specifies the portion of the program to be listed. If you do not enter a line-number-range, the entire program is listed. The program lines are always listed in ascending order.

A line-number-range can consist of a single line number, a single line number followed by a space or a comma then a capital E or a second line number.

COMMAND:	LINES LISTED
LIST	All lines.
LIST X	Line number X only
LIST X E or LIST X,E	Lines from line number X to the highest line number, inclusive
LIST 1 X or LIST 1,X	Lines from the lowest line number to line number X, inclusive
LIST X Y or LIST X,Y	All lines from line number X to line number Y, inclusive

If the line-number-range does not include a line number in your program, the folowing conventions apply:

If line-number-range is higher than any line number in the program, the highest-numbered program line is listed.

If line-number-range is lower than any line number in the program, the lowest-numbered program line is listed.

If line-number-range is between lines in the program, the next higher numbered program line is listed.

Continued-->

File Specifications

If you enter a file-specification, the program listing is output to the specified file or device. The file-specification, a string constant, must be enclosed in quotation marks.

The program listing is output as a SEQUENTIAL file in DISPLAY format with VARIABLE records (see OPEN); the file-specification option can be used only with devices that accept these options. For more information about listing a program on a particular device, refer to the owner's manual that comes with that device. If you do not enter a file-specification, the program listing is displayed on the screen.

The LIST command only works with peripherals that support DISPLAY/VARIABLE type records.

EXAMPLES

LIST will list the whole program onto the screen

LIST 400,450 will list all lines from 400 to 450 onto the screen.

LIST 400 450 will also list all lines from 400 to 450 onto the screen.

LIST "PIO" will list the whole program to a parallel printer, device "PIO".

LIST "DSK1.LISTING" will list the whole program to a disk file on Drive One, with file name LISTING, in the Display Variable 80 format used by eg TI Writer.

LIST "RD.LIST" will list the whole program to a Display Variable 80 file called LIST on the RamDisk device

LIST 2000 E will list from line 2000 to the end of the program onto the screen

LIST "DSK1.NAME":300 500 will list lines 300 to 500 to a display variable 80 file called NAME on Drive One.

LIST "RD.PART2":1 400 will list all lines up to and including line 400 to a display variable file called PART2 on the RamDisk.

LIST "TP" will list the whole program to the Texas Instruments Thermal Printer.

Format
File Only
```
     CALL LOAD(file-specification-list)
```
Data Only
```
     CALL LOAD(address,byte-list[,"",address,byte-list[,...]])
```
File and Data
```
     CALL LOAD(file-specification-list,address,byte-list[,...])
     CALL LOAD(address,byte-list,file-specification-list[,...])
```

Cross Reference
INIT, LINK, PEEK, PEEKV, POKEV, VALHEX

Description
The LOAD subprogram enables you to load assembly-language subprograms into memory. You can also use LOAD to assign values directly to specified CPU (Central Processing Unit) memory addresses. You can use the POKEV subprogram to assign values to VDP (Video Display Processor) memory.

To load an assembly-language subprogram, specify a file-specification-list; to assign values to CPU memory, specify an address and a byte-list (an address must always be followed by a byte-list).

You must enter at least one parameter. The first parameter you specify can be either a file-specification-list or an address.

If you wish to follow an address and byte-list with another address and byte-list, enter a file-specification-list or a null string (two-adjacent quotation marks) as a separator.

The optional file-specification-list consists of one or more file-specifications separated by commas. A file-specification is a string expression; if you use a string constant, you must enclose it in quotation marks.

Each file-specification names an assembly-language object (program) file to be loaded into memory. The specified file can include subprogram names, so that the subprograms can be executed by the LINK subprogram.

The object file to be loaded must be in DISPLAY format with FIXED records (see OPEN). For more information about the file options available with a particular device, refer to the owner's manual that comes with that device.

You can optionally load bytes of data to a specified CPU memory address. The address specifies the first address where the data is to be loaded; if the byte-list specifies more than one byte of data, the bytes are assigned to sequential memory addresses starting with the address you specify.

Continued-->

The numeric expression address must have a value from -32768 to 32767 inclusive.

You can specify an address from 0 to 32767 inclusive by specifying the actual address.

You can specify an address from 32768 to 65535 inclusive by subtracting 65536 from the actual address. This will result in a value from -32768 to -1 inclusive.

If you know the hexadecimal value of the address, you can use the VALHEX function to convert it to a decimal numeric expression, eliminating the possible need for calculations.

If necessary, the address is rounded to the nearest integer.

The byte-list consists of one or more bytes of data, separated by commas, that are to be loaded into CPU memory starting with the specified address.

Each byte in the byte-list must be a numeric expression with a value from 0 to 32767. If the value of a byte is greater than 255, it is repeatedly reduced by 256 until it is less than 256. If necessary, a byte is rounded to the nearest integer.

Note that you must use the INIT subprogram to reserve memory space before you use LOAD to load a subprogram.

If you call the LOAD subprogram with invalid parameters or load an object file with absolute (rather than relocatable) addresses, the computer may function erratically or cease to function entirely. If this occurs, turn off the computer, wait several seconds, then turn the computer back on again.

The Loader

LOAD uses a "relocatable linking" loader.

Because it is "relocatable," you cannot use LOAD to specify a memory address at which you want to load a file. However, the file you are loading may specify an absolute load address if it includes an AORG directive.

Because if is "linking," the object files specified in the file-specification-list can reference each other.

Format
CALL LOCATE(#sprite-number,pixel-row,pixel-column[,...])

Cross Reference
DELSPRITE, SPRITE

Description
The LOCATE subprogram enables you to change the location of one or more sprites.

The sprite-number is a numeric expression whose value specifies the number of a sprite as assigned by the SPRITE subprogram.

The pixel-row and pixel-column are numeric expressions whose values specify the screen pixel location of the pixel at the upper-left corner of the sprite.

LOCATE can cause a sprite that has been deleted with DELSPRITE sprite-number to reappear.

Program

The following program illustrates the use of the LOCATE subprogram.

```
100 CALL CLEAR
110 CALL SPRITE(#1,33,7,1,1,25,25)
120 YLOC=INT(RND* 150+1)
130 XLOC=INT(RND* 200+1)
140 FOR DELAY=1 TO 300 :: NEXT DELAY
150 CALL LOCATE(#1,YLOC,XLOC)
160 GOTO 120
(Press CLEAR to stop the program.)
```

Line 110 creates a sprite as a fairly quickly moving red exclamation point.

Line 140 locates the sprite at a location randomly chosen in lines 120 and 130.

Line 150 repeats the process.

Also see the third example of the SPRITE subprogram.

LOG function--Natural Logarithm

Format
LOG(numeric-expression)

Type
REAL

Cross Reference
EXP

Description
The LOG function returns the natural logarithm of the value of the numeric-expression. LOG is the inverse of the EXP function.

The value of the numeric-expression must be greater than zero.

Examples

```
100 PRINT LOG(3.4)
```
Prints the natural logarithm of 3.4, which is 1.223775432.

```
100 X=LOG(EXP(7.2))
```
Sets X equal to the natural logarithm of e raised to the 7.2 power, which is 7.2.

```
100 S=LOG(SQR(T))
```
Sets S equal to the natural logarithm of the square root of the value of T.

Program

The following program returns the logarithm of any positive number in any base.

```
100 CALL CLEAR
110 INPUT "BASE: ":B
120 IF B =1 THEN 110
130 INPUT "NUMBER: ":N
140 IF N =0 THEN 130
150 LG=LOG(N)/LOG(B)
160 PRINT "LOG BASE";B;"OF";N;"IS
170 PRINT
180 GOTO 110
```
(Press CLEAR to stop the program.

MAGNIFY subprogram

Format
CALL MAGNIFY(numeric-expression)

Cross Reference
CHAR, SPRITE

Description
The MAGNIFY subprogram enables you to specify whether all sprites are single- or double-sized and whether they are unmagnified or magnified.

The value of the numeric-expression specifies the size and magnification "level" of all sprites. (You cannot specify the level of an individual sprite.)

LEVEL	CHARACTERISTICS
1	Single-sized, unmagnified
2	Single-sized, magnified
3	Double-sized, unmagnified
4	Double-sized, magnified

The screen position of the pixel in the upper-left corner of a sprite is considered to be the position of that sprite. That pixel remains in the same screen position regardless of changes to the magnification level.

When you enter MYARC Extended BASIC II, sprites are single-sized and unmagnified (level 1). When your program ends (either normally or because of an error), stops at a breakpoint, or changes graphics mode, the sprite magnification level is restored to 1.

Single-Sized Sprites

A single-sized sprite is defined only by the character you specify when the sprite is created.

Double-Sized Sprites

A double-sized sprite is defined by four consecutive characters, including the character that you specify when the sprite is created.

If the number of the character you specify is a multiple of 4, that character is the first of the four characters that comprise the sprite's definition. If the character number is not a multiple of 4, the next lower character that is a multiple of four is the first character of the sprite.

The first of the four characters defines the upper-left quarter of the sprite, te second character defines the lower-left quarter of the sprite, the third defines the upper-right quarter of the sprite, and the last of the four characters defines the lower-right quarter of the sprite.

Continued-->

Unmagnified Sprites

An unmagnified sprite occupies only the number of characters on the screen specified by the characters that define it.

A single-sized unmagnified sprite occupies 1 character position on the screen; a double-sized unmagnified sprite occupies 4 character positions.

Magnified Sprites

A magnified sprite expands to twice the height and twice the width of an unmagnified sprite. The expansion occurs down and to the right; the pixel in th upper-left corner of the sprite remains in the same screen position.

A magnified sprite has 4 times the area of an unmagnified sprite. When you magnify a sprite, each pixel of the unmagnified sprite expands to 4 pixels of the magnified sprite.

A single-sized magnified sprite occupies 4 character positions on the screen; a double-sized magnified sprite occupies 16 character positions.

Program

The following program illustates a use of the MAGNIFY subprogram.

A little figure (single-sized, unmagnified) appears near the center of the screen. In a moment, it becomes twice as big (single-sized, magnified), covering four character positions. In another moment, it is replaced by the upper-left corner of a larger figure (single-sized, magnified), still covering four character positions. Then the full figure appears (double-sized, magnified), covering sixteen character positions. Finally it is reduced in size to four character positions (double-sized, unmagnified).

```
100 CALL CLEAR
110 CALL CHAR(148,"1898FF3D3C3CE404")
120 CALL SPRITE(#1,148,5,92,124)
130 GOSUB 230
140 CALL MAGNIFY(2)
150 GOSUB 230
160 CALL CHAR(148,"0103C3417F3F07070707077E7C40000080C0C080
FCFEE2E3E0E0E06060606070")
170 GOSUB 230
180 CALL MAGNIFY(4)
190 GOSUB 230
200 CALL MAGNIFY(3)
210 GOSUB 230
220 STOP
230 REM DELAY
240 FOR DELAY=1 TO 500
250 NEXT DELAY
260 RETURN
```

Line 110 defines character 148.

Continued-->

Line 120 sets up sprite using character 148. By default the magnification factor is 1.

Line 140 changes the magnification factor to 2.

Line 160 redefines character 148. Because the definition is 64 characters long, it also defines characters 149, 150, and 151.

Line 180 changes the magnification factor to 4.

Line 200 changes the magnification factor to 3.

Format
CALL MARGINS(left,right,top,bottom)

Cross Reference
ACCEPT, CLEAR, DISPLAY, DISPLAY USING, GRAPHICS, INPUT, LINPUT, PRINT, PRINT USING, WRITE

Description
The MARGINS subprogram enables you to define screen margins. The margins you specify define a screen window that affects the operation of several instructions.

Left, right, top, and bottom are numeric expressions whose values specify the margins.

The margins cannot "overlap"; that is, the position of the top margin must be higher on the screen than the bottom margin, and the position of the left margin must be farther left on the screen than the right margin.

When creating a screen window, you must leave the window large enough to allow entry of a command.

The valid range for margin location varies according to the graphics mode. Acceptable values for the margins in each mode are as follows:

MODE	TOP&BOTTOM	LEFT&RIGHT
Pattern	1-24	1-32
Text	1-24	1-40
High-Resolution *	1-24	1-32

The upper-left corner of the window defined by the margins is considered to be the intersection of row 1 and column 1 by the ACCEPT, DISPLAY, and DISPLAY USING instructions that use the AT option and the WRITE instruction.

The lower-left corner of the window is considered to be the beginning of the input line by the ACCEPT, INPUT, and LINPUT instructions.

The lower-left corner of the window is considered to be the beginning of the print line by the DISPLAY, DISPLAY USING, PRINT, and PRINT USING instructions.

When the ACCEPT, INPUT, LINPUT, or PRINT USING instructions cause scrolling, scrolling occurs only in the window.

The CLEAR, GCHAR, HCHAR, and VCHAR subprograms are not affected by the margin settings.

In all Modes, the margins can extend to the edges of the screen.

* Margins are NOT supported in high resolution mode (Graphics(3))

Continued-->

When you enter MYARC Extended BASIC II, the left margin is set to 3 and the right margin to 30. The top and bottom margins are set to 1 and 24 respectively. When a program running in High-Resolution Mode ends, these default margin settings are restored.

Examples

```
100 CALL MARGINS(3,30,1,24)
Sets all four margins to the default value in Pattern and High-Resolution
Modes.

100 CALL MARGINS(1,40,1,24)
Sets the left, right, top and bottom margins to the extreme edges of the
screen in Text Mode.
```

NOTE; Some BASIC / EXTENDED BASIC programs may assume that screen columns 1 and 2 and 31 and 32 will scroll with columns 3 to 30 eg with PRINT commands. In MYARC XBII this will not happen. This will only affect programs that have used a combination of PRINT and CALL HCHAR commands and have placed characters in the left and right-most two columns of the graphics display.
TI BASIC / EXTENDED BASIC PRINT commands place characters in columns 3 to 30 producing the standard PRINT screen width of 28 characters.

The following program will behave differently in MYARC XBII to TI EXTENDED BASIC:

```
1 CALL CLEAR
2 CALL HCHAR(4,1,42,96)
3 PRINT
4 PRINT
5 GOTO 5
```

MAX function--Maximum

Format
MAX(numeric-expression1,numeric-expression2)

Type
Numeric (REAL or DEFINT)

Cross Reference
MIN

Description
The MAX function returns the larger value of two numeric-expressions.

MAX is the opposite of the MIN function.

If the values of the numeric-expressions are equal, MAX returns that value.

Examples

```
100 PRINT MAX(3,8)
```
Prints 8.

```
100 F=MAX(3E12,1800000)
```
Sets F equal to 3E12.

```
100 G=MAX(-12,-4)
```
Sets G equal to -4.

```
100 A=7::B=-5
110 L=MAX(A,B)
```
Sets L equal to 7 when A=7 and B=-5.

Format
MERGE["]file-specification["]

Cross Reference
SAVE

Description
The MERGE command combines a program from an external storage device with the program currently in memory. MERGE is frequently used to combine several previously written program segments into one program.

The file-specification is a string constant that indicates the name of the program on the external device. The file-specification can optionally be enclosed in quotation marks.

The lines of the external program are inserted in line-number order among the lines of the program in memory. If a line number in the external program duplicates a line number in the program in memory, the new line replaces the old line.

The MERGE command does not clear breakpoints.

A program on an external device can be merged only if it was saved with the MERGE option of the SAVE command.

A program saved to disk with the MERGE option eg SAVE "DSK1.ROUTINE,MERGE" will be stored on disk as a DISPLAY VARIABLE 163 file

Example

MERGE DSK1.SUB
Merges the program SUB into the program currently in memory.

Program

Listed below is an example of how to merge programs. If the following program is saved on DSK1 as BOUNCE with the merge option, it can be merged with other programs.

```
100 CALL CLEAR
110 RANDOMIZE
140 DEF RND50=INT(RND* 50-25)
150 GOSUB 10000
10000 FOR AA=1 TO 100
10010 QQ=RND50
10020 LL=RND50
10030 CALL MOTION(#1,QQ,LL)
10040 NEXT AA
10050 RETURN
SAVE "DSK1.BOUNCE",MERGE
NEW
```

Continued-->

Place the following program into the computer's memory.

```
120 CALL CHAR(96,"18183CFFFF3C1818")
130 CALL SPRITE(#1,96,7,92,128)
150 GOSUB 500
160 STOP
```

Now merge BOUNCE with the above program.

```
MERGE DSK1.BOUNCE
```

The program that results from merging BOUNCE with the above program is shown here.

```
LIST
100 CALL CLEAR
110 RANDOMIZE
120 CALL CHAR(96,"18183CFFFF3C1818")
130 CALL SPRITE(#1,96,7,92,128)
140 DEF RND50=INT(RND* 50-25)
150 GOSUB 10000
160 STOP
10000 FOR AA=1 TO 100
10010 QQ=RND50
10020 LL=RND50
10030 CALL MOTION(#1,QQ,LL)
10040 NEXT AA
10050 RETURN
```

Note that line 150 is from the program that was merged (BOUNCE), not from the program that was in memory.

MIN function--Minimum

Format
MIN(numeric-expression1,numeric-expression2)

Type
Numeric (REAL or DEFINT)

Cross Reference
MAX

Description
The MIN function returns the smaller value of two numeric-expressions. MIN is the opposite of the MAX function.

If the values of the numeric-expressions are equal, MIN returns that value.

Examples

```
100 PRINT MIN(3,8)
```
Prints 3.

```
100 F=MIN(3E12,1800000)
```
Sets F equal to 1800000.

```
100 G=MIN(-12,-4)
```
Sets G equal to -12.

```
100 A=7::B=-5
110 L=MIN(A,B)
```
Sets L equal to -5 when A=7 andB=-5.

MOTION subprogram

Format
CALL MOTION(#sprite-number,vertical-velocity,horizontal-velocity[,...])

Cross Reference
SPRITE

Description
The MOTION subprogram enables you to change the velocity of one or more sprites.

The sprite-number is a numeric expression whose value specifies the number of a sprite as assigned by the SPRITE subprogram.

The vertical- and horizontal-velocity are numeric expressions whose values range from -128 to 127. If both values are zero, the sprite is stationary. The speed of a sprite is in direct linear proportion to the absolute value of the specified velocity.

A positive vertical-velocity causes the sprite to move toward the bottom of the screen; a negative vertical-velocity causes the sprite to move toward the top of the screen.

A positive horizontal-velocity causes the sprite to move to the right; a negative horizontal-velocity causes the sprite to move to the left.

If neither the vertical- nor horizontal-velocity are zero, the sprite moves at an angle in a direction and at a speed determined by the velocity values.

When a moving sprite reaches an edge of the screen, it disappears. The sprite reappears in the corresponding position at the opposite edge of the screen.

Program
The following program illustrates a use of the MOTION subprogram.

```
100 CALL CLEAR
110 CALL SPRITE(#1,33,5,92,124)
120 FOR XVEL=-16 TO 16 STEP 2
130 FOR YVEL=-16 TO 16 STEP 2
140 DISPLAY AT(12,11):XVEL;YVEL
150 CALL MOTION(#1,YVEL,XVEL)
160 NEXT YVEL
170 NEXT XVEL
```

Line 110 creates a sprite.
Lines 120 and 130 set values for the motion of the sprite.
Line 140 displays the current values of the motion of the sprite.
Line 150 sets the sprite in motion.
Lines 160 and 170 complete the loops that set the values for the motion of the sprite.

Format
NEW

Description
The NEW command erases the program currently in memory, so that you can enter a new program.

The NEW command restores the computer to the condition it was in when you selected MYARC Extended BASIC II from the main selection list, with the following exceptions:

Memory allocated by the INIT subprogram is not returned to the memory area available to MYARC Extended BASIC II.

Assembly-language subprograms loaded by the LOAD subprogram remain in memory.

NEW restores all other default values, closes any open files, erases all variable values and names, and cancels any BREAK or TRACE commands in effect.

Format
NEXT control-variable

Cross Reference
FOR TO

Description
The NEXT instruction marks the end of a FOR-NEXT loop.

You can use NEXT as either a program statement or a command.

The control-variable is the same control-variable that appears in the corresponding FOR TO instruction.

The NEXT instruction is always paired with a FOR TO instruction to form a FOR-NEXT loop (see FOR TO).

A NEXT statement cannot be part of an IF THEN statement.

IF NEXT is used as a command, it must be part of a multiple-statement line. A FOR TO instruction must precede it on the same line.

Program
The following program illustrates a use of the NEXT statement in lines 130 and 140.

```
100 TOTAL=0
110 FOR COUNT=10 TO 0 STEP -2
120 TOTAL=TOTAL+COUNT
130 NEXT COUNT
140 FOR DELAY=1 TO 100::NEXT DELAY
150 PRINT TOTAL,COUNT;DELAY
RUN
30           -2  101
```

Format

```
NUMBER [initial-line-number][,increment]
NUM
```

Description
The NUMBER command puts the computer in Number Mode, so that it automatically generates line numbers for your program.

If you enter an initial-line-number, the first line number displayed is the one you specify. If you do not specify an initial-line-number, the computer starts with line number 100.

Succeeding line numbers are generated by adding the value of the numeric expression increment to the previous line number. To specify increment only (without specifying an initial-line-number), you must precede the increment with a comma. The default increment is 10.

If a line number generated by the NUMBER command is the number of a line already in the program in memory, the existing program line is displayed with the line number. To indicate that the displayed line is an existing program line, the prompt symbol (>) that normally appears to the left of the line number is not displayed. When the computer displays an existing program line, you can either edit the line or press ENTER to leave the line unchanged.

If you enter a program line that contains an error, the appropriate error message is displayed, and the same line number appears again, enabling you to retype the line correctly.

If the next line number to be generated is greater than 32767, the computer leaves Number Mode.

To leave Number Mode, press CLEAR (FCTN 4). If the computer is displaying only a line number (that is, a line number not followed by any characters), you can leave Number Mode by pressing ENTER, UP ARROW, DOWN ARROW, PROC'D, BEGIN, AID, or BACK.

Continued-->

Special Editing Keys in Number Mode

In Number Mode, you can use the editing keys whether you are changing existing program lines or entering new ones.

LEFT ARROW (FCTN S)--Pressing LEFT ARROW moves the cursor one character position to the left. When the cursor moves over a character, it does not change or delete it.

RIGHT ARROW (FCTN D)--Pressing RIGHT ARROW moves the cursor one character position to the right. When the cursor moves over a character, it does not change or delete it.

INS (FCTN 2)--Pressing INS enables you to insert characters at the cursor position. Characters that you type are inserted until you press one of the other special editing keys. The character at the cursor position and all characters to the right of the cursor move to the right as you type. You may lose characters if they move so far to the right that they are no longer in the program line.

DEL (FCTN 1)--Pressing DEL deletes the character in the cursor position. All characters to the right of the cursor move to the left.

ERASE (FCTN 3)--Pressing ERASE erases the program line currently displayed (inluding the line number). The program line is erased only from the screen, not from memory.

REDO (FCTN 8)--Pressing REDO causes the program line or other text most recenty input to be displayed.. This line can be especially helpful if you make an error while editing a program line, causing the computer not to accept it. Pressing REDO displays the original line so that you can make corrections without having to retype the entire line. When you press REDO, the computer leaves Number Mode and enters Edit Mode.

CLEAR (FCTN 4)--Pressing CLEAR causes the computer to leave Number Mode. If you were entering a new program line, it is not accepted. If you were changing an existing program line, any changes that you made are ignored.

ENTER --If you press ENTER when the computer is displaying only a line number (that is, a line number not followed by any characters), the computer leaves Number Mode. If the line number is the number of an existing program line, that program line is not changed or deleted.

If you press ENTER when the computer is displaying a line number followed by a program line, that line is accepted and the next line number is generated. The displayed line may be a new line that you have entered, an existing program line that you have not changed, or an existing program line that you have edited.

UP ARROW (FCTN E)--UP ARROW works exactly the same as ENTER in Number Mode.

DOWN ARROW (FCTN X)--DOWN ARROW works exactly the same as ENTER in Number Mode.

Continued-->

Example

In the following, what you type is UNDERLINED. Press ENTER after each line. NUM instructs the computer to number starting at 100 with increments of 10.

```
NUM
100 X=4
110 Z=10
120
NUM 110
110 Z=11
120 PRINT (Y+X)/Z
130
NUM 105,5
105 Y=7
110 Z=11
115
LIST
100 X=4
105 Y=7
110 Z=11
120 PRINT (X+Y)/Z
```

NUM 110 instructs the computer to number starting at 110 with increments of 10. Change line 110 to Z=11.

NUM 105,5 instructs the computer to number starting at line 105 with increments of 5. Line 110 already exists.

Format
OLD ["]file-specification["]

Cross Reference
SAVE CHDIR

Description
The OLD command loads a program from an external storage device into memory.

The file-specification indicates the name of the program to be loaded from the external device. The file-specification, a string constant, can optionally be enclosed in quotation marks.

OLD GAME will load the file GAME from the device defined as the Working Directory, which by default is DSK1. Refer to CHDIR to change the working directory. Command PWD will display the current working directory string.

The program to be loaded can be one of the following:

A saved MYARC Extended BASIC II program.

MYARC XBII uses more VDP memory for graphics than TI XB, and for some large programs written and saved with TI XB stored on disk as PROGRAM format, XBII may use the character definition table of VDP RAM as load space. The characters on the display will briefly become undefined but will be restored when the program has completed loading. To prevent this happening again immediately SAVE the program to disk and XBII will save in the IV254 format. This is compatible with TI XB.

A specially prepared assembly-language program that executes automatically when it is loaded.

This will be stored on disk as PROGRAM format to load with Editor Assembler Option 5, but to OLD in MYARC XBII will need to (i) autostart and (ii) be compatible with the Assembly Language requirements of MYARC XBII and its differing memory mapping. Many program will run with no changes required.

Before the program is loaded, all open files are closed. The program currently in memory is erased after the program begins to load. For more information see "Loading an Existing Program."

Protected and Unprotected Programs

To execute an unprotected MYARC Extended BASIC II program that has been loaded into memory, enter the RUN command when the cursor appears. You can use the LIST comand to display the program or any portion of the program.

*MYARC XBII can load larger TI Basic programs than TI Extended Basic is able to due to differing VDP usage. In MYARC XBII the availability of Character Sets 15 and 16 will mean you will not have to rewrite many TI Basic programs that TI Extended Basic programs failed to run.

Examples

OLD "DSK1.MYPROG"
Loads into the computer's memory the program MYPROG from diskette in disk drive one.

OLD DSK.DISK3.UPDATE85
Loads into the computer's memory the program UPDATE85 from the diskette named DISK3.

OLD RD.GAME will load the file GAME from the RamDisk.

Format
ON BREAK STOP
ON BREAK NEXT

Cross Reference
BREAK

Description
The ON BREAK statement enables you to specify the action you want the computer to take when either a breakpoint is encountered or CLEAR (FCTN 4) is pressed.

If you enter the STOP option, or if your program does not include an ON BREAK statement, program execution stops when a breakpoint is encountered or CLEAR is pressed.

If you enter the NEXT option, program execution continues normally (with the next program statement) when a breakpoint is encountered or CLEAR is pressed. If you press CLEAR while the computer is performing an input or an output operation with certain external devices, an error condition occurs, causing the program to halt. When the NEXT option is in effect, pressing QUIT (FCTN =) is the only way to interrupt your program. However, pressing QUIT erases the program in memory and causes you to exit from MYARC Extended BASIC II without closing any open files, possibly causing the loss of data in those files.

ON BREAK does not affect a breakpoint that occurs when a BREAK statement with no line-number-list is encountered in a program.

Program

The following program illustrates the use of ON BREAK.

```
100 CALL CLEAR
110 BREAK 150
120 ON BREAK NEXT
130 BREAK
140 FOR A=1 TO 50
150 PRINT "CLEAR IS DISABLED."
160 NEXT A
170 ON BREAK STOP
180 FOR A=1 TO 50
190 PRINT "NOW IT WORKS."
200 NEXT A
```

Line 110 sets a breakpoint at line 150.

Line 120 sets breakpoint handling to go to the next line.

Continued-->

A breakpoint occurs at line 130 despite line 120, because no line number has been specified after BREAK. Enter CONTINUE.

No breakpoint occurs at line 150 because of line 120; CLEAR has no effect during the execution of lines 140 through 160 because of line 120. Line 170 restores the normal use of CLEAR.

Format

```
ON ERROR STOP
ON ERROR line-number
```

Cross Reference
ERR, GOSUB, RETURN

Description
The ON ERROR statement enables you to specify the action you want the computer to take if a program error occurs.

> If you enter the STOP option, or if your program does not include an ON ERROR statement, program execution stops when a program error occurs.
>
> If you enter a line-number, a program error causes program control to be transferred to the subroutine that begins at the specified line-number. A RETURN statement in the subroutine returns control to a specified program statement.

When an error transfers control to a subroutine, the line-number option is cancelled. If you wish to restore it, your program must execute an ON ERROR line-number statement again.

The ON ERROR line-number statement does not transfer control when the error is caused by a RUN statement.

Program

The following program illustrates the use of ON ERROR.

```
100 CALL CLEAR
110 DATA "A","4","B","C"
120 ON ERROR 190
130 FOR G=1 TO 4
140 READ X$
150 X=VAL(X$)
160 PRINT X;"SQUARED IS";X*X
170 NEXT G
180 STOP
190 REM ERROR SUBROUTINE
200 ON ERROR 230
210 X$="5"
220 RETURN
230 REM SECOND ERROR
240 CALL ERR(CODE,TYPE,SEVER,LINE)
250 PRINT "ERROR";CODE;" IN LINE";LINE
260 RETURN 170
```

Line 120 causes any error to pass control to line 190.

Continued-->

Line 130 begins a loop. An error occurs in line 150 and control passes to line 190.

Line 200 causes the next error to pass control to line 230.

Line 210 changes the value of X$ to an acceptable value. Line 220 returns control to the line in which the error occurred (line 150).

The second time an error occurs, the SECOND ERROR subroutine is called because of line 200. Line 240 obtains specific information about the error by using CALL ERR. Line 250 reports the nature of the error, and line 260 returns control to line 170 of the main program, which begins the next iteration of the loop.

When the third error occurs, the message Bad argument in 150 is displayed because the program does not specify what action to take if another error occurs. Program execution ceases.

Format
ON numeric-expression;GOSUB; line-number-list
GOSUB

Cross Reference
GOSUB, RETURN

The ON GOSUB statement enables you to transfer conditional program control to one of several subroutines.

The value of the numeric-expression determines to which of the line numbers in the line-number-list program control is transferred.

If the value of the numeric-expression is 1, program control is transferred to the subroutine that begins at the program statement specified by the first line number in the line-number-list; if the value of the numeric-expression is 2, program control is transferred to the subroutine that begins at the program statement specified by the second line number in the line-number-list; and so on.

If necessary, the value of the numeric-expression is rounded to the nearest integer. The value of the numeric-expression must be greater than or equal to 1 and less than or equal to the number of line numbers in the line-number-list.

The line-number-list consists of one or more line numbers separated by commas. Each line number specifies a program statement at which a subroutine begins.

Use a RETURN statement to return program control to the statement immediately following the ON GOSUB statement that called the subroutine.

To avoid unexpected results, it is recommended that you exercise special care if you use ON GOSUB to transfer control to or from a subprogram or into a FOR-NEXT loop.

Examples

100 ON X GOSUB 1000,2000,300
Transfers control to 1000 if X is 1, 2000 if X is 2, and 300 if X is 3.

100 ON P-4 GOSUB 200,250,300,800,170
Transfers control to 200 if P-4 is 1 (P is 5), 250 if P-4 is 2, 300 if P-4 is 3, 800 if P-4 is 4, and 170 if P-4 is 5.

Continued-->

Program

The following program illustrates a use of ON GOSUB.

```
100 CALL CLEAR
110 DISPLAY AT(11,1):"CHOOSE ONE OF THE FOLLOWING:"
120 DISPLAY AT(13,1):"1 ADD TWO NUMBERS."
130 DISPLAY AT(14,1):"2 MULTIPLY TWO NUMBERS."
140 DISPLAY AT(15,1):"3 SUBTRACT TWO NUMBERS."
150 DISPLAY AT(16,1):"4 EXIT PROGRAM."
160 DISPLAY AT(20,1):"YOUR CHOICE:"
170 DISPLAY AT(22,2):"FIRST NUMBER."
180 DISPLAY AT(23,1):"SECOND NUMBER."
190 CALL MARGINS(3,30,1,24)
200 ACCEPT AT(20,14)VALIDATE(DIGIT):CHOICE
210 IF CHOICE<1 OR CHOICE>4 THEN 200
220 IF CHOICE=4 THEN STOP
230 ACCEPT AT(22,16)VALIDATE(NUMERIC):FIRST
240 ACCEPT AT(23,16)VALIDATE(NUMERIC):SECOND
250 CALL MARGINS(3,30,1,8)
260 ON CHOICE GOSUB 280,300,320
270 GOTO 190
280 DISPLAY AT(3,1)ERASE ALL:FIRST;"PLUS";SECOND;"EQUALS";FIRST+SECOND
290 RETURN
300 DISPLAY AT(3,1)ERASE ALL:FIRST;"TIMES";SECOND;"EQUALS";FIRST*SECOND
310 RETURN
320 DISPLAY AT(3,1)ERASE ALL:FIRST;"MINUS";SECOND;"EQUALS";FIRST-SECOND
330 RETURN
```

Line 260 determines where to go according to the value of CHOICE.

Format
ON numeric-expression GOTO line-number-list
GOTO

Cross Reference
GOTO

Description
The ON GOTO statement enables you to transfer unconditional program control to one of several program statements.

The value of the numeric-expression determines to which of the line numbers in the line-number-list program control is transferred. If the value of the numeric-expression is 1, program control is transferred to the program statement specified by the first line number in the line-number-list; if the value of the numeric-expression is 2, program control is transferred to the program statement specified by the second line number in the line-number-list; and so on.

If necessary, the value of the numeric-expression is rounded to the nearest integer. The value of the numeric-expression must be greater than or equal to 1 and less than or equal to the number of line numbers in the line-number-list.

The line-number-list consists of one or more line numbers separated by commas. Each line number specifies a program statement.

To avoid unexpected results, it is recommended that you exercise care if you use ON GOTO to transfer control to or from a subroutine or a subprogram or into a FOR-NEXT loop.

Examples

100 ON X GOTO 1000,2000,300
Transfers control to 1000 if X is 1, 2000 if X is 2, and 300 if X is 3. The equivalent statement using an IF-THEN-ELSE statement is IF X=1 THEN 1000 ELSE IF X=2 THEN 2000 ELSE IF X=3 THEN 300 ELSE PRINT "ERROR!"::STOP.

100 ON P-4 GOTO 200,250,300,800,170
Transfers control to 200 if P-4 is 1 (P is 5), 250 if P-4 is 2, 300 if P-4 is 3, 800 if P-4 is 4, and 170 is P-4 is 5.

Contin ued-->

Program
The following program illustrates a use of ON GOTO. Line 260 determines where to go according to the value of CHOICE.

```
100 CALL CLEAR
110 DISPLAY AT(11,1):"CHOOSE ONE OF THE FOLLOWING:"
120 DISPLAY AT(13,1):"1 ADD TWO NUMBERS."
130 DISPLAY AT(14,1):"2 MULTIPLY TWO NUMBERS."
140 DISPLAY AT(15,1):"3 SUBTRACT TWO NUMBERS."
150 DISPLAY AT(16,1):"4 EXIT PROGRAM."
160 DISPLAY AT(20,1):"YOUR CHOICE:"
170 DISPLAY AT(22,2):"FIRST NUMBER:"
180 DISPLAY AT(23,1):"SECOND NUMBER:"
190 CALL MARGINS(3,30,1,24)
200 ACCEPT AT(20,14)VALIDATE(DIGIT):CHOICE
210 IF CHOICE<1 OR CHOICE>4 THEN 200
220 IF CHOICE=4 THEN STOP
230 ACCEPT AT(22,16)VALIDATE(NUMERIC):FIRST
240 ACCEPT AT(23,16)VALIDATE(NUMERIC):SECOND
250 CALL MARGINS(3,30,1,8)
260 ON CHOICE GOTO 270,290,310
270 DISPLAY AT(3,1)ERASE ALL:FIRST;"PLUS";SECOND;"EQUALS";FIRST+SECOND
280 GOTO 190
290 DISPLAY AT(3,1)ERASE ALL:FIRST;"TIMES";SECOND;"EQUALS";FIRST*SECOND
300 GOTO 190
310 DISPLAY AT(3,1)ERASE ALL:FIRST;"MINUS";SECOND;"EQUALS";FIRST-SECOND
320 GOTO 190
```

Format
ON WARNING PRINT
STOP
NEXT

Description
The ON WARNING statement enables you to specify the action you want the computer to take if a warning condition occurs during the execution of your program.

A warning, a condition caused by invalid input or output, does not normally cause program execution to be terminated.

If you enter the PRINT option, or if your program does not include an ON WARNING statement, the computer displays a warning message when a warning condition occurs during program execution.

If you enter the STOP option, program execution stops when a warning condition occurs during program execution.

If you enter the NEXT option, program execution continues normally when a warning condition occurs and no warning message is displayed. Normally, execution continues beginning with the next program statement; however, if the cause of the warning is an invalid response to an INPUT statement, program execution continues beginning with that same INPUT statement.

You may have multiple ON WARNING statements in the same program.

If your program is running in the High-Resolution Mode, no message is displayed. See Appendix K.

Program

The following program illustrates the use of ON WARNING.

```
100 CALL CLEAR
110 ON WARNING NEXT
120 PRINT 120,5/0
130 ON WARNING PRINT
140 PRINT 140,5/0
```

Continued-->

```
150 ON WARNING STOP
160 PRINT 160,5/0
170 PRINT 170
RUN
120           9.99999E+**
140
* WARNING
  NUMERIC OVERFLOW IN 140
              9.99999E+**
160
* WARNING
  NUMERIC OVERFLOW IN 160
```

Line 110 sets warning handling to go to the next line. Line 120 therefore prints the result without any message.

Line 130 sets warning handling to the default, printing the message and then continuing execution. Line 140 therefore prints 140, then the warning, and then continues.

Line 150 sets warning handling to print the warning message and then stop execution. Line 160 therefore prints 160 and the warning message and then stops.

```
Format
OPEN #file-number:file-specification[ file-organization[ size]]
[,file-type][,open-mode][,record-type[ record-length]]

Cross Reference
CLOSE, INPUT, PRINT

Description
The OPEN instruction establishes an association between the computer and an
external device, enabling you to store, retrieve, and process data.
```

The OPEN statement describes a file's characteristics to the computer so that your program can process it or create it. With some accessory devices the computer will check that the file or device characteristics match the information specified in the OPEN statement for that file. If they don't match or the computer cannot find or create the file, the file will not be opened and an I/O error message will be printed.

The file-number and file-name must be included in the OPEN statement. The other information can be included in any order or can be omitted. If you leave out any specification, the computer will assume certain standard characteristics for the file, called "defaults," as described later in this section.

file-number — All statements which refer to files do so by means of a file-number between 1 and 255 inclusive. The file-number is assigned to a particular file by the OPEN statement. Each open file in your program must have different number. The file-number is entered as the number sign (#) followed by a numeric expression. When the computer evaluates this expression and rounds the answer to the nearest integer, the number must be 1 to 255 inclusive and cannot be the same file-number as any other file you are using concurrently in the program.

file-name — A file-name refers to a device or to a file located on a device, depending on the capability of the accessory. Each accessory has a pre-defined name which the computer recognizes. By including this file-name in the OPEN statement, you are telling the computer to access a particular file or device whenever the program references the associated file-number. The file-name can be any string expression which evaluates to a valid file-name. If you use a string constant, you must enclose it in quotes.

A disk may be referred to by a specific device name eg "DSK1." , "DSK2."."DSK3." or by referencing the disk volume name eg "DSK.TIMP." where TIMP is the name of the Disk.

file-organization — Files can be organized either sequentially or randomly. Records on a sequential file are read or written one after the other in sequence from beginning to end. Random-access files (called RELATIVE in TI Basic) can be read or written in any record order. They may also be processed sequentially. If you define a file as RELATIVE, you must use FIXED-length records.

To indicate which logical structure a file has, enter either SEQUENTIAL or RELATIVE in the OPEN statement. You may optionally specify the initial number of records on a file by following the word SEQUENTIAL or RELATIVE with a numeric expression.

If you omit the file-organization specification, the computer will assume SEQUENTIAL organization.

file-type — This specification designates the format of the data stored on the file: DISPLAY or INTERNAL.

The DISPLAY-type format refers to printable (ASCII) characters. The DISPLAY format is normally used when the output will be read by people, rather than by the computer. Each DISPLAY-type record usually corresponds to one print line.

INTERNAL-type data is recorded in internal machine format which has not been translated into printable characters. Data in this form can be read easily by the computer but not by people. (See "INPUT" for an explanation of how data is stored internally.)

The INTERNAL format requires less space and is easier to format with a PRINT statement (see "PRINT" for directions on formatting PRINT statements for INTERNAL-type records and for DISPLAY-type records).

If this specification is omitted, the computer assumes DISPLAY format.

Continued--

open-mode — This entry instructs the computer to process the file in the INPUT, OUTPUT, UPDATE or APPEND mode. If you omit this clause, the computer will assume the UPDATE mode.

INPUT files may be read only.
OUTPUT files may be written only. The new file created will have all the characteristics given by the OPEN statement specifications and any standard defaults.
UPDATE files may be both read and written. The usual processing is to read a record, change it in some way, then write the altered record back out on the file.
APPEND mode allows data to be added at the end of the existing file. The records already on the file cannot be accessed in this mode.

record-type — This entry specifies whether the records on the file are all the same length (FIXED) or vary in length (VARIABLE).
The keyword FIXED or VARIABLE may be followed by a numeric expression specifying the maximum length of a record.
Each accessory device has its own maximum record length, so be sure to check the manuals which accompany them. If you omit the record-length specification, the computer will assume a record length depending upon the device used.

If you define a file as RELATIVE, you must use FIXED-length records.
If this entry is omitted for RELATIVE files, FIXED-length records are assumed, with the length dependent on the device.

SEQUENTIAL files may have FIXED or VARIABLE length records. If this entry is omitted for SEQUENTIAL files, VARIABLE-length records are assumed.

If records are FIXED, the computer will pad each record on the right to ensure that it is the specified length.
If the data is recorded in DISPLAY format, the computer will pad the record with spaces.
If the INTERNAL format is used, the FIXED-length record will be padded with binary zeroes.

Continued-->

Program:
```
100 OPEN #1:"DSK1.LARGE", RELATIVE
110 PRINT #1, REC 100: 0
120 CLOSE #1
130 OPEN #1:"DSK1.LARGE", SEQUENTIAL, FIXED
140 CLOSE #1
```

Line 100 opens a RELATIVE file on diskette.

Line 110 writes a file to the 100th record, thereby reserving space for 100 contiguous records.

Line 120 closes the file.

Line 130 repends the file, this time with SEQUENTIAL file organisation.

Line 140 closes the file.

Files on disk in DV80 format (Display, Variable 80) will often be text files - this is the format used by the TI Writer module.

Files on disk in DF80 format will often be Assembly Language Source Code - these files can be viewed and save using TI Writer or the Editor Assembler editor etc,.

Files on disk in DV163 format will normally be programs that have been SAVEd using the MERGE option and can be loaded using the MERGE command.

Programs on disk listed as PROGRAM are blocks of memory saved in a single file and may not be loadable programs. Files listed as PROGRAM may be data for modules or programs that have been written to save/load memory blocks.

Files showing as IV254 are generally Extended Basic progras which can be loaded with Extended Basic. Normally used for larger Extended Basic programs which will not fit into the VDP program loader buffer. Saving in IV254 is automatic for long programs and can be forced in MYARC XBII by using eg SAVE DSK1.NAME,INTERNAL

OPTION BASE **OPTION BASE**

Format
OPTION BASE 0
1

Cross Reference
DIM, INTEGER, REAL

Description
The OPTION BASE statement enables you to set the lower limit of array subscripts.

You can use the OPTION BASE statement to specify a lower array-subscript limit of either 0 or 1. If your program does not include an OPTION BASE statement, the lower limit is set to 0.

The OPTION BASE statement applies to every array in your program. You can have only one OPTION BASE statement in a program.

If you do not set the lower array-subscript limit to 1, the computer reserves memory for element 0 of each dimension of each array. To avoid reserving unnecessary memory, it is recommended that you set the lower limit to 1 if your program does not use element 0.

The OPTION BASE statement must have a lower line number than any DIM statement or any reference to an array in your program. The OPTION BASE statement is evaluated during pre-scan and is not executed.

The OPTION BASE statement cannot be part of an IF THEN statement.

Example

```
100 OPTION BASE 1
Sets the lowest allowable subscript of all arrays to one.
```

PART subprogram -- partition Myarc Expansion RAM **PART**

Format: CALL PART(128,RAMDISK,SPOOLER)

Cross Reference: EMDK, VOL

Description: CALL PART is used to partition the 512k Myarc Expansion Memory Card in the Peripheral Box. To use Myarc XBII the first value MUST be 128. This allocates memory in the card for the 128k OS to use (see memory map in Appendix A)..

The remaining two values must add up to 384 (that is 512-128), the second value is the amount of memory allocated to the RAM disk. The final value may be 0 or be used as a Print Spooler. To print to RS232 via the spooler use SP, to print to PIO via the spooler use SPPIO. To abort printing with the spooler type CALL ABPS.
Note- CALL PART is supplied with the Myarc Expansion Memory card and can be used in both Myarc XBII and TI Basic. (When using only TI Basic the first value may be 32)

PATTERN subprogram

Format
CALL PATTERN(#sprite-number,character-code[...])

Cross Reference
CHAR, MAGNIFY, SPRITE

Description
The PATTERN subprogram enables you to change the pattern of one or more sprites.

The sprite-number is a numeric expression whose value specifies the number of the sprite as assigned in the SPRITE subprogram.

Character-code is a numeric expression with a value from 0-255, specifying the character number of the character you want to use as the pattern for a sprite.

If you use the MAGNIFY subprogram to change to double-sized sprites, the sprite definition includes the character specified by the character-code and three additional characters (see MAGNIFY).

Program

The following program illustrates the use of the pattern subprogram.

```
100 CALL CLEAR
110 CALL COLOR(12,16,16)
120 FOR A=19 TO 24
130 CALL HCHAR(A,1,120,32)
140 NEXT A
150 A$="0107182121414 1FFFF4141212119070080E09884848282FFFF8282848498E000"
160 B$="0106182030 5C46818142462 42C180700806018342462428181623A0C0418E000"
170 C$="0106182C24464281814 65C3020180700806018040C3A628181426224 3418E000"
180 CALL CHAR(244,A$,248,B$,252,C$)
190 CALL SPRITE(#1,244,5,130,1,0,8)
200 CALL MAGNIFY(3)
210 FOR A=244 TO 252 STEP 4
220 CALL PATTERN(#1,A)
230 FOR DELAY=1 TO 15 :: NEXT DELAY
240 NEXT A
250 GOTO 210
(Press CLEAR to stop the program.)
```

Lines 110 through 140 build a floor.
Lines 150 through 180 define characters 244 through 255.
Line 190 creates a sprite in the shape of a wheel and starts it moving to the right.
Line 200 makes the sprite double-sized.
Lines 210 through 250 make the spokes of the wheel appear to move as the character displayed is changed.

Format
CALL PEEK(address,numeric-variable-list[,"",address,
numeric-variable-list[,...]])

Cross Reference
LOAD, PEEKV, POKEV, VALHEX

Description
The PEEK subprogram enables you to ascertain the contents of specified CPU memory addresses.

You can use the PEEKV subprogram to ascertain the contents of VDP memory.

The address is a numeric expression whose value specifies the first CPU (Central Processing Unit) memory address at which you want to peek.

The address must have a value from -32768 to 32767 inclusive.

You can specify an address from 0 to 32767 inclusive by specifying the actual address.

You can specify an address from 32768 to 65535 inclusive by subtracting 65536 from the actual address. This will result in a value from -32768 to -1 inclusive.

If you know the hexadecimal value of the address, you can use the VALHEX function to convert it to a decimal numeric expression, eliminating the need for manual calculations.

If necessary, the address is rounded to the nearest integer.

The numeric-variable-list consists of one or more numeric-variables separated by commas. Bytes of data starting from the specified CPU memory address are assigned sequentially to the numeric-variables in the numeric-variable-list.

One byte, with a value from 0 to 255 inclusive, is returned to each specified numeric-variable.

You can specify multiple addresses and numeric-variable-lists by entering a null string (two adjacent quotation marks) as a separator between a numeric-variable-list and the next address.

If you call the PEEK subprogram with invalid parameters, the computer may function erratically or cease to function entirely. If this occurs, turn off the computer, wait several seconds, and then turn the computer back on again.

Continued-->

Examples

```
100 CALL PEEK(8192,X1,X2,X3,X4)
```
Returns the values in memory locations 8192, 8193, 8194, and 8195 in the variables X1, X2, X3, and X4, respectively.

```
100 CALL PEEK(22433,A,B,C,"",-4276,X,Y,Z)
```
Returns the values in locations 22433, 22434, and 22435 in A, B, C, respectively; and the values in locations 61260, 61261, and 61263 in X, Y, and Z, respectively.

```
100 CALL PEEK(VALHEX("4F55"),V1,V2,V3)
```
Uses VALHEX to ascertain the decimal equivalent of the hexidecimal number 4F55, which is 20309. Then the values in locations 20309, 20310, and 20311 are returned in V1, V2, and V3, respectively.

Program

The following program returns in A the number of the highest numbered sprite (#15) currently in use. A zero is returned to B, because no sprites are defined after the DELSPRITE statement.

```
100 CALL CLEAR
110 CALL SPRITE(#15,33,7,100,100,0,0)
120 CALL PEEK(VALHEX("837A"),A)
130 CALL DELSPRITE(ALL)
140 CALL PEEK(VALHEX("837A"),B)
150 PRINT A,B
```

PEEKV Subprogram--Peek at VDP RAM

Format
CALL PEEKV(address,numeric-variable-list[,"",address,
numeric-variable-list[,...])

Cross Reference
LOAD, PEEK, POKEV, VALHEX

Description
The PEEKV subprogram enables you to ascertain the contents of specified VDP memory addresses. You can use the PEEK subprogram to ascertain the contents of CPU memory.

The address is a numeric expression whose value specifies the first VDP (Video Display Processor) memory address at which you want to peek.

The address must have a value from 0 to 16383 inclusive.

If you know the hexadecimal value of the address (0000-3FFF), you can use the VALHEX function to convert it to a decimal numeric expression.

If necessary, the address is rounded to the nearest integer.

The numeric-variable-list consists of one or more numeric-variables separated by commas. Bytes of data starting from the specified VDP memory address are assigned sequentially to the numeric-variables in the numeric-variable-list.

One byte, with a value from 0 to 255 inclusive, is returned to each specified numeric-variable.

You can specify multiple addresses and numeric-variable-lists by entering a null string (two adjacent quotation marks) as a separator between a numeric-variable-list and the next address.

If you call the PEEKV subprogram with invalid parameters, the computer may function erratically. If this occurs, turn off the computer, wait several seconds, then turn the computer back on.

NOTE that Myarc XBII uses VDP very differently to TI Extended Basic, to enable longer programs and bit map mode. See Appendix A for a VDP memory map in the various graphics modes.
TI Extended Basic did not support PEEKV or POKEV however any assembly code used by Extended Basic programs which refers to VDP ram addresses may not function correctly.

Example

100 CALL PEEKV(6300,A1,A2,A3)
Returns the values in locations 6300, 6301, and 6302 in A1, A2, and A3, respectively.

Continued-->

Programs

The following program gives an example of the use of PEEKV.

```
100 CALL CLEAR
110 CALL POKEV(32* 16+12,66)
120 CALL PEEKV(32* 16+12,A)
130 PRINT A
```

Line 110 pokes a "B" into a location that causes it to appear in the middle of the screen. Line 120 peeks at that location, and assigns the value found there (66) to the variable A.

The next program starts a sprite moving diagonally across the screen. Line 120 assigns the values of the row and column coordinates of the sprite to Y and X, respectively.

```
100 CALL CLEAR
110 CALL SPRITE(#1,33,5,100,100,25,25)
120 CALL PEEKV(VALHEX("300"),X,Y)
130 DISPLAY AT(24,1):Y;X
140 GOTO 120
(Press CLEAR to stop the program.)
```

PI function--Pi **PI**

Format
PI

Type
REAL

Description
The PI function returns the value of pi.

The value of pi is 3.14159265359.

Example

```
100 VOLUME=4/3*PI*6^3
Sets VOLUME equal to four-thirds times pi  times  six  cubed,  which  is  the
volume of a sphere with a radius of six.
```

Written as the symbol π , pi is used in maths and is defined as the distance around a circle- its circuference- divided by the distance across the circle at its widest, that is, through the centre.

The radius of the circle is the distance from its centre to its edge, that is, half the diameter.
The circumference of a circle is 2 x pi x radius.
The area of a circle is pi x radius x radius.
The surface area of a sphere (a round ball) is 4 x pi x radius x radius.

Pi is also used in much more complex mathematical formulae.

Format
CALL POINT(pixel-type,pixel-row,pixel-column[,pixel-row,pixel-column2[,...]])

Cross Reference
CIRCLE, DCOLOR, DRAW, DRAWTO, FILL, GCHAR, GRAPHICS, RECTANGLE, WRITE

Description
The POINT subprogram enables you to place, or erase specific points (pixels) on the screen, one or more at a time.

Pixel-type is a numeric-expression whose value specifies the action taken by the POINT subprogram.

TYPE	ACTION
2	Reverses the status of the specified point (pixel). (If a pixel is on, it is turned off; if a pixel is off, it is turned on). This effectively reverses the color of the specified pixel.
1	Places a point, of the foreground color specified by the DCOLOR subprogram, at a specified pixel-row and pixel-column. This is accomplished by turning on the pixel at the designated row and column.
0	Erases a point at a specified pixel-row and pixel-column. This is accomplished by turning on the pixel at the designated row and column.

Pixel-row and pixel-column are numeric expressions whose values represent the screen position where the point will be placed (turned on or off).

You can optionally place more points by specifying additional sets of pixels.

Pixel-row must have a value from 1 to 192, pixel-column must have a value from 1 to 256.

The last pixel-row/pixel-column you specify becomes the current position used by the DRAWTO subprogram.

POINT can only be used in High-Resolution Mode. An error results if you use POINT in Pattern or Text Modes.

Example

```
100 CALL POINT(1,96,128)
```
Turns on a single pixel in the center of the screen

POKEV subprogram--Poke to VDP RAM

Format
CALL POKEV(address,byte-list[,"",address,byte-list[,...]])

Cross Reference
LOAD, PEEK, PEEKV, VALHEX

Description
The POKEV subprogram enables you to assign values directly to specified VDP memory addresses.

You can use the LOAD subprogram to assign values to CPU.

The address is a numeric expression whose value specifies the first VDP (Video Display Processor) memory address where data is to be poked. If the byte-list specifies more than one byte of data, the bytes are assigned to sequential memory addresses starting with the address you specify.

The address must have a value from 0 to 16383 inclusive.

If you know the hexadecimal value of the address (0000-3FFF), you can use the VALHEX function to convert it to a decimal numeric expression.

If necessary, the address is rounded to the nearest integer.

The byte-list consists of one or more bytes of data, separated by commas, that are to be poked into VDP memory starting with the specified address.

Each byte in the byte-list must be a numeric expression with a value from 0 to 32767. If the value of a byte is greater than 255, it is repeatedly reduced by 256 until it is less than 256. If necessary, a byte is rounded to the nearest integer.

You can specify multiple addresses and byte-lists by entering a null string (two adjacent quotation marks) as a separator between a byte-list and the next address.

If you call the POKEV subprogram with invalid parameters the computer may function erratically. If this occurs, turn off the computer, wait several seconds, then turn the computer back on.

Examples

```
100 CALL POKEV(3333,233)
```
Pokes the value 233 into location 3333.

```
100 CALL POKEV(13784,273)
```
Pokes the value 17 (273 reduced by 256 once) into location 13784.

```
100 CALL POKEV(7343,246,"",VALHEX("2E4F"),433)
```

Pokes the value 246 into location 7343, and uses VALHEX to ascertain the decimal equivalent of the hexadecimal number 2E4F (11855). The value 177 (433 reduced by 256 once) is then poked into this location.

Program

The following program uses POKEV to display on the screen the characters that correspond to ASCII codes 65 through 208, at the location specified by the value of R* 32+C.

```
100 CALL CLEAR::X=65
110 FOR R=0 TO 23
120 FOR C=0 TO 31 STEP 6
130 CALL POKEV(R* 32+C,X)
140 X=X+1
150 NEXT C
160 NEXT R
```

MYARC XBII uses differing mapping of VDP memory to TI Extended Basic, and differing mapping depending upon the graphics mode selected.
Programs written for TI XB which access the VDP memory may not function correctly in MYARC XB II.

In graphics mode 1 and 2 the blocks reserved for floppy disks, using the default CALL FILES(3) is from 14296 to 16383. In Bit Map mode the single file block is from >3BE4 to >3FFF.

In Graphics Modes 1 and 2 the Screen Image Table begins at VDP 0000 in Pattern Mode it runs to 767 and in Text mode to 959.

In Pattern Mode (1) Sprite Attributes are from 768 to 895, and the Colour Table from 896 to 927. The character pattern table and the sprite pattern table are from 2048 to 4095.

POS Function--Position

Format
POS(string-expression,substring,numeric-expression)

Type
DEFINT

Description
The POS function returns the position of the first occurence of a substring within a specified string.

The string-expression specifies the string within which you are seeking the substring. If you use a string constant, it must be enclosed in quotation marks.

The substring is the segment (of the string-expression) you are trying to locate. The substring is a string expression; if you use a string constant, it must be enclosed in quotation marks.

The value of the numeric-expression specifies the character position in the string-expression where the search for the substring begins.

If necessary, the value of the numeric-expression is rounded to the nearest integer. The value of the numeric-expression is rounded to the nearest integer.

If the substring is present within the string-expression, POS returns the number of the character position (within the string-expression) of the first character of the substring.

If the substring is not present, or if the value of the numeric-expression is greater than the number of characters in the string-expression, POS returns a zero.

Examples

```
100 X=POS("PAN","A",1)
```
Sets X equal to 2 because A is the second letter in PAN.

```
100 Y=POS("APAN","A",2)
```
Sets Y=3 because the A in the third position in APAN is the first occurence of A in the portion of APAN that was searched.

```
100 Z=POS("PAN","A",3)
```
Sets Z equal to 0 because A was not in the part of PAN that was searched.

```
100 R=POS("PABNAN","AN",1)
```
Sets R equal to 5 because the first occurence of AN starts with the A in the fifth position in PABNAN.

Continued--.

Program

The following program illustrates a use of POS. Input is searched for spaces, and is then printed with each word on a single line.

```
100 CALL CLEAR
110 PRINT "ENTER A SENTENCE."
120 LINPUT X$
130 S=POS(X$," ",1)
140 IF S=0 THEN PRINT X$::PRINT::GOTO 110
150 Y$=SEG$(X$,1,S)::PRINT Y$
160 X$=SEG$(X$,S+1,LEN(X$))
170 GOTO 130
(Press CLEAR to stop the program.)
```

If you need a user to key in A, B, C or D you can use POS:

```
100 CALL KEY(0.K.S)
110 IF S=0 THEN 100
120 ON POS("ABCD",CHR$(K),1)+1 GOTO 400,500,600,700,800
...
```

Four letters and five lines to transfer to? Line 400 will be jumped to if the user presses any key other than A B C or D.

POSITION subprogram

Format
CALL POSITION(#sprite-number,numeric-variable1,numeric-variable2[,...])

Cross Reference
SPRITE

Description
The POSITION subprogram enables you to ascertain the current position of one or more sprites.

The sprite-number is a numeric expression whose value specifies the number of the sprite as assigned in the SPRITE subprogram.

The current screen position of a sprite is returned as two numeric-variables representing the pixel-row and pixel-column, respectively, specifying the position of a screen pixel.

The screen position of the pixel in the upper-left corner of a sprite is considered to be the position of that sprite.

Note that a sprite in motion continues to move during and following the execution of the POSITION subprogram. Remember to allow for this continued motion in your program.

Example

```
100 CALL POSITION(#1,Y,X)
Returns the position of the upper left corner of sprite #1.  Also see the
third example of the SPRITE subprogram.
```


!@P+ !@P- !@P*

Please refer to Page 241 in the appendices at the back for the use of the prescan commands. When you RUN a program the computer sets up internal tables for the variables and carries out an initial syntax check which can delay the start of your program a little.
Prescan commands can reduce the time it takes for your program to start after you enter RUN.

Format
Print to the Screen
PRINT [print-list]
Print to a File (or Device)
PRINT #file-number[,REC record-number][:print-list]

Cross Reference
DISPLAY, OPEN, PRINT USING, TAB

Description
The PRINT instruction enables you to display data items on the screen or print them to an external device. You can use PRINT as either a program statement or a command.

The print-list consists of one or more print items (items to be printed or displayed) separated by print separators. A PRINT instruction without a print-list advances the print position to the first position of the next record. This has the effect of printing a blank record, unless the preceding PRINT instruction ended with a print-separator.

The numeric and/or string expressions in the print-list can be constants and/or variables.

Print items are the numeric and string expressions to be printed. Any function is also a valid print item.

Print separators are the punctuation (commas, semicolons, and colons) between print items specifying the placement of the print items in the print record.

Printing to the Screen

Each print item is displayed in the row of the screen window defined by the margins, starting from the far left column of the window. Before a new line is displayed at the bottom of the window, the entire contents of the window (excluding sprites) scroll up one line to make room for the new line. The contents of the top line of the window scroll off the screen and are discarded.

Each line on the screen is treated as one print record. The record length of the screen is the width of the window.

In High-Resolution Mode, attempting to print to the screen has no effect. See Appendix K.

Printing to a File

If you include an optional file-number, the print-list is sent to the specified device. The file-number is a numeric expression whose value specifies the number of the file as assigned in its OPEN instruction. You cannot print to a file opened in INPUT mode.

If you do not specify a file-number (or if you specify file-number 0), the print-list is displayed on the screen.

If you use the REC option, the record-number is a numeric expression whose value specifies the number of the record in which you want to print the print-list. The records in a file are numbered sequentially, starting with zero. The REC option can be used only with a file opened for RELATIVE access.

If you print to a file opened in INTERNAL format with FIXED records, each record is filled with trailing binary zeros, if necessary, to bring it to its specified length. If a record is longer than the record length of the file, it is truncated (extra characters are discarded).

For more information about printing to a particular device, refer to the owner's manual that comes with that device.

Printing Numbers: INTERNAL Files

The amount of memory space allocated to a number printed to a file opened in INTERNAL format varies according to its data-type. A DEFINT is always allocated 3 bytes, whereas a REAL number is always allocated 9 bytes.

Note that if you print a DEFINT value to a file, you cannot access that file on a Home Computer that does not support the INTEGER data-type. You can circumvent this by converting all DEFINT variables and functions to REAL variables before printing them to a file.

Printing Numbers: The Screen and DISPLAY Files

The format of a number printed to the screen or to a file opened in DISPLAY format varies according to the characteristics of the number.

Positive numbers and zero are printed with a leading space (instead of a plus sign); negative numbers are printed with a leading minus sign. All numbers are printed with a trailing space.

Numbers are printed in either decimal form or scientific notation, according to these rules:

All numbers with 10 or fewer digits are printed in decimal form.

REAL numbers with more than 10 digits are printed in scientific notation only if they can be presented with more significant digits in scientific notation than in decimal form. If printed in decimal form, all digits beyond the tenth are omitted.

If a number is printed in decimal form, the following rules apply:

DEFINT numbers and REAL numbers with no decimal portion are printed without decimal points.

REAL numbers are printed with decimal points in the proper position. If

Continued-->

the number has more than 10 digits, it is rounded to 10 digits. A zero is not printed by itself to the left of the decimal point. Trailing zeros after the decimal point are omitted.

If number is printed in scientific notation, the following rules apply:

The format is mantissaEexponent.

The mantissa is printed with six or fewer digits, with one digit to the left of the decimal point.

Trailing zeros are omitted after the decimal point of the mantissa.

If there are more than five digits after the decimal point of the mantissa, the fifth digit is rounded.

The exponent is a two-digit number displayed with a plus or minus sign.

If you attempt to print a number with an exponent greater than 99 or less than -99, the computer prints two asterisks (**) following the sign of the exponent.

Printing Strings

A string constant in a print-list must be enclosed in quotation marks. A quotation mark within a string constant is represented by two adjacent quotation marks.

A string printed to a file opened in INTERNAL format has a length one greater than the length of the string.

When a string is printed to the screen or to a file opened in DISPLAY format, no leading or trailing spaces are added to the string.

Print Separators

At least one print separator must be placed between adjacent print items in the print-list. Valid print separators are the semicolon (;), the colon (:), and the comma (,).

A semicolon (;) print separator causes the next print item to print immediately after the current print item.

A colon (:) print separator causes the next print item to print at the beginning of the next record. Consecutive colons used as print separators must be divided by a space. Otherwise, they are treated as a statement separator symbol.

If you print to the screen or to a file opened in DISPLAY format, a comma (,) print separator causes the next print item to print at the beginning of the next "zone." Print records are divided into 14-character zones; the number of zones in a print record varies according to its record length.

Continued-->

If you print to a file opened in INTERNAL format, a comma print separator has the same effect as a semicolon print separator.

If a print separator would have the effect of splitting the next print item between two records, the print item is moved to the beginning of the following record. However, if discarding the trailing space from a numeric print item allows it to fit in the current record, the number is printed in the current record without its trailing space.

If the print-list ends with a print separator, the computer is placed in a print-pending condition. Unless the next PRINT instruction includes the REC option, it is considered to be a continuation of the current PRINT instruction. RESTORE #file-number terminates a print-pending condition.

If the print-list is not terminated by a print separator, the computer considers the current record complete when all the print items in the print-list are printed. The first print-item in the next PRINT instruction begins in the next record.

Examples

100 PRINT
Causes a blank line to appear on the display screen.

100 PRINT "THE ANSWER IS";A
Causes the string constant THE ANSWER IS to be printed on the display screen, followed immediately by the value of ANSWER. If ANSWER is positive, there will be a blank for the positive sign after IS.

100 PRINT X:Y/2
Causes the value of X to be printed on a line and the value of Y/2 to be printed on the next line.

100 PRINT #12,REC 7:A
Causes the value of A to be printed on the eighth record of the file that was opened as number 12 with RELATIVE file organization. (Record number 0 is the fist record.)

100 PRINT #32:A,B,C,
Causes the values of A, B, and C to be printed on the next record of the file that was opened as number 32. The final comma creates a pending print-condition. The next PRINT statement directed to file number 32 will print on the same record as this PRINT statement unless it specifies a record, or a RESTORE #32 statement is executed, thereby closing the print-pending print conditon.

```
100 PRINT #1,REC 3:A,B
150 PRINT #1:C,D
```
Causes A and B to be printed in record 3 of the file that was opened as number 1. PRINT #1:C,D causes C and D to be printed in record 4 of the same file.

Continued-->

Program

The following program prints out values in various positions on the screen.

```
100 CALL CLEAR
110 PRINT 1;2;3;4;5;6;7;8;9
120 PRINT 1,2,3,4,5,6
130 PRINT 1:2:3
140 PRINT
150 PRINT 1;2;3;
160 PRINT 4;5;6/4
RUN
1  2  3  4  5  6  7  8  9
1           2
3           4
5           6
1
2
3

1  2  3  4  5  1.5
```

Format
Print to the Screen
```
PRINT USING format-string[:print-list]
            line-number
```
Print to a File (or Device)
```
PRINT #file-number[,REC record-number],USING format-string[print-list]
                                        line-number
```

Cross Reference
IMAGE, PRINT

Description
The PRINT USING instruction enables you to define specific formats for numbers and strings you print.

You can use PRINT USING as either a program statement or a command.

The format-string specifies the print format. The format-string is a string expression; if you use a string constant you must enclose it in quotation marks. See IMAGE for an explanation of format-strings.

You can optionally define a format-string in an IMAGE statement, as specified by the line-number.

See PRINT for an explanation of the print-list print options.

The PRINT USING instruction is identical to the PRINT instruction with the addition of the USING option, except that:

You cannot use the TAB function.

You cannot use any print separator other than a comma (,), except that the print-list can end with a semicolon (;).

If you use PRINT USING to print to a file, the file must have been opened in DISPLAY format.

Examples

```
100 PRINT USING "###.##":32.5
Prints 32.50.

100 PRINT USING "THE ANSWER IS ###.#":123.98
Prints THE ANSWER IS 124.0.

100 PRINT USING 185:37.4,-86.2
185 IMAGE ###.#
Prints the values of 37.4 and -86.2 using the IMAGE statement in line 185.
```

PWD - - Print Working Directory **PWD**

Format
PWD Print Working Directory

Cross Reference
CHDIR

Description
The PWD command reminds you of the current setting of the Working Directory.

If you type RUN FILENAME or OLD FILENAME or SAVE FILENAME,
the Working Directory string is added before FILENAME.

The default value of Working Directory is "DSK1."
The Working Directory is changed using the CHDIR command.

RANDOMIZE **RANDOMIZE**

Format RANDOMIZE[seed]

Cross Reference
RND

Description
The RANDOMIZE instruction varies the sequence of pseudo-random numbers generated by the RND function.

You can use RANDOMIZE as either a program statement or a command.

> The optional seed is a numeric expression whose value specifies the random number sequence to be generated by RND functions. The first two bytes of the internal representation of the value of the seed determine the random number sequence generated by RND. If the first two bytes of the seed are identical each time you run your program, the same random number sequence is generated. If you do not enter a seed, a different and unpredictable sequence of random numbers is generated by RND each time you run your program.

Program

The following program illustrates a use of the RANDOMIZE statement. It accepts a value for the seed and prints the first 10 values obtained using the RND functon.

```
100 CALL CLEAR
110 INPUT "SEED: ":S
120 RANDOMIZE S
130 FOR A=1 TO 10::PRINT A;RND::NEXT A::PRINT
140 GOTO 110
(Press CLEAR to stop the program.)
```

RDDIR subprogram-- Ram Disk Directory **RDDIR**

Format: CALL RDDIR

Description:
CALL RDDIR will display the contents of the RAM Disk on the screen. It may be used from the command line or as part of a Myarc XBII program. Note that if used in a program it will assume Graphics Mode(1) (see GRAPHICS) and will disrupt any content showing on the screen before it is called.

RDDIR is supplied with the Myarc 512k expansion memory card and can be used in Myarc Extended Basic II and also in TI Basic from the immediate mode or from within a program..

READ **READ**

Format
READ variable-list

Cross Reference
DATA, RESTORE

Description
The READ statement enables you to assign constants (stored within your program in DATA statements) to variables.

The variable-list, consisting of one or more variables separated by commas, specifies the numeric and/or string variables that are to be assigned values. When a READ statement is executed, the variables in its variable-list are assigned values from the data-list of a DATA statement. Unless you use a RESTORE statment to specify otherwise, DATA statements are read in ascending line-number order.

If a data-list does not contain enough values to assign to all the variables, the READ statement assigns values from subsequent DATA statements until all the variables have been assigned a value. If there are no more DATA statements, a program error occurs and the message Data error in line-number is displayed.

If a numeric variable is specified in the variable-list, a numeric constant must be in the corresponding position in the data-list of a DATA statement. If a string variable is specified in the variable-list, either a string or a numeric constant can be in the corresponding position in the DATA statement.

See the DATA statement for examples.

IMPORTANT UPDATE; From Version 2.10 MYARC XBII has replaced REAL with DEFREAL. The following text should be read as referring to DEFREAL.

Format
REAL numeric-variable-list **DEFREAL**
REAL ALL **DEFREAL ALL**

Cross Reference
DEF, DIM, DEFINT, OPTION BASE, SUB

Description
The REAL instruction enables you to declare the data type of specified numeric variables as REAL.

REAL variables have a greater range of values than do DEFINT variables and can contain decimal portions. You can use REAL as either a program statement or a command.

The numeric-variable-list consists of one or more numeric variables separated by commas. The variables are all assigned the REAL data type. A REAL statement with a numeric-variable-list must have a line number lower than any program reference to any variable in that list.

If you enter the ALL option, all numeric variables in your program are assigned the REAL data-type unless specifically declared as DEFINT. A REAL statement with the ALL option must have a line number lower than any program reference to any numeric variable or array.

When REAL ALL is used as a command, it does not affect any variables unless they follow it on a multiple-statement line.

A numeric variable of the REAL data-type can be of any number that can be expresed by the computer.

If you do not specify the data type of a numeric variable, it is assigned the REAL data-type (unless your program includes a DEFINT ALL statement or defines the specific variable as an integer).

REAL statements are evaluated during pre-scan, and are not executed.

100 DEFINT ALL
110 DEFREAL A,B,C
120 ...

Will define all variables in your program to be integers except the variables A, B and C

Continued-->

Examples

DEFREAL A

As a command, specifies that the variable A is a real number.

100 DEFREAL ALL

As a statement, specifies that all numeric variables in the program are real numbers, unless specifically declared as DEFINT.

100 DEFREAL DIM X(20)

Reserves space in memory for 21 real number elements of array X if it is not preceded by an OPTION BASE 1 statement.

REC function--Record Number

Format
REC(file-number)

Type
DEFINT

Description
The REC function returns a record number reflecting the position of the next record in the specified file.

The file-number is a numeric expression whose value specifies the number of the file as assigned in its OPEN instruction.

The REC function returns the number of the record in the specified file that is to be accessed by the next PRINT, INPUT, or LINPUT instruction (the next sequential record). (REC always treats a file as if it were being accessed sequentially, even if it has been opened for relative access.)

The records in a file are numbered sequentially starting with zero.

Example

```
100 PRINT REC(4)
```
Prints the position of the next record in the file that was opened as number 4.

Program

Continued-->

Program

The following program illustrates a use of the REC function.

```
100 CALL CLEAR
110 OPEN #1:"DSK1.PROFILE",RELATIVE,INTERNAL
120 FOR A=0 TO 3
130 PRINT #1:"THIS IS RECORD",A
140 NEXT A
150 RESTORE #1
160 FOR A=0 TO 3
170 PRINT REC(1)
180 INPUT #1:A$,B
190 PRINT A$;B
200 NEXT A
210 CLOSE #1
RUN
0
THIS IS RECORD 0
1
THIS IS RECORD 1
2
THIS IS RECORD 2
3
THIS IS RECORD 3
```

Line 110 opens a file.

Lines 120 through 140 write four records on the file.

Line 150 resets the file to the beginning.

Lines 160 through 200 print the file position and read and print the values at that position.

Line 210 closes the file.

Format
CALL RECTANGLE(line-type,pixel-row1,pixel-column1,
pixel-row2,pixel-column2,pixel-row3 ,pixel-column3[,...]])

Cross Reference
CIRCLE, DCOLOR, DRAW, DRAWTO, FILL, GRAPHICS, POINT, WRITE

Description
The RECTANGLE subprogram enables you to place rectangles of various types and proportions on the screen.

A rectangle is defined by three points, the pixel row and column of the top left corner, the top right corner and the bottom left corner. All line types (0 to 5) support vertical and horizontal lines. Additionally Line Type 1 ONLY supports diagonal lines and therefore drawing of generic parallelograms.

Rectangles may be hollow (only the perimeter of the rectangle is drawn), or solid (both the perimeter and the entire area enclosed by the perimeter is drawn).

Line-type is a numeric-expression whose value specifies the action taken by the RECTANGLE subprogram.

TYPE	ACTION
5	Reverses the status of each pixel of the specified rectangle (solid). (If a pixel is on, it is turned off; if a pixel is off, it is turned on). This effectively reverses the color of the specified rectangle.
4	Draws a rectangle (solid), of the foreground color specified by the DCOLOR subprogram. This is accomplished by turning on each pixel in the specified rectangle.
3	Erases a rectangle (solid). This is accomplished by turning off each pixel in the specified rectangle.
2	Reverses the status of each pixel in the perimeter of the specified rectangle. (If a pixel is on, it is turned off; if a pixel is off, it is turned on). This effectively reverses the color of the perimeter.
1	Draws the perimeter of a rectangle, of the foreground color specified by the DCOLOR subprogram. This is accomplished by turning on each pixel in the specified rectangle.
0	Erases the perimeter of a rectangle. This is accomplished by turning off each pixel in the specified rectangle.

Pixel-row(#), and pixel-column(#), are numeric expressions whose values represent the screen positions of specific points of the rectangle. There are three points needed to define the rectangle, as shown below.

Pixel-row1 / pixel-column1 specify the TOP LEFT corner of the rectangle.

Pixel-row2 / pixel-column2 specify the TOP RIGHT corner of the rectangle.

Pixel-row3 / pixel-column3 specify the BOTTOM LEFT corner of the rectangle.

All pixel-rows must have a value from 1 to 192. All pixel-columns must have a value from 1 to 256.

Continued-->

Note that the first pixel set (pixel-row1 and pixel-column1) represents the top leftmost point of the rectangle and must have a lower column value than the second pixel set. The second pixel set represents the top rightmost point of the rectangle. In the same manner, the third pixel set, which represents the bottom leftmost point of the rectangle, must have a higher row value than set1 or set2.

If the procedure outlined above is not followed, an error is issued.

You can optionally draw more rectangles by specifying additional sets of pixels. You must specify three sets of pixels for each rectangle.

The bottom-rightmost point of the last rectangle drawn becomes the current positon used by the DRAWTO subprogram.

RECTANGLE can only be used in High-Resolution Mode. An error results if you use RECTANGLE in Pattern or Text Modes.

```
Program
100 CALL GRAPHICS(3)
110 CALL RECTANGLE(1,8,80,8,175,134,80)
120 FOR T=1 TO 8 :: CALL RECTANGLE(4,T* 16,100,T* 16,155,T* 16+T-1,100) :: N
EXT T
130 FOR DELAY=1 TO 2000 :: NEXT DELAY
140 CALL RECTANGLE(3,16,100,16,155,128,100)
150 FOR DELAY=1 TO 2000 :: NEXT DELAY
160 END
```

Line 100 selects High-Resolution Mode (and clears the screen).

Line 110 draws a large box on the screen.

Line 120 uses a for-next loop to fill the box with lines of different thickness. (This shows how RECTANGLE could be used to replace DRAW. RECTANGLE is slower, but more versatile).

Line 130 uses a for-next loop to delay execution of the next statement.

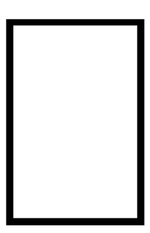
Line 140 clears the lines, but leaves the box to illustrate how RECTANGLE can be used as an eraser.

Line 150 delays the execution of the next statement.

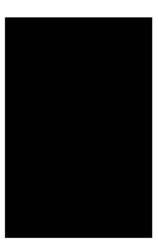
Line 160 ends the program.

Set the values of T and BC in the program below as the diagrams to the right.

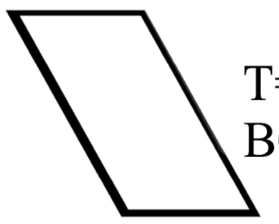
```
100 CALL CLEAR
110 CALL GRAPHICS(3)
120 CALL RECTANGLE(T,8,80,8,175,134,BC)
130 FOR N=1 TO 9000
140 NEXT N
150 CALL GRAPHICS(1)
160 STOP
```



T=1
BC=80



T=4
BC=80



T=1
BC=100

BAD VALUE **T=4**
BC=100

REM --Remark

Format
REM remark
! remark

Description
The REM statement enables you to document your program by including explanatory remarks within the program itself.

You can use any character in a remark.

The length of a REM statement is limited only by the length of a program statement.

A REM statement encountered during program execution is ignored by the computer.

Trailing Remarks

In addition to the REM statement, trailing remarks can be added to the ends of lines in MYARC Extended BASIC II, allowing detailed internal documentation of programs. An exclamation mark (!) begins each trailing remark.

Example

```
100 REM BEGIN SUBROUTINE
Identifies a section beginning a subroutine.

100 FOR X=1 to 16 ! BEGIN LOOP
Identifies a section beginning a FOR-NEXT loop.
```

NOTE: You may not use as tail remarks the following combinations of characters:
!@P+ !@P- !@P*
These combinations are reserved for PRE SCAN switches which are dealt with at the back of this manual in the appendices.

Format
RESEQUENCE [initial-line-number][,increment]
RES

Description
The RESEQUENCE command assigns new line numbers to all lines in the program currently in memory.

If you enter an initial-line-number, the first line number assigned is one you specify. If you do not specify an initial-line-number, the computer starts with line number 100.

Succeeding line numbers are assigned by adding the value of the numeric expression increment to the previous line number. Note that to specify an increment only (without specifying an initial-line-number), you must precede the increment with a comma. The default increment is 10.

To ensure that your program continues to function properly, all line-number references within your program are changed to reflect the newly assigned line numbers. (Line numbers mentioned in REM statements are not affected.) If an invalid line-number reference (a reference to a line number that does not exist in your program) is encountered, the computer changes the line-number reference to 32767, without displaying any error message or warning.

If the values you enter for the initial-line-number and increment would have the effect of creating a line number greater than 32767, the message Bad line number is displayed and the program is not resequenced.

Examples

RES
Resequences the lines of the program in memory to start with 100 and number by 10s.

RES 1000
Resequences the lines of the program to start with 1000 and number by 10s.

RES 1000,15
Resequences the lines of the program in memory to start with 1000 and number by 15s.

RES ,15
Resequences the lines of the program in memory to start with 100 and number by 15s.

Format
Restore Data
RESTORE [line-number]
Restore a File
RESTORE #file-number[,REC record-number]

Cross Reference
DATA, INPUT, PRINT, READ

Description
The RESTORE instruction specifies either the DATA statement to be used with the next READ statement or the record to be accessed by the next file-processing instruction.

RESTORE with DATA and READ Statements

If you enter a line-number, the next READ statement executed assigns values beginning from the data-list in the specified DATA statement.

If the specified line-number is not the line-number of a DATA statement, the computer uses the first DATA statement with a line-number higher than the one you specified.

If there is no higher numbered DATA statment, a program error occurs and the message Data error in line-number is displayed (the line-number is the line number of the READ statement that caused the error).

If you do not enter a line-number or a file-number, the next READ statement executed assigns values beginning from the data-list of the first DATA statement in your program.

If there are no DATA statements in your program, the message Data error in line-number is diplayed.

RESTORE with a File

If you enter a file-number, RESTORE repositions the specified file at its first record, record zero (unless you use the REC option). The file-number is a numeric expression whose value specifies the number of the file as assigned in its OPEN instruction.

If you use the REC option, the record-number is a numeric expression specifying the number of the record at which you want to position the file. The records in a file are numbered sequentially, starting with zero. The REC option can be used only with a file opened for RELATIVE access.

RESTORE terminates any print- or input-pending conditions.

Continued-->

Examples

100 RESTORE
Sets the next DATA statement to be used to the first DATA statement in the program.

100 RESTORE 130
Sets the next DATA statement to be used to the DATA statement at line 130 or, if line 130 is not a DATA statement, to the next DATA statement after line 130.

100 RESTORE #1
Sets the next record to be used by the next PRINT, INPUT, or LINPUT statement using file #1 to be the first record in the file.

100 RESTORE #4,REC H5
Sets the next record to be used by the next PRINT, INPUT, or LINPUT statement using file #4 to be record H5.

Format
With GOSUB and ON GOSUB
RETURN
With ON ERROR
RETURN [NEXT
line-number]

Cross Reference
GOSUB, ON GOSUB, ON ERROR

Description
The RETURN statement causes program control to return to the main program from a subroutine called by a GOSUB, ON GOSUB, or ON ERROR statement.

RETURN with GOSUB and ON GOSUB

When the computer encounters a RETURN statement in a subroutine called by a GOSUB or ON GOSUB statement, program control returns to the statement immediately following the GOSUB or ON GOSUB statement.

No options are allowed with a RETURN statement in a subroutine called by a GOSUB or ON GOSUB statement.

RETURN with ON ERROR

The action taken by the computer when it encouters a RETURN statement in a subroutine called by an ON ERROR statement depends on the RETURN option.

If you specify the NEXT option, program control returns to the statement immediately following the statement that caused the error.

If you specify a line-number, program control is transferred to the specified program statement.

If you do not specify an option, program control returns to the statement that caused the error. The statement is re-executed.

RETURN "clears" the error, so that it can no longer be analyzed by the ERR subprogram.

Programs

The following program illustrates a use of RETURN as used with GOSUB. The program figures interest on an amount of money put into savings.

```
100 CALL CLEAR
110 INPUT "AMOUNT DEPOSITED: ":AMOUNT
120 INPUT "ANNUAL INTEREST RATE: ":RATE
130 IF RATE 1 THEN RATE=RATE* 100
140 PRINT "NUMBER OF TIMES COMPOUNDED"
```

Continued-->

Program continues on next page...

```
150 INPUT "ANNUALLY: "COMP
160 INPUT "STARTING YEAR: ":Y
170 INPUT "NUMBER OF YEARS: ":N
180 CALL CLEAR
190 FOR A=Y TO Y+N
200 GOSUB 240
210 PRINT A,INT(AMOUNT* 100+.5)/100
220 NEXT A
230 STOP
240 FOR B=1 TO COMP
250 AMOUNT=AMOUNT+AMOUNT*RATE/(COMP* 100)
260 NEXT B
270 RETURN
```

The following program illustrates the use of RETURN with ON ERROR.

```
100 CALL CLEAR
110 A=1
120 ON ERROR 160
130 X=VAL("D")
140 PRINT 140
150 STOP
160 REM ERROR HANDLING
170 IF A>4 THEN 220
180 A=A+1
190 PRINT 190
200 ON ERROR 160
210 RETURN
220 PRINT 220 :: RETURN NEXT
RUN

190
190
190
190
220
140
```

Line 120 causes an error to transfer control to line 160. Line 130 causes an error.

Line 170 checks to see if the error has occurred four times and transfers control to 220 if it has. Line 180 increments the error counter by one. Line 190 prints 190. Line 200 resets the error handling to transfer to line 160. Line 210 returns to the line that caused the error and executes it again.

Line 220, which is executed only after the error has occurred four times, prints 220 and returns to the line following the line that caused the error.

Line 140, the next one after the one that causes the error, prints 140.

Also see example of the ON ERROR statement.

RND function--Random Number

Format RND

Type
REAL

Cross Reference
RANDOMIZE

Description
The RND function returns a pseudo-random number.

RND returns the next pseudo-random number in the current series of pseudo-random numbers. The number returned is always greater than or equal to 0 and less than 1.

The numbers returned by RND are called "pseudo-random" because they are not generated strictly at random, but are generated as members of predefined series. You can use the RANDOMIZE instruction to make the numbers generated by RND more random.

The same sequence of random numbers is generated by RND each time you run a particular program unless the program includes a RANDOMIZE instruction.

Examples

```
100 COLOR16=INT(RND* 16)+1
```
Sets COLOR16 equal to some number from 1 through 16.

```
100 VALUE=INT(RND* 16)+10
```
Sets VALUE equal to some number from 10 through 25.

```
100 LL(8)=INT(RND*(B-A+1))+A
```
Sets LL(8) equal to some number from A through B.

RPT$ function --Repeat String

Format
RPT$(string-expression,numeric-expression)

Type
String

Description
The RPT$ function returns a string consisting of a specified string repeated a specified number of times.

The string-expression specifies the string to be repeated. If you use a string constant, it must be enclosed in quotation marks.

The value of the numeric-expression specifies the number of repetitions of the string-expression.

If the length of the string-expression and the value of the numeric-expression would create a string longer than 255 characters, the excess characters are discarded and the following message is displayed:

```
*WARNING
 STRING TRUNCATED
```

Examples

```
100 M$=RPT$("ABCD",4)
Sets M$ equal to "ABCDABCDABCDABCD"

100 CALL CHAR(244,RPT$("0000FFFF",8))
Defines characters 244 through 247 with the string
"0000FFFF0000FFFF0000FFFF0000FFFF0000FFFF0000FFFF0000FFFF0000FFFF"

100 PRINT USING RPT$("#",40):X$
Prints the value of X$ using an image that consists of 40 number signs.
```

Format
Execute Program in Memory
RUN [line-number]
Execute Program on External Device
RUN file-specification [,CONTINUE]

Description
The RUN instruction causes the computer either to execute the program currently in memory or to both load and execute a program from an external. You can use RUN as either a program statement or a command.

When you use RUN as a program statement, one program can start the execution of another program. This enables you to divide a large program into smaller segments, each of which can be loaded into memory only as needed.

If you specify a line-number, your program starts running at the specified program line.

If you enter a file-specification, your program is first loaded into memory from the specified external device, and then executed starting from the lowest-numbered line in the program. The file-specification is a string expression; if you use a string constant, you must enclose it in quotation marks.

If you do not enter either a line-number or a file-specification, the computer executes the program currently in memory starting with the lowest-numbered line in the program.

In a program RUN must be used with a quoted string:
100 RUN "DSK1.PROGRAM"
however from the command line you may use quotation marks optionally so that it is correct to type:
RUN DSK1.PROGRAM
Also RUN PROGRAM will look for PROGRAM in the device described as the Working Directory, which by default is DSK1. and can be changed with the CHDIR subprogram..

Before the program starts running, the computer:

Sets the values of all numeric variables to zero.

Sets the values of all string variables to null strings (strings containing no characters).

Closes all open files.

Restores the default screen color (cyan).

Deletes all sprites.

Resets the sprite magnification level to 1.

Checks for certain program errors.

RUN does not affect the graphics mode, margin settings, graphics colors (see DCOLOR), or current position (see DRAWTO).

Continued-->

CONTINUE option

If you use the CONTINUE option in a program, the new program that it loads will retain the variable values of the loading program

```
100 PRINT A
110 A=8
  [SAVE DSK1.PROG]
  [RUN]
   0
120 RUN "DSK1.PROG",CONTINUE
  [RUN]
   0
   8
```

The program initially has no value for A and will print 0, then after the value of A has been set in line 110, the program will run itself but retain the value it initially set for A and print 8

Examples

RUN
Causes the computer to begin execution of the program in memory.

RUN 200
100 RUN 200
Causes the computer to begin execution of the program in memory starting at line 200.

RUN "DSK1.PRG3"
100 RUN "DSK1.PRG3"
Causes the computer to load and begin execution of the program named PRG3 from the diskette in disk drive 1.

```
100 A$="DSK1.MYFILE"
110 RUN A$
```
Causes the computer to load and begin execution of the program named MYFILE from the diskette in disk drive 1.

Program

The following program illustrates the use of the RUN command used as a statement. It creates a "menu" and lets the person using the program choose what other program he wishes to run. The other programs should RUN this program rather than ending in the usual way, so that the menu is given again after they are finished.

```
100 CALL CLEAR
110 PRINT "1 PROGRAM 1."
120 PRINT "2 PROGRAM 2."
130 PRINT "3 PROGRAM 3."
140 PRINT "4 END."
150 PRINT
160 INPUT "YOUR CHOICE: "C
170 IF C=1 THEN RUN "DSK1.PRG1"
180 IF C=2 THEN RUN "DSK1.PRG2"
190 IF C=3 THEN RUN "DSK1.PRG3"
200 IF C=4 THEN STOP
210 GOTO 100
```

Format
SAVE device.program-name [,PROTECTED]
SAVE device.program-name [,MERGE]
SAVE device.program-name [,INTERNAL]

Cross Reference
OLD, MERGE

Description
The SAVE command allows you to copy the program in memory to an external device under the name program-name.
By using the OLD command, you can later recall the program into memory.
SAVE clears breakpoints that have been put into a program.

Options

Only one option can be specified- you cannot save a program in Merge or Internal format AND protect it from being listed. If you try to use two options only the first will be effective- you will not receive an error message.

By using the keyword PROTECTED, you may optionally specify that a program can only be run or brought into memory with OLD. The program cannot be listed, edited, or saved.
This is not the same as using the protection available with the Disk Manager Module.
Note: Be sure to keep an unprotected copy of any program.
If you also wish to protect the program from being copied, use the protect feature of the Disk Manager module.

You may optionally specify that the program is to be available for merging with another program by using the key word MERGE. Only programs saved with the key word MERGE may be merged with another program. MERGE files on disk will show as Display Variable 163.

You may optionally specify that the program is to be saved to disk in the format used for long Extended Basic programs, using the INTERNAL option.
This will cause the program to be saved as an INTERNAL VARIABLE 254 file instead of the usual PROGRAM file.
The IV254 file can be loaded with MYARC XBII and TI Extended Basic in the usual manner.
MYARC XBII automatically saves in IV254 format for long programs - which would otherwisefail to LOAD back in due to limited VDP memory space.
Programs stored in PROGRAM format are first loaded into VDP.
Note: In GRAPHICS MODE(3) if a program loads another from disk, that further program must be in INTERNAL file format, saved using the INTERNAL option eg SAVE DSK1.PROG,INTERNAL.

Continued-->

SAVE DSK1.PRG1
Saves the program in memory onto the diskette in disk drive 1 under the name PRG1.

SAVE DSK1.PRG1,PROTECTED
Saves the program in memory on the diskette in disk drive 1 under the name PRG1. The program may be loaded into memory, but it may not be edited, listed, or resaved. You should keep a copy of the program without protection in order to edit it later.

SAVE DSK1.PRG1,MERGE
Saves the program in memory on the diskette in disk drive 1 under the name PRG1. The program may later be merged with a program in memory by using the MERGE command.

SAVE DSK1.PRG1,INTERNAL
Saves the program in memory onto the diskette in Disk Drive 1 under the name PRG1. The program is saved in a format that will load directly into expansion RAM instead of via the VDP RAM.

SAVE DSK.NAME.PROGRAM
Saves the program in memory to a disk with the Volume Name "NAME" under the name PROGRAM.
The disk labelled with the volume name will be searched for in all available drives.
The Myarc Expansion Memory Ram-disk can be given a volume name using CALL VOL.

SAVE RD.PROGRAM
Saves the program to the Myarc Expansion Memory Card Ram-disk under the name PROGRAM.

SAVE PROGRAM
Saves the program in memory to the device named in the Working Directory under the name PROGRAM.
The default working directory is DSK1.
The working directory can be changed using CHDIR
You can see the current value of the working directory by typing PWD.

SAY subprogram

Format
CALL SAY(word-string[,direct-string][,...])

Cross Reference
SPGET

Description
The SAY subprogram enables you to instruct the computer to produce speech.

Word-string is a string-expression whose value is any of the words or phrases in the computer's resident vocabulary. If you use a string constant, you must enclose it in quotation marks. Alphabetic characters must be upper-case.

The computer substitutes "UHOH" for a word-string not in the vocabulary.

A speech phrase (more than one word) must be enclosed in pound signs (#). A speech phrase must be predefined; that is, it must be resident in the computer's vocabulary.

A compound is a new word formed by combining two words already in the vocabulary. For example, SOME+THING produces "something" and THERE+FOUR produces "therefore." A compound must not be enclosed in pound signs.

See Appendix H for a list of the computer's resident vocabulary.

Direct-string is a string expression whose value is the computer's internal representation of a word or phrase. You can use or modify a direct-string returned by the SPGET subprogram.

See Appendix I for information on adding suffixes to direct-strings. You can specify multiple word-strings and direct-strings by alternating them. To specify two consecutive word-strings or direct-strings, enter an extra comma as a separator between them.

Examples
100 CALL SAY("HELLO, HOW ARE YOU")
Causes the computer to say "Hello, how are you."

CALL SAY(,A$,,B$)
Causes the computer to say the words indicated by A$ and B$, which must have been returned by SPGET.

Program
The following program illustrates using CALL SAY with a word-string and three direct-strings.

```
100 CALL SPGET("HOW",X$)
110 CALL SPGET("ARE",Y$)
120 CALL SPGET("YOU",Z$)
130 CALL SAY("HELLO",X$,,Y$,,Z$)
```

Format
CALL SCREEN([,foreground-color,]backgroung-color)

Cross Reference
COLOR, DCOLOR, GRAPHICS

Description
The SCREEN subprogram enables you to change the screen color. The screen color is the color of the border and the color displayed when transparent is specified as the foreground- or background-color of a character or pixel.

In Text Mode, SCREEN enables you to change the color of the displayed characters, as well as the color of the screen.

Background-color is a numeric expression whose value specifies a screen color from among the 16 available colors.

In Text Mode, foreground-color is a numeric expression whose value specifies a color from among the 16 available colors, representing the foreground-color of all 256 characters.

If you specify a foreground-color and the computer is not in Text Mode, it has no effect. If the computer is in Text Mode and you do not specify foreground-color, the foreground-color remains unchanged.

When you enter MYARC Extended BASIC II, the background-color is cyan and the foreground-color is black. When your program ends (either normally or because of an error), stops at a breakpoint, or changes graphics mode, the default colors are restored.

The codes for the available colors are listed in Appendix F.

Examples

100 CALL SCREEN(8)
Changes the screen to cyan, which is the standard screen color.

100 CALL SCREEN(2)
Changes the screen to black.

Continued-->

COLOR	*CODE*
Transparent	1
Black	2
Medium Green	3
Light Green	4
Dark Blue	5
Light Blue	6
Dark Red	7
Cyan	8
Medium Red	9
Light Red	10
Dark Yellow	11
Light Yellow	12
Dark Green	13
Magenta	14
Gray	15
White	16

Program

The following program uses CALL SCREEN with CALL VCHAR and PRINT in the Text Mode to change the color of a character.

```
100 CALL CLEAR
110 CALL GRAPHICS(2)
120 CALL VCHAR(12,12,33,3)
130 CALL SCREEN(5,16)
140 PRINT "DARK BLUE SCREEN WITH WHITE LETTERS"
150 GOTO 150
(Press CLEAR to stop the program.)
```

Line 130 changes the screen to dark blue and the characters to white.

SEG$ function--String Segment

Format
SEG$(string-expression, start-position,length)

Type
String

Purpose
The SEG$ function returns a specified substring (segment of a string).

The string-expression specifies the string of which you want to specify a substring. If you use a string constant, it must be enclosed in quotation marks.

The start-position is a numeric expression whose value specifies the character position in the string-expression where the substring begins. The value of the start-position must be greater than zero.

The length is a numeric expression whose value specifies the length of the substring.

If the start-position is greater than the length of the string-expression, os if the length is zero, SEG$ returns a null string.

If the specified length is greater than the remaining length of the string-expression (starting from the specified start-position), SEG$ returns a substring consisting of all characters in the string-expression starting from the start-position to the end of the string-expression.

Examples

```
100 X$=SEG$("FIRSTNAME LASTNAME",1,9)
```
Sets X$ equal to FIRSTNAME.

```
100 Y$=SEG$("FIRSTNAME LASTNAME"11,8)
```
Sets Y$ equal to LASTNAME.

```
100 Z$=SEG$("FIRSTNAME LASTNAME",10,1)
```
Sets Z$ equal to " ".

```
100 PRINT SEG$(A$,B,C)
```
Prints the substring of A$ starting at the character at position B and extending for C characters.

SGN function--Signum (Sign)

Format
SGN(numeric-expression)

Type
DEFINT

Description
The SGN function returns a number indicating the algebraic sign of the value of the numeric-expression.

If the value of the numeric-expression is negative, SGN returns a -1.

If the value of the numeric-expression is zero, SGN returns a 0.

If the value of the numeric-expression is positive, SGN returns a (+)1.

Examples

```
100 IF SGN(X2)=1 THEN 300 ELSE 400
```
Transfers control to line 300 if X2 is positive and to line 400 if X2 is zero or negative.

```
100 ON SGN(X)+2 GOTO 200,300,400
```
Transfers control to line 200 if X is negative, line 300 if X is zero, and line 400 if X is positive.

SIN function--Sine

Format
SIN(numeric-expression)

Type
REAL

Cross Reference
ATN, COS, TAN

Description
The SIN function returns the sine of the angle whose measurement in radians is the value of the numeric-expression.

The value of the numeric-expression cannot be less than -1.570796326794E10 or greater than 1.570796326794E10.

If you normally think of angles being measured in degrees rather than radians, just multiply the angle in degrees by pi divided by 180.

So the sine of 30 degrees is SIN(30*PI/180)

Program

The following program gives the sine for each of several angles.

```
100 A=.5235987755982
110 B=30
120 C=45*PI/180
130 PRINT SIN(A);SIN(B)
140 PRINT SIN(B*PI/180)
150 PRINT SIN(C)
RUN
.5    -.9880316241
.5
.7071067812
```


SIZE command

Format: SIZE

Description: The SIZE command will return the amounts of memory free for your Extended Basic program, the program variables, and the program strings.
Each category starts with 24k free.
Memory addresses are >A000 to >FFE8 in three banks of 24k.

SOUND subprogram

Format
CALL SOUND(duration,frequency1,volume1[,frequency2,volume2]
[,frequency3,volume3][,frequency4,volume4]

Description
The SOUND subprogram enables you to instruct the computer to produce musical tones or noise.

The computer contains three music generators and one noise generator, enabling you to create up to four different sounds at once. You can specify the frequency and volume of each sound independently.

Duration is a numeric expression whose absolute value specifies the length of the sound in milliseconds (thousanths of seconds). Duration can have an absolute value from 1 to 4250. (A value of 1000 will produce a sound for one second.)

The actual duration produced by the computer may vary by as much as one sixtieth (1/60) of a second from the value you specify. [PAL models by 1/50th sec]

You can enter only one duration, which applies to all specified sounds (music and noise).

Frequency is a numeric expression that has different meanings depending on whether you use it to specify one of the music generators or the noise generator.

You must enter at least one frequency.

The frequency of a music generator specifies the frequency of the tone in Hertz (cycles per second). The acceptable values range from 110 to 44733; the upper limit exceeds the range of human hearing.

The actual frequency produced by the computer may vary by as much as ten percent from the value you specify.

See Appendix C for the frequencies of some commomly used tones.

The frequency of the noise generator has a value from -1 to -8, specifying the type of noise produced.

The frequencies from -1 to -3 produce different types of periodic noise. A frequency of -4 produces a periodic noise that varies depending on the frequency value of the third music generator.

The frequencies from -5 to -7 produce different types of white noise. A frequency of -8 produces a white noise that varies depending on the frequency value of the third music generator.

By using the noise generator setting of -4 or -8, appropriate settings of the third tone generator can produce a note which sounds below 110Hz, which is varied as the third tone setting varies.
eg CALL SOUND(2000,200,30,200,30,150,30,-4,0)

Continued-->

Volume is a numeric expression whose value is inversely proportional to the loudness of the sound.

You must enter at least one volume.

The volume can be from 0 to 30. Zero is the maximum volume and 30 is silence.

If you call SOUND while the computer is still producing the tones specified in a previous call to the SOUND subprogram, the result depends on the algebraic sign of the duration of the previous call to SOUND. If the duration was positive, the new sound does not begin until the old sound is complete. If the duration was negative, the new sound begins immediately, interrupting the old sound.

Examples

```
100 CALL SOUND(1000,110,0)
```
Plays A below low C loudly for one second.

```
100 CALL SOUND(500,110,0,131,0,196,3)
```
Plays A below low C and low C loudly, and G below C not as loudly, all for half a second.

```
100 CALL SOUND(4250,-8,0)
```
Plays loud white noise for 4.250 seconds.

```
100 CALL SOUND(DUR,TONE,VOL)
```
Plays the tone indicated by TONE for a duration indicated by DUR, at a volume indicated by VOL.

Program

The following program plays the 13 notes of the first octave that is available on the computer.

```
100 X=2^(1/12)
110 FOR A=1 TO 13
120 CALL SOUND(100,110*X^A,0)
130 NEXT A
```

SPGET subprogram--Get Speech

Format
CALL SPGET(word-string,string-variable[,...])

Cross Reference
SAY

Description
The SPGET subprogram enables you to assign the computer's internal representation of a speech word to a variable.

SPGET is especially useful if you want to add a suffix to a word in the computer's resident vocabulary.

Word-string is a string expression whose value is any of the words or phrases in the computer's resident vocabulary. If you use a string constant, you must enclose it in quotes.

The computer substitutes "UHOH" for a word-string not in the vocabulary.

A speech phrase (more than one word) must be enclosed in pound signs (#).

See Appendix H for a list of the computer's resident vocabulary.

The internal representation of the word-string (the direct-string) is returned in the string-variable. See Appendix I for information on adding suffixes to direct-strings.

You can specify multiple word-strings and direct-strings by alternating them.

Program

The following program illustrates using CALL SPGET.

```
100 CALL SPGET("TEXAS INSTRUMENTS",X$)
110 CALL SPGET("COMPUTER",Y$)
120 CALL SAY("I AM A",X$,,Y$)
```

Format
CALL SPRITE(#sprite-number,character-code,foreground-color,
pixel-row,pixel-column[, vertical-velocity,horizontal-velocity][,...])

Cross Reference
CHAR, COINC, COLOR, DELSPRITE, DISTANCE, GRAPHICS, LOCATE, MAGNIFY, MOTION, PATTERN, POSITION, SCREEN

Description
The SPRITE subprogram enables you to create sprites.

Sprites are graphics that can be assigned any valid color and placed anywhere on the screen. Sprites treat the screen as a grid 256 pixels high and 256 pixels wide. However, only the first 192 pixels are visible on the screen.

You can create up to 32 sprites in all modes except Text Mode, which does not allow sprites (the SPRITE subprogram has no effect in Text Mode).

In Pattern Mode, sprites can be set in motion in any direction at a variety of speeds. A sprite continues its motion until it is specifically changed by the program or until program execution stops. Because sprites move from pixel to pixel, their motion can be smoother than that of characters, which can be moved only one character position (8 pixels) at a time.

Sprites "pass over" characters on the screen. When two or more sprites are coincident (occupying the same screen pixel position), the sprite with the lowest sprite-number covers the other sprite(s).

At any given time, only four sprites can be on the same horizontal pixel-row. When five or more sprites are on the same pixel-row, that row of pixels in the sprite(s) with the highest sprite-number(s) disappears.

You can use the DELSPRITE subprogram to delete one or more sprites. All sprites are deleted when your program ends (either normally or because of an error), stops at a breakpoint, or changes graphics mode.

Sprite Specifications

The sprite-number is a numeric expression with a value from 1 to 32. If you specify the value of a previously defined sprite, the old sprite is replaced by the new sprite. If the old sprite had a vertical- or horizontal-velocity and you do not specify a new velocity, the new sprite retains the old velocity.

Character-code is a numeric expression with a value from 0-255, specifying the character that defines the sprite pattern.

Continued-->

If you use the MAGNIFY subprogram to change to double-sized sprites, the sprite definition includes the character specified by the character-code and three additional characters (see MAGNIFY).

Once defined by the SPRITE subprogram, the character-code of a sprite can be changed by the PATTERN subprogram.

The foreground-color is a numeric expression with a value from 1 to 16, specifying one of the 16 available colors. Once defined by the SPRITE subprogram, the foreground-color of a sprite can be changed by the COLOR subprogram.

COLOR	*CODE*	*COLOR*	*CODE*
Transparent	1	Medium Red	9
Black	2	Light Red	10
Medium Green	3	Dark Yellow	11
Light Green	4	Light Yellow	12
Dark Blue	5	Dark Green	13
Light Blue	6	Magenta	14
Dark Red	7	Gray	15
Cyan	8	White	16

The background-color of a sprite is always transparent.

The pixel-row and pixel-column are numeric expressions whose values specify the screen pixel position of the pixel at the upper-left corner of the sprite.

Once defined by the SPRITE subprogram, the pixel-row and pixel-column of a sprite can be changed by the LOCATE subprogram, and the current pixel-row and pixel column of a sprite can be ascertained by the POSITION subprogram. Also, the distance between sprites or between a sprite and a specified screen pixel can be ascertained by the DISTANCE subprogram, and the COINC subprogram can be used to ascertain whether sprites are coincident with each other or with a specified screen pixel.

Sprite Motion

The optional vertical- and horizontal-velocity are numeric expressions with values from -128 to 127. If both values are zero, the sprite is stationary. The speed of a sprite is in direct linear proportion to the absolute value of the specified velocity.

A positive vertical-velocity causes the sprite to move toward the top of the screen; a negative vertical-velocity causes the sprite to move toward the bottom of the screen.

A positive horizontal-velocity causes the sprite to move to the right; a negative horizontal-velocity causes the sprite to move to the left.

If neither the vertical- nor horizontal-velocity are zero, the sprite moves at an angle, in a direction and at a speed determined by the velocity values.

The velocity of a sprite can be changed by the MOTION subprogram.

When a moving sprite reaches an edge of the screen, it disappears. The sprite reappears in the corresponding position at the opposite edge of the screen.

Continued-->

The motion of a sprite may be affected by the computer's internal processing and by input to, and output from, external devices.

Program

The following three programs show some possible uses of sprites.

```
100 CALL CLEAR
110 CALL CHAR(244,"FFFFFFFFFFFFFFFF")
120 CALL CHAR(246,"183C7EFFFF7E3C18")
130 CALL CHAR(248,"F00FF00FF00FF00F")
140 CALL SPRITE(#1,244,5,92,124,#2,248,7,1,1)
150 CALL SPRITE(#28,33,16,12,48,1,1)
160 CALL SPRITE(#15,246,14,1,1,127,-128)
170 GOTO 170
(Press CLEAR to stop program.)
```

Line 140 creates a dark blue sprite in the center of the screen and a red striped sprite in the upper-right corner of the screen. Line 150 creates a white sprite near the upper-left corner of the screen and starts it moving slowly at a 45-degree angle down and to the right. The sprite is an exclamation point.

Line 160 creates a dark red sprite at the upper-right corner of the screen and starts it moving very fast at a 45 degree angle down and to the left.

The following program makes a rather spectacular use of sprites.

```
100 CALL CLEAR
110 CALL CHAR(244,"0008081C7F1C0808")
120 RANDOMIZE
130 CALL SCREEN(2)
140 FOR A=1 TO 28
150 CALL SPRITE(#A,244,INT(A/3)+3,92,124,A*INT(RND*4.5)
-2.25+A/2*SGN(RND-.5),A*INT(RND*4.5)-2.25+A/2*SGN(RND-.5))
160 NEXT A
170 GOTO 140
(Press CLEAR to stop the program.)
```

Line 110 defines character 244.

Line 150 defines the sprites, 28 in all. The sprite-number is the current value of A. The character-value is 244. The sprite-color is INT(A/3)+3. The starting dot-row and dot-column are 92 and 124, the center of the screen. The row- and column-velocities are chosen randomly using the value of A*INT(RND*4.5)-2.25+A/2*SGN(RND-.5).

Line 170 causes the sequence to repeat.

The following program uses all the subprograms that relate to sprites except for COLOR. They are CHAR, COINC, DELSPRITE, LOCATE, MAGNIFY, MOTION, PATTERN, POSITION, and SPRITE.

Continued-->

The program creates two double-sized magnified sprites in the shapes of two people walking along a floor. There is a barrier that one of them passes through and the other jumps through. The one that jumps through goes a little faster after each jump, eventually catching the other one. When this happens, they each become double-sized, unmagnified sprites and continue walking. When they meet for the second time, the one that has been going faster disappears and the other continues walking.

```
100 CALL CLEAR
110 S1$="0103030103030303030303030303030380C
0C080C0C0C0C0C0C0C0C0C0C0C0E0"
120 S2$="0103030103070F1B1B030303060C0C0E80C
0C080C0E0F0D8CCC0C0C060303038"
130 COUNT=0
140 CALL CHAR(244,S1$)
150 CALL CHAR(248,S2$)
160 CALL SCREEN(14)
170 CALL COLOR(14,13,13)
180 FOR A=19 TO 24
190 CALL HCHAR(A,1,136,32)
200 NEXT A
210 CALL COLOR(13,15,15)
220 CALL VCHAR(14,22,128,6)
230 CALL VCHAR(14,23,128,6)
240 CALL VCHAR(14,24,128,6)
250 CALL SPRITE(#1,244,5,113,129,#2,244,7,113,9)
260 CALL MAGNIFY(4)
270 XDIR=4
280 PAT=2
290 CALL MOTION(#1,0,XDIR,#2,0,4)
300 CALL PATTERN(#1,246+PAT,#2,246-PAT)
310 PAT=-PAT
320 CALL COINC(ALL,CO)
330 IF CO>0 THEN 370
340 CALL POSITION(#1,YPOS1,XPOS1)
350 IF XPOS1>136 AND XPOS1<192 THEN 470
360 GOTO 300
370 REM COINCIDENCE
380 CALL MOTION(#1,0,0#2,0,0)
390 CALL PATTERN(#1,244,#2,244)
400 IF COUNT>0 THEN 540
410 COUNT=COUNT+1
420 CALL POSITION(#1,YPOS1,XPOS1,#2,YPOS2,XPOS2)
430 CALL MAGNIFY(3)
440 CALL LOCATE(#1,YPOS1+16,XPOS1+8,#2,YPOS2+16,XPOS2)
450 CALL MOTION(#1,0,XDIR,#2,0,4)
460 GOTO 340
470 REM #1 HIT WALL
480 CALL MOTION(#1,0,0)
490 CALL POSITION(#1,YPOS1,XPOS1)
500 CALL LOCATE(#1,YPOS1,193)
510 XDIR=XDIR+1
520 CALL MOTION(#1,0,XDIR)
```

Continued-->

```
530 GOTO 300
540 REM SECOND COINCIDENCE
550 FOR DELAY=1 TO 1000 :: NEXT DELAY
560 CALL MOTION(#2,0,4)
570 CALL DELSPRITE(#1)
580 FOR STEP1=1 TO 20
590 CALL PATTERN(#2,248)
600 FOR DELAY=1 TO 40 :: NEXT DELAY
610 CALL PATTERN(#2,244)
620 FOR DELAY=1 TO 40 :: NEXT DELAY
630 NEXT STEP1
640 CALL CLEAR
```

Lines 110, 120, 140, 150, 250, and 260 define the sprites.

Line 130 sets the meeting counter to zero.

Lines 170 through 200 build the floor.

Lines 210 through 240 build the barrier.

Line 270 sets the starting speed of the sprite that will speed up.

Line 290 sets the sprites in motion.

Line 300 creates the illusion of walking.

Line 320 checks to see if the sprites have met. Line 330 transfers control if the sprites have met. Lines 340 and 350 check to see if the sprite has reached the barrier and transfer control if it has.

Line 360 loops back to continue the walk. Lines 370 through 460 handle the sprites running into each other. Lines 380 and 390 stop them.

Line 400 checks to see if it is the first meeting. Line 410 increments the meetng counter. Line 420 finds the sprites position.

Line 430 makes them smaller. Line 440 puts them on the floor and moves the fast one slightly ahead. Line 450 starts them moving again.

Lines 470 through 530 handle the fast sprite jumping through the barrier. Line 480 stops it. Line 490 finds where it is.

Line 500 puts it at the new location beyond the barrier. Lines 510 and 520 start it moving again, a little faster.

Lines 540 through 640 handle the second meeting.

Line 560 starts the slow sprite moving. Line 570 deletes the fast sprite.

Lines 580 through 630 make the slow sprite walk 20 steps.

Format
SQR(numeric-expression)

Type
REAL

Description
The SQR function returns the positive square root of the value of the numeric-expression.

The value of the numeric-expression cannot be negative.

Examples

```
100 PRINT SQR(4)
```
Prints 2.

```
100 X=SQR(2.57E5)
```
Sets X equal to the square root of 257,000, which is 506.9516742255.

Format
STOP

Cross Refernc
END

Description
The STOP statement stops the execution of your program.

When your computer encounters a STOP statement, the computer performs the following operations:

It closes all open files.

If the computer is in Pattern or Text Mode, it restores the default character definitions of all characters.

If the computer is in High-Resolution Mode, it restores the default character definitions of all characters and restores the default graphics mode (Pattern) and margin settings (3, 30, 1, 24)

Restores the default foreground color (black) and background color (transparent) to all characters.

Restores the default screen color (cyan).

Deletes all sprites.

Resets the sprite magnification level to 1.

The graphics colors (see DCOLOR) and current position (see DRAWTO) are not affected. If the computer is in Pattern or Text Mode the graphics mode and margin settings remain unchanged.

A STOP statement is not necessary to stop your program; the program automatically stops after the highest-numbered line is executed.

STOP is frequently used before a subprogram that follows the main portion of a program, to ensure that the subprogram is not executed after the execution of the highest-numbered line in the main program.

STOP can be used interchangeably with the END statement, except that you cannot use STOP to end a subprogram.

Continued-->

Program

The following program illustates the use of the STOP statement. The program adds the numbers from 1 to 100.

```
100 CALL CLEAR
110 TOT=0
120 NUMB=1
130 TOT=TOT+NUMB
140 NUMB=NUMB+1
150 IF NUMB>100 THEN PRINT TOT::STOP
160 GOTO 130
```

STR$ function--String-Number
STR$

Format
STR$(numeric-expression)

Type
String

Cross Reference
VAL

Description
The STR$ function returns the string representation of the value of the numeric-expression.

STR$ enables you to use the string representation of the numeric-expression with an instruction that requires a string expression as a parameter.

STR$ is the inverse of the VAL function.

STR$ removes leading and trailing spaces.

Examples

```
100 NUM$=STR$(78.6)
```
Sets NUM$ equal to "78.6".

```
100 LL$=STR$(3E15)
```
Sets LL$ equal to "3.E+15".

```
100 X$=STR$(A*4)
```
Sets X$ equal to a string representation of whatever value is obtained when A is multiplied by 4. For instance, if A is equal to -8, X$ is set equal to "-32".

SUB --Subprogram

Format
SUB subprogram-name[(parameter[,...])]

Cross Reference
CALL, SUBEND, SUBEXIT

Description
The SUB statement is the first statement in a subprogram.

You can use a subprogram to separate a group of statements from the main program. Subprograms are generally used to perform a specific operation several times in the same program or in different programs, or to isolate variables that are specific to the subprogram.

Subprograms are accessed from your main program with a CALL statement. The subprogram-name in the SUB statement is the same name that you use in the CALL statement that transfers control to the subprogram.

The maximum length of a subprogram-name is 15 characters.

A user-written subprogram may have the same subprogram-name as a built-in subprogram. In such a case, a CALL statement will access the user-written subprogram instead of the built-in one.

You can use parameters to pass values to a subprogram. Parameters must be valid names of variables or arrays.

Within a sub program all numeric variables are considered to be REAL. If DEFINT ALL has been used in the main program, the sub program will use the variable as REAL but if you return the value to the calling program it will be INT. See example on page 200.

SUBEND must be the last statement executed in a subprogram. When the computer encounters a SUBEND or a SUBEXIT statement in a subprogram, program control returns to the statement immediately following the CALL statement that called the subprogram.

It is recommended that you do not use any statement other than SUBEND or SUBEXIT to leave a subprogram. If you use another statement to leave a subprogram you may still be using variables local to the subprogram, which may cause unexpected results.

Subprograms must have higher line numbers than any part of your main program. A SUB statement cannot be part of an IF THEN statement.

Subprogram Variables

The variables used in a subprogram (other than those used as parameters) are local to the subprogram; that is, even if a variable in your main program has

Continued-->

the same name as a variable in a subprogram, the value of that variable outside the subprogram is not affected by changes to its value in the subprogram. If a subprogram is called more than once, any local variables used in the subprogram retain their values from one call to the next.

Numeric variables used in a subprogram are considered to be REAL A DEFINT ALL statement in your main program does not affect the data-type of numeric variables in a subprogram.

Parameters

When your program executes a subprogram beginning with a SUB statement with parameters, the parameter values (constants or variables) are passed from the parameter-list of the CALL statement to the subprogram. The parameter-list in the CALL statement must contain the same number of parameters as the SUB statement. Values are passed in the order in which they are listed.

A numeric parameter must be passed a numeric value. A string parameter must be passed a string value.

An array parameter must be passed an array. A string-array parameter must be passed a string array;

To pass an entire array as one parameter, follow the array name with left and right parentheses. If the array has more than one dimension, place one comma between the parentheses for each additional dimension.

Passing Parameters by Reference and Value

When a subprogram manipulates the value of a parameter passed to it, the new parameter value may or may not be passed back to the main program. When a parameter is passed to a subprogram "by reference," the new value is passed back to the main program after the subprogram has executed.

When a parameter is passed to a subprogram "by value," the new value is not passed back to the main program.

To specify that a variable is to be passed by value rather than by reference, enclose it in parentheses in the CALL

Continued-->

statement's parameter-list. Note that this option is not available for arrays. See the example program on page 200.

If you use an expression as a parameter, it is evaluated and passed by value.

Examples

100 SUB MENU
Marks the beginning of a subprogram. No parameters are passed or returned.

100 SUB MENU(COUNT,CHOICE)
Marks the beginning of a subprogram. The variables COUNT and CHOICE may be used and/or have their values changed in the subprogram and returned to the variables in the same position in the calling statement.

100 SUB PAYCHECK(DATE,Q,SSN,PAYRATE,TABLE(,))
Marks the beginning of a subprogram. The variables DATE, Q, SSN, PAYRATE, and the array TABLE with two dimensions may be used and/or have their values changed in the subprogram and returned to the variables in the same position in the calling statement.

Program

The following program illustrates the use of SUB. The subprogram MENU had been previously saved with the MERGE option. It prints a menu and requests a choice. The main program tells the subprogram how many choices there are and what the choices are. It then uses the choice made in the subprogram to determine what program to run.

```
100 CALL MENU(5,R)
110 ON R GOTO 120,130,140,150,160
120 RUN "DSK1.PAYABLES"
130 RUN "DSK1.RECEIVE"
140 RUN "DSK1.PAYROLL"
150 RUN "DSK1.INVENTORY"
160 RUN "DSK1.LEDGER"
170  DATA  ACCOUNTS   PAYABLE,ACCOUNTS   RECEIVABLE,PAYROLL,INVENTORY,GENERAL
LEDGER

Beginning of subprogram MENU.

Note  that  this  R is not the same as the R used in lines 100 and 110 in the
main program.

10000 SUB MENU(COUNT,CHOICE)
10010 CALL CLEAR
10020 IF COUNT>22 THEN PRINT "TOO MANY ITEMS" :: CHOICE=0 :: SUBEXIT
10030 RESTORE
10040 FOR R=1 TO COUNT
10050 READ TEMP$
10060 TEMP$=SEG$(TEMP$,1,25)
10070 DISPLAY AT(R,1):R;TEMP$
```

Continued-->

```
10080 NEXT R
10090 DISPLAY AT(R+1,1):"YOUR CHOICE: 1"
10100 ACCEPT AT(R+1,14)BEEP VALIDATE(DIGIT)SIZE(-2):CHOICE
10110 IF CHOICE>COUNT OR CHOICE<1 THEN 10100
10120 SUBEND
```

The following program demonstrates that the subprogram uses REAL variable values regardless of the main program settings:

```
100 DEFINT A
110 A=4
120 CALL P(A)
130 PRINT A
140 STOP
150 SUB P(A)
160 A=A/5
170 PRINT A
180  SUBEXIT
   [RUN]
0.80
1
```

The decimal number is printed by line 170 inside the subprogram, the value is then returned to the main program as an integer as set in line 100, and printed by line 130.

The following program demonstrates how a variable can be passed to the sub program and its modified value or its original value returned to the main program.

```
100 A=1 :: B=2
110 CALL P(A,B)
120 PRINT A,B
130 STOP
140 SUB P(A,B)
150 B=B+A :: A=B*3
160 PRINT A,B
170 SUBEXIT
   [RUN]
9  3
9  3
```

If you then amend line 110 to CALL P(A,(B))
and RUN the program again the result is:

```
9  3
9  2
```

Now amend line 110 to CALL P((A),(B)) and RUN the program again and the result is

```
9  3
1  2
```

in this final case the first PRINT is from within the subprogram, where the values are amended, then the final print is from line 120 after the subexit, and the variables are not changed due to the extra parenthesis ().

SUBEND Subprogram End

Format
SUBEND

Cross Reference
SUB, SUBEXIT

Description
The SUBEND statement marks the end of a subprogram.

SUBEND must be the last statement executed in a subprogram. When the computer encounters a SUBEND statement in a subprogram, program control returns to the statement immediately following the CALL statement that called the subprogram.

It is recommended that you do not use any statement other than SUBEND or SUBEXIT to leave a subprogram. If you use another statement to leave a subprogram you may still be using variables local to the subprogram, which may cause unexpected results.

A SUBEND statement cannot be part of an IF THEN statement.

The only statements that can immediately follow a SUBEND statement are REM, END, or the SUB statement for the next subprogram.

Format
SUBEXIT

Cross Reference
SUB, SUBEND

Description
The SUBEXIT statement enables you to leave a subprogram before the computer executes the SUBEND statement that ends the subprogram.

SUBEXIT enables you to have more than one exit from a subprogram.

When the computer encounters a SUBEXIT statement in a subprogram, program control returns to the statement immediately following the CALL statement that called the subprogram.

It is recommended that you do not use any statement other than SUBEND or SUBEXIT to leave a subprogram. If you use another statement to leave a subprogram you may still be using variables local to the subprogram, which may cause unexpected results.

Format
TAB(numeric-expression)

Cross Reference
DISPLAY, PRINT

Description
The TAB function specifies the starting position of the next item to be printed by a PRINT or DISPLAY instruction.

The numeric-expression specifies the starting position of the next print item in a print-list of a PRINT or DISPLAY instruction.

If the value of the numeric-expression is not an integer, it is rounded to the nearest integer. If the value of the numeric-expression is less than 1, it is replaced by 1.

If the value of the numeric-expression is greater than the record length of the screen or device, it is repeatedly reduced by the record length until it is less than or equal to the record length. The record length of the screen is the width of the screen window defined by the margins. For more information about the record length of a particular device, refer to the owner's manual that comes with that device.

TAB is relative to the left side of the screen, not the current screen window.

Because the TAB function itself is treated as a separate print item, it must be preceded and/or followed by a print separator (usually a semicolon), unless it is the only item in the print-list.

If the number of characters already printed in the current record is greater than or equal to the position indicated by the value of the numeric-expression, the print item following the TAB is printed in the next record, beginning in the position specified by the value of the numeric-expression.

TAB can be used to print to a device or file only if the device or file has been opened in DISPLAY format.

TAB cannot be used with PRINT USING or DISPLAY USING.

Examples

```
100 PRINT TAB(12);35
```
Prints the number 35 at the twelfth position.

```
100 PRINT 356;TAB(18);"NAME"
```
Prints 356 at the beginning of the line and NAME at the eighteenth position of the line

Continued-->

```
100 PRINT "ABCDEFGHIJKLM";TAB(5);"NOP"
```
Prints ABCDEFGHIJKLM at the beginning of the line and NOP at the fifth position of the next line.

```
100 DISPLAY AT(12,1):"NAME";TAB(15);"ADDRESS"
```
Displays NAME at the beginning of the twelfth line on the screen and ADDRESS at the fifteenth position on the twelfth line of the screen.

TAN function -Tangent

Format
TAN(numeric-expression)

Type
REAL

Cross Reference
ATN, COS, SIN

Description
The TAN function returns the tangent of the angle whose measurement in radians is the value of the numeric-expression.

The numeric-expression cannot be less than -1.570796326951 4E10 or greater than 1.570796326637 4E10.

If you wish to use the TAN of an angle that is measured in DEGREES, multiply by pi and divide by 180.
So that to find the tangent of 45 degrees we use:
A = TAN(45*PI/180)

It is possible to program a sub program to deal with angles in degrees:

```
100 INPUT "ANGLE IN DEGREES":ANGD
110 CALL TAND(ANGD)
120 PRINT "TANGENT=";ANGD
130 STOP
140 SUB TAND(A)
150 A=TAN(A*PI/180)
160 SUBEND
```

Program

The following program gives the tangent for each of several angles.

```
100 A=.7853981633973
110 B=26.565051177
120 C=45*PI/180
130 PRINT TAN(A);TAN(B)
140 PRINT TAN(B*PI/180)
150 PRINT TAN(C)
RUN
1.   7.17470553
.5
1
```

Format
TERMCHAR

Type
DEFINT

Cross Reference
ACCEPT, INPUT, LINPUT

Description
The TERMCHAR function returns the character code of the key pressed to exit from the previously executed INPUT, ACCEPT, or LINPUT statement.

In a program, the value returned by TERMCHAR depends on the key pressed to exit from the last instruction that accepted input from the keyboard.

VALUE RETURNED	KEY
1	AID
2	CLEAR
10	DOWN ARROW
11	UP ARROW
12	PROC'D
13	ENTER
14	BEGIN
15	BACK

If you use TERMCHAR as part of a command (unless it is preceded by ACCEPT, INPUT, or LINPUT), the value returned depends on the key pressed to enter the command (ENTER, UP ARROW, or DOWN ARROW).

Note that pressing CLEAR during keyboard input normally causes a break in the program. However, if your program includes an ON BREAK NEXT statement, you can use CLEAR to exit from an input field.

Program

The following program illustrates a use of TERMCHAR. The program displays name, address, and city, state, and zip code information entered from the keyboard. Line 160 enables you to correct errors in previously entered lines by pressing UP ARROW. This returns the cursor to the beginning of the line that immediately precedes the one from which UP ARROW was entered.

```
100 CALL CLEAR
110 R=5::C=12
120 DISPLAY AT(R,C-10):"NAME :"
130 DISPLAY AT(R+1,C-10):"ADDRESS:"
140 DISPLAY AT(R+2,C-10):"C,S,Z:"
```

Continued-->

```
150 ACCEPT AT(R,C)SIZE(-20):A$(R)
160 IF TERMCHAR=11 THEN R=R-1 ELSE R=R+1
170 IF R=7 THEN 150
180 DISPLAY AT(20,1):A$(5):A$(6):A$(7)
190 GOTO 110
(Press CLEAR to stop the program.)
```

Format
TRACE

Cross Reference
UNTRACE

Description
The TRACE instruction causes the computer to display the line number of each line in your program before it is executed.

TRACE enables you to see the order in which the computer performs statements as it runs your program. It is valuable as a debugging aid to help you find errors (such as unwanted infinite loops) in your program.

You can use TRACE either as a program statement or a command.

The effect of a TRACE instruction is cancelled when an UNTRACE instruction or a NEW command is executed.

Programs

The following programs display a trace of the order of execution of the program lines.

```
100 FOR J=1 TO 3
110 PRINT "WORD"
120 NEXT J
130 TRACE
```

```
100 FOR J=1 TO 3
110 PRINT "WORD"
120 NEXT J
TRACE
```

Format
UNBREAK [line-number-list]

Cross Reference
BREAK

Description
The UNBREAK instruction removes a breakpoint from each program statement you specify.

You can use UNBREAK as either a program statement or a command.

> The line-number-list consists of one or more line numbers separated by commas. When an UNBREAK instruction is executed, breakpoints are removed from the specified program lines.
>
> If you do not include a line-number-list, UNBREAK removes all breakpoints, except for a breakpoint that occurs when a BREAK statement with no line-number-list is encountered in a program.

If the line-number-list includes an invalid line number (0 or a value greater than 32767), the message Bad line number is displayed. If the line-number-list includes a fractional or negative line number, the message Syntax error is displayed. In both cases, the UNBREAK instruction is ignored; that is, breakpoints are not removed even at valid line numbers in the line-number-list. If you were entering UNBREAK as a program statement, it is not entered into your program.

If the line-number-list includes a line number that is valid (1-32767) but is not the number of a line in your program, or a fractional number greater than 1, the message

```
* WARNING
  LINE NOT FOUND
```

is displayed. (If you were entering UNBREAK as a program statement, the line-number is included in the warning message.) A breakpoint is, however, removed from any valid line in the line-number-list that precedes the line number that caused the warning.

Examples

```
UNBREAK
450 UNBREAK
```
Removes all breakpoints (except those resulting from a BREAK statement with no line-number-list).

```
UNBREAK 100,130
350 UNBREAK 100,130
```
Removes the breakpoints from lines 100 and 130.

UNTRACE

Format
UNTRACE

Cross Reference
TRACE

Description
The UNTRACE instruction cancels the effect of a TRACE instruction.

You can use UNTRACE as either a program statement or a command.

Examples

UNTRACE
450 UNTRACE
Removes the effect of TRACE.

VAL function--Value

Format
VAL(string-expression)

Type
REAL

Cross Reference
STR$

Description
The VAL function returns the numeric value of the string-expression.

VAL enables you to use the numeric value of the string-expression with an instruction that requires a numeric expression as a parameter.

VAL is the inverse of the STR$ function.

> The string-expression must be a valid representation of a number. The length of the string-expression must be greater than 0 and less than 255. If you use a string constant, it must be enclosed in quotation marks.

Examples

```
100 NUMB=VAL("78.6")
110 PRINT NUMB
```
Prints 78.6.

```
100 LL=VAL("3E15")
```
Sets LL equal to 3E+15, or 315.

Format
VALHEX(string-expression)

Type
DEFINT

Description
VALHEX returns the numeric value of the hexadecimal number represented by the string-expression.

The string-expression specifies the hexadecimal (base 16) number to be converted to a decimal (base 10) number. If you use a string constant, it must be enclosed in quotation marks.

The string-expression must contain only valid hexadecimal digits (0-9,A-F). Alphabetic hexadecimal digits must be upper-case letters. VALHEX can convert a hexadecimal number from one to four digits long. If the length of the string-expression is greater than four, VALHEX uses only the last four characters.

VALHEX returns an integer greater than or equal to -32768 (hexadecimal 8000) and less than or equal to 32767 (hexidecimal 7FFF).

Examples

```
100 A=VALHEX("400A")
```
Sets A equal to 16394.

```
100 PRINT VALHEX("8200")
```
Prints -32256.

VCHAR subprogram--Vertical Character

Format
CALL VCHAR(row,column,character-code[,number-of-repetitions])

Cross Reference
DCOLOR, GCHAR, GRAPHICS, HCHAR

Description
The VCHAR subprogram enables you to place a character on the screen and repeat it hortizontally.

Row and column are numeric expressions whose values specify the position on the screen where the character is displayed.

The value of row must be greater than or equal to 1, row must be less than or equal to 24.

The value of column must be greater than or equal to 1. In Pattern or High-Resolution Mode, the column must be less than or equal to 32; in Text Mode, column must less than or equal to 40.

VCHAR is not affected by margin settings.

Character-code is a numeric expression with a value from 0-255, specifying the number of the character. See Appendix B for a list of ASCII character codes.

The optional number-of-repetitions is a numeric expression whose value specifies the number of times the character is repeated horizontally. If the repetitions extend past the end of a column, they continue from the first character of the next column. If the repetitions extend past the end of the last column, they continue from the first character of the first column.

If you use VCHAR to display a character on the screen, and then later use CHAR, COLOR, or DCOLOR to change the appearance of that character, the result depends on the graphics mode.

In Pattern and Text Modes, the displayed character changes to the newly specified pattern and/or color(s).

In High-Resolution Mode, the displayed character remains unchanged.

Continued-->

Examples

100 CALL VCHAR(12,16,33)
Places character 33 (an exclamation point) in row 12, column 16.

100 CALL VCHAR(1,1,ASC("!"),768)
Places an exclamation point in row 1, column 1, and repeats it 768 times which fills the screen in Pattern Mode.

100 CALL VCHAR(R,C,K,T)
Places the character with an ASCII code specified by the value of K in row R column C, and repeats it T times.

VERSION subprogram VERSION

Format
CALL VERSION(numeric-variable)

Description
The VERSION subprogram returns a value indicating the version of BASIC being used.

In MYARC Extended BASIC II, VERSION returns a value of 212 to the numeric-variable you specify.

Example

```
100 CALL VERSION(V)
```

Will set the variable V to 212

VOL subprogram -- allocated volume name VOL

Format: CALL VOL("TIMP")

Description:
CALL VOL is used to allocate a volume name to the RamDISK so that it may be used with programs that look for a particular disk name rather than a drive number. For example the Multiplan module looks for a disk called TIMP in all available drives.

CALL VOL is supplied with the Myarc 512k expansion memory cna can be used in both Myarc XBII and in TI Basic.

Giving the RAM Disk a number (EMDK) or volume name (VOL) is optional and permits the use of programs that cannot be adjusted to use "RD.LOAD" etc.

Example:
CALL VOL("MICRO")
OLD DSK.MICRO.LOADER
will look for a program called LOADER on the ram disk

WRITE subprogram

Format

CALL WRITE(type,row,column,string-expression
[row2,column2,string-expression2,[,...]])

Cross Reference

GRAPHICS, HCHAR, MARGIN, VCHAR

Description

The WRITE subprogram enables you to display strings on the screen in High-Resolution Mode. The string-expression may be a constant or a variable.

Type is a numeric-expression whose value specifies the action taken by the WRITE subprogram.

TYPE	ACTION
0, 1	Displays the string-expression horizontally within the screen boundaries. Margins are disregarded. Display begins at the specified row and column.
2	Displays the string-expression vertically within the screen boundaries. Margins are disregarded. Display begins at the specified row and column.

If the string to be displayed will not fit within the screen, the string will wrap around on the screen.

For WRITE, the screen is considered to be 24 rows by 32 columns. As in HCHAR and VCHAR, blocks of pixels 8x8 are the unit of measurement not single pixels as in most other High-Resolution subprograms.

Row must have a value from 1 to 24, column must have a value from 1 to 32.

WRITE can only be used in High-Resolution Mode. An error results if you use WRITE in Pattern or Text Modes.

Example

```
100 CALL GRAPHICS(3)
110 CALL WRITE(0,1,1,"HELLO, HOW ARE YOU")
```

Displays "HELLO, HOW ARE YOU", starting at row 1, column 1, relative to the upper-left corner of the screen.

APPENDICES

The following appendices give useful information for utilization with Extended BASIC II.

Appendix A

Appendix B: ASCII Codes

Appendix C: Musical Tone Frequencies

Appendix D: Character Sets

Appendix E: Pattern-Identifier Conversion Table

Appendix F: Color Codes

Appendix G: Mathematical Functions

Appendix H: List of Speech Words

Appendix I: Adding Suffixes to Speech Words

Appendix J: Error Messages

Appendix K: High-Resolution Mode (Restrictions and Conventions)

Appendix

Appendix

Appendix

Appendix

Appendix

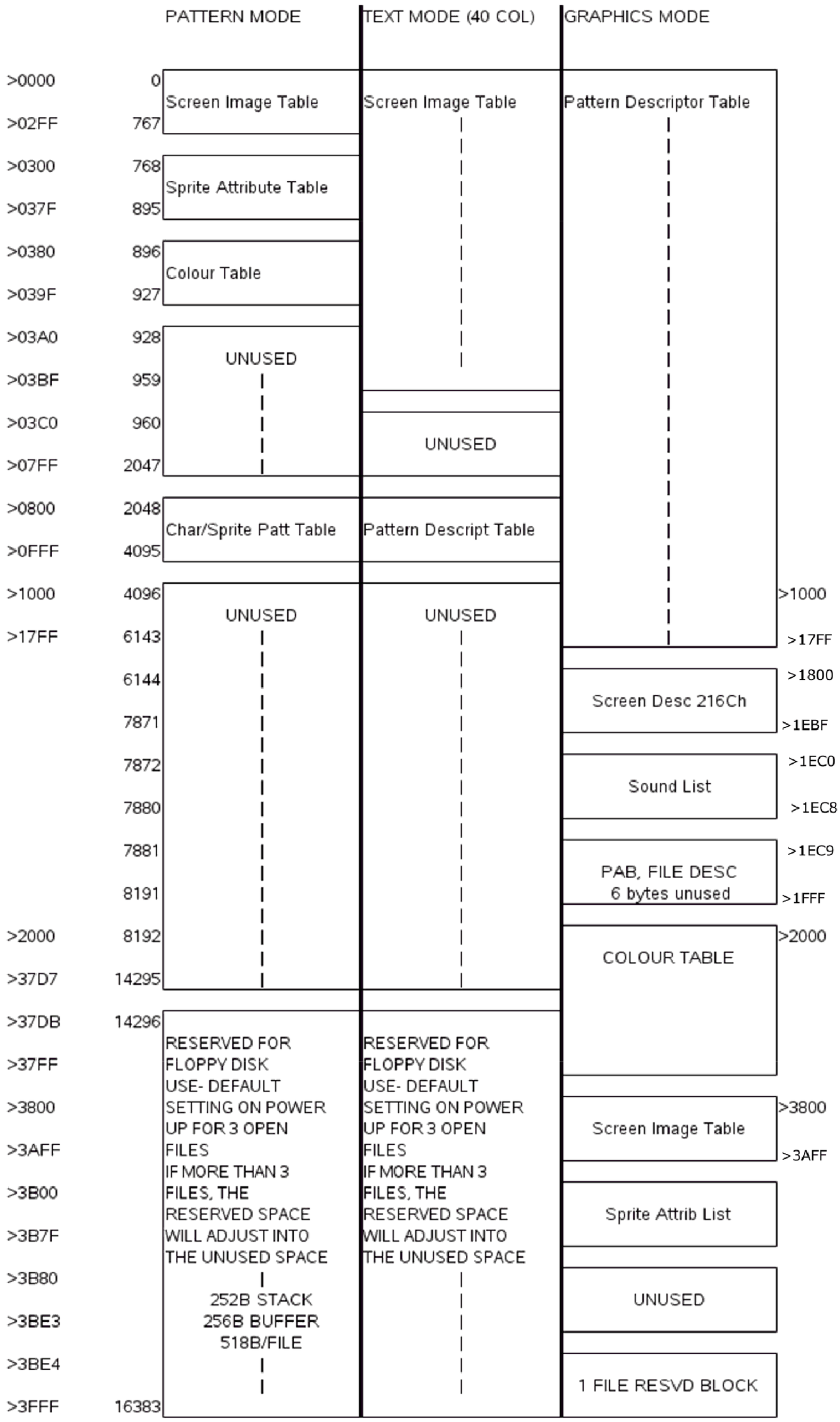
Appendix

Appendix

APPENDIX A

MEMORY MAPS:

VDP MEMORY MAP



MYARC EXTENDED BASIC II CRAM MEMORY MAP
4 PAGES OF 24K in Expansion Ram plus 8k in ROM area.

	PAGE ONE	PAGE TWO	PAGE THREE	PAGE FOUR
>2000	UNUSED	RAM DISK	VDP SPEECH	BASIC INTERPRETER
TO			ROUTINES	
	User Assembly	Basic		
>4000	Language Use	Interpreter	I/O BUFFERS	VALUE STACK
(8Kb)				

On page one the first K is left unused for compatibility with TI Extended Basic, so that Assembly Language programs will use the same addresses in each system. Users may elect to make use of that memory by using
CALL INIT
CALL LOAD(8194,32,230)

>6000 to >8000 (8 Kb)	**MEMORY MANAGEMENT ROUTINES**

>A000 TO >FFE8 (24Kb)	EXTENDED BASIC PROGRAM	VARIABLE SPACE	STRING SPACE	BASIC INTERPRETER

VDP REGISTERS:

IN HEX (>)	PATTERN MODE 32 COL	TEXT MODE 40 COL	BIT MAP MODE
REG 0 (mode)	00	00	02
REG 1 (mode)	E0	F0	E0
REG 2 Image Table	00	00	0E SIT at 3800
REG 3 Colour Table	0E 0380	0F '03C0	FF 2000
REG 4 Pattern Descp	01 0800	01 0800	03 0000
REG 5 Sprite Attrib	06 0300	na	76 3B00
REG 6 Screen Descrip	01 0800	na	03 1800
REG 7	17 black/cyan	17 black/cyan	17 black/cyan
SPRITE MOTION 7A5C	na 7A5C	NA NA	NA 7A5C

(Memory DSR is at >4000)

ASCII CODES

30	CURSOR	55	7	80	P	105	i
31	np	56	8	81	Q	106	j
32	SPACE	57	9	82	R	107	k
33	!	58	:	83	S	108	l
34	"	59	;	84	T	109	m
35	#	60	<	85	U	110	n
36	$	61	=	86	V	111	o
37	%	62	>	87	W	112	p
38	&	63	?	88	X	113	q
39	'	64	@	89	Y	114	r
40	(	65	A	90	Z	115	s
41	)	66	B	91	[	116	t
42	*	67	C	92	\	117	u
43	+	68	D	93	]	118	v
44	,	69	E	94	^	119	w
45	-	70	F	95	_	120	x
46	.	71	G	96	`	121	y
47	/	72	H	97	a	122	z
48	0	73	I	98	b	123	{
49	1	74	J	99	c	124	¦
50	2	75	K	100	d	125	}
51	3	76	L	101	e	126	~
52	4	77	M	102	f	127	DEL
53	5	78	N	103	g		
54	6	79	O	104	h		

The following characters can be obtained from the keyboard by pressing the FCTN key and the key indicated below:

Use For:	FCTN+	Use For:	FCTN+	Use For:	FCTN+
~	W	'	O	\	Z
[	R	"	P	`	C
]	T	¦	A		
_	U	{	F		
?	I	}	G		

Continued-->

Key Codes Continued

FUNCTION AND CONTROL KEY CODES

Press FCTN +	Codes returned when Using CALL KEY(N) KEY(3)or (5)	KEY(4)	
1	3	131	DEL
2	4	132	INS
3	7	135	ERASE
4	2	130	CLEAR
5	14	142	BEGIN
6	12	140	PROCD
7	1	129	AID
8	6	134	REDO
9	15	143	BACK
=	5	133	QUIT
S	8	136	
E	11	139	
D	9	137	
X	10	138	
ENTER	13	141	

Note: When using CALL KEY(3) no control codes are returned! Use CALL KEY(5...)

Using CALL KEY(N)

Press CTRL +	CALL KEY(5)	KEY(4)
A	129	1
B	130	2
C	131	3
D	132	4
E	133	5
F	134	6
G	135	7
H	136	8
I	137	9
J	138	10
K	139	11
L	140	12
M	141	13
N	142	14
O	143	15

Press CTRL +	CALL KEY(5)	KEY(4)
P	144	16
Q	145	17
R	146	18
S	147	19
T	148	20
U	149	21
V	150	22
W	151	23
X	152	24
Y	153	25
Z	154	26
.	155	27
:	156	28
=	157	29
8	158	30
9	159	31
/	187	

SPLIT KEYBOARD CODES (CALL KEY(1... AND 2...)

Two keys for each code- the first key is Key Unit 1, the second is key unit 2.

CODE	KEYS
0	X M
1	A H
2	S J
3	D K
4	W U
5	E I
6	R 0

CODE	KEYS
7	2 7
8	3 8
9	4 9
10	5 0
11	T P
12	F L
13	V .

CODE	KEYS
14	C ,
15	Z N
16	B /
17	G ;
18	Q Y
19	1 6

MUSICAL TONE FREQUENCIES

The following table gives frequencies (rounded to integers) of four octaves of the tempered scale (one half-step between notes). While this list does not represent the entire range of tones – or even of musical tones – it can be helpful for musical programming.

Frequency	*Note*
110	A
117	A#,B♭
123	B
131	C (low C)
139	C#,D♭
147	D
156	D#,E♭
165	E
175	F
185	F#,G♭
196	G
208	G#,A♭
220	A (below middle C)

Frequency	*Note*
220	A (below middle C)
233	A#,B♭
247	B
262	C (middle C)
277	C#,D♭
294	D
311	D#,E♭
330	E
349	F
370	F#,G♭
392	G
415	G#,A♭
440	A (above middle C)
466	A#,B♭
494	B
523	C (high C)
554	C#,D♭
587	D

Frequency	*Note*
587	D
622	D#,E♭
659	E
698	F
740	F#,G♭
784	G
831	G#,A♭
880	A (above high C)

880	A (above high C)
932	A#,B♭
988	B
1047	C
1109	C#,D♭
1175	D
1245	D#,E♭
1319	E
1397	F
1480	F#,G♭
1568	G
1661	G#,A♭
1760	A

APPENDIX D

CHARACTER SETS

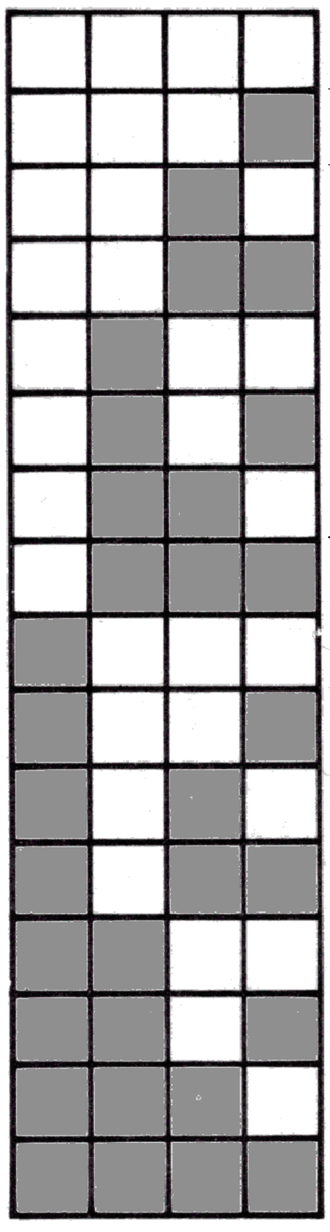
SET	ASCII CODES	SET	ASCII CODES
29	0-7	13	128-135
30	8-15	14	136-143
31	16-23	15	144-151
0	24-31	16	152-159
1	32-39	17	160-167
2	40-47	18	168-175
3	48-55	19	176-183
4	56-63	20	184-191
5	64-71	21	192-199
6	72-79	22	200-207
7	80-87	23	208-215
8	88-95	24	216-223
9	96-103	25	224-231
10	104-111	26	232-239
11	112-119	27	240-247
12	120-127	28	248-255

Character sets are used eg with CALL COLOR

In bit-map mode only charsets 0 to 23 are available- characters 216 to 255 are not accessible.

APPENDIX E

PATTERN-IDENTIFIER CONVERSION TABLE

Blocks	BINARY CODE (0 = off; 1 = on)	HEXADECIMAL CODE
	0000	0
	0001	1
	0010	2
	0011	3
	0100	4
	0101	5
	0110	6
	0111	7
	1000	8
	1001	9
	1010	A
	1011	B
	1100	C
	1101	D
	1110	E
	1111	F

APPENDIX F

COLOR CODES

COLOR	*CODE*	*COLOR*	*CODE*
Transparent	1	Medium Red	9
Black	2	Light Red	10
Medium Green	3	Dark Yellow	11
Light Green	4	Light Yellow	12
Dark Blue	5	Dark Green	13
Light Blue	6	Magenta	14
Dark Red	7	Gray	15
Cyan	8	White	16

APPENDIX G

MATHEMATICAL FUNCTIONS

The following mathematical functions may be defined with DEF as shown.

Function	*Extended BASIC statement*
Secant	DEF SEC(X)=1/COS(X)
Cosecant	DEF CSC(X)=1/SIN(X)
Cotangent	DEF COT(X)=1/TAN(X)
Inverse Sine	DEF ARCSIN(X)=ATN(X/SQR(1-X*X))
Inverse Cosine	DEF ARCCOS(X)=-ATN(X/SQR(1-X*X))+PI/2
Inverse Secant	DEF ARCSEC(X)=ATN(SQR(X*X-1))+(SGN(X)-1)*PI/2
Inverse Cosecant	DEF ARCCSC(X)=ATN(1/SQR(X*X-1))+(SGN(X)-1)*PI/2
Inverse Cotangent	DEF ARCCOT(X)=PI/2-ATN(X) *or* =PI/2+ATN(-X)
Hyberbolic Sine	DEF SINH(X)=(EXP(X)-EXP(-X))/2
Hyberbolic Cosine	DEF COSH(X)=(EXP(X)+EXP(-X))/2
Hyperbolic Tangent	DEF TANH(X)=-2*EXP(-X)/(EXP(X)+EXP(-X))+1
Hyperbolic Secant	DEF SECH=2/(EXP(X)+EXP(-X))
Hyperbolic Cosecant	DEF CSCH=2/(EXP(X)-EXP(-X))
Hyperbolic Cotangent	DEF COTH(X)=2*EXP(-X)/(EXP(X)-EXP(-X))+1
Inverse Hyperbolic Sine	DEF ARCSINH(X)=LOG(X+SQR(X*X+1))
Inverse Hyperbolic Cosine	DEF ARCCOSH(X)=LOG(X+SQR(X*X-1))
Inverse Hyperbolic Tangent	DEF ARCTANH(X)=LOG((1+X)/(1-X))/2
Inverse Hyperbolic Secant	DEF ARCSECH(X)=LOG((1+SQR(1-X*X))/X)
Inverse Hyperbolic Cosecant	DEF ARCCSCH(X)=LOG((SGN(X)*SQR(X*X+1)+1)/X)
Inverse Hyperbolic Cotangent	DEF ARCCOTH(X)=LOG((X+1)/(X-1))/2

APPENDIX H

LIST OF SPEECH WORDS

The following is a list of all the letters, numbers, words, and phrases that can be accessed with CALL SAY and CALL SPGET. See Appendix __ for instructions on adding suffixes to anything in this list.

- (NEGATIVE)
+ (POSITIVE)
. (POINT)
0
1
2
3
4
5
6
7
8
9
A (a)
A1 (^e)
ABOUT
AFTER
AGAIN
ALL
AM
AN
AND
ANSWER
ANY
ARE
AS
ASSUME
AT
B
BACK
BASE
BE
BETWEEN
BLACK
BLUE
BOTH
BOTTOM
BUT
BUY
BY
BYE
C
CAN
CASSETTE
CENTER
CHECK
CHOICE
CLEAR
COLOR
COME
COMES
COMMA
COMMAND
COMPLETE
COMPLETED
COMPUTER
CONNECTED
CONSOLE
CORRECT
COURSE
CYAN
D
DATA
DECIDE
DEVICE
DID
DIFFERENT
DISKETTE
DO
DOES
DOING
DONE
DOUBLE
DOWN
DRAW
DRAWING
E
EACH
EIGHT
EIGHTY
ELEVEN
ELSE
END
ENDS
ENTER
ERROR
EXACTLY
EYE
F
FIFTEEN
FIFTY
FIGURE
FIND
FINE
FINISH
FINISHED
FIRST
FIT
FIVE
FOR
FORTY
FOUR
FOURTEEN
FOURTH
FROM
FRONT
G
GAMES
GET
GETTING
GIVE
GIVES
GO
GOES
GOING
GOOD
GOOD WORK
GOODBYE
GOT
GRAY
GREEN
GUESS
H
HAD
HAND
HANDHELD UNIT
HAS
HAVE
HEAD
HEAR
HELLO
HELP
HERE
HIGHER
HIT
HOME
HOW
HUNDRED
HURRY
I
I WIN
IF
IN
INCH
INCHES
INSTRUCTION
INSTRUCTIONS
IS
IT
J
JOYSTICK
JUST
K
KEY
KEYBOARD
KNOW
L
LARGE
LARGER
LARGEST
LAST
LEARN
LEFT
LESS
LET

LIKE
LIKES
LINE
LOAD
LONG
LOOK
LOOKS
LOWER
M
MADE
MAGENTA
MAKE
ME
MEAN
MEMORY
MESSAGE
MESSAGES
MIDDLE
MIGHT
MODULE
MORE
MOST
MOVE
MUST
N
NAME
NEAR
NEED
NEGATIVE
NEXT
NICE TRY
NINE
NINETY
NO
NOT
NOW
NUMBER
O
OF
OFF
OH
ON
ONE
ONLY
OR
ORDER
OTHER
OUT
OVER
P
PART
PARTNER
PARTS
PERIOD
PLAY
PLAYS
PLEASE
POINT
POSITION
POSITIVE
PRESS
PRINT
PRINTER
PROBLEM
PROBLEMS
PROGRAM
PUT
PUTTING
Q
R
RANDOMLY
READ (read)
READ1 (red)
READY TO START
RECORDER
RED
REFER
REMEMBER
RETURN
REWIND
RIGHT
ROUND
S
SAID
SAVE
SAY
SAYS
SCREEN
SECOND
SEE
SEES
SET
SEVEN
SEVENTY
SHAPE
SHAPES
SHIFT
SHORT
SHORTER
SHOULD
SIDE
SIDES
SIX
SIXTY
SMALL
SMALLER
SMALLEST
SO
SOME
SORRY
SPACE
SPACES
SPELL
SQUARE
START
STEP
STOP
SUM
SUPPOSED
SUPPOSED TO
SURE
T
TAKE
TEEN
TELL
TEN
TEXAS INSTRUMENTS
THAN
THAT
THAT IS INCORRECT
THAT IS RIGHT
THE (the)
THE1 (th^e)
THEIR
THEN
THERE
THESE
THEY
THING
THINGS
THINK
THIRD

List of Speech Words (Continued)

THIRTEEN
THIRTY
THIS
THREE
THREW
THROUGH
TIME
TO
TOGETHER
TONE
TOO
TOP
TRY
TRY AGAIN
TURN
TWELVE
TWENTY
TWO
TYPE
U
UHOH
UNDER
UNDERSTAND
UNTIL
UP
UPPER
USE
V
VARY
VERY
W
WAIT
WANT
WANTS
WAY
WE
WEIGH
WEIGHT
WELL
WERE
WHAT
WHAT WAS THAT
WHEN
WHERE
WHICH
WHITE
WHO
WHY
WILL
WITH
WON
WORD
WORDS
WORK
WORKING
WRITE
X
Y
YELLOW
YES
YET
YOU
YOU WIN
YOUR
Z
ZERO

APPENDIX I

ADDING SUFFIXES TO SPEECH WORDS

This appendix describes how to add ING, S, and ED to any word available in the Solid State Speech™ Synthesizer resident vocabulary.

The code for a word is first read using SPGET. The code consists of a number of characters, one of which tells the speech unit the length of the word. Then, by means of the subprograms listed here, additional codes can be added to give the sound of a suffix.

Words often have trailing-off data that make the word sound more natural but prevent the easy addition of suffixes. In order to add suffixes this trailing-off data must be removed.

The following program allows you to input a word and, by trying different truncation values, make the suffix sound like a natural part of the word.

The subprograms DEFING (lines 1000 through 1130), DEFS1 (lines 2000 through 2100), DEFS2 (lines 3000 through 3090), DEFS3 (lines 4000 through 4120), DEFED1 (lines 5000 through 5070), DEFED2 (lines 6000 through 6110), DEFED3 (lines 7000 through 7130), and MENU (lines 10000 through 10120) should be input separately and saved with the MERGE option.

You may wish to use different line numbers. Each of these subprograms (except MENU) defines a suffix.

DEFING defines the ING sound. DEFS1 defines the S sound as it occurs at the end of "cats". DEFS2 defines the S sound as it occurs at the end of "cads". DEFS3 defines the S sound as it occurs at the end of "wishes". DEFED1 defines the ED sound as it occurs at the end of "passed". DEFED2 defines the ED sound as it occurs at the end of "caused". DEFED3 defines the ED sound as it occurs at the end of "heated".
In running the program, enter a 0 for the truncation value in order to leave the truncation sequence.

```
100 REM ********************
110 REM REQUIRES MERGE OF:
120 REM MENU (LINES 10000 THROUGH 10120)
130 REM DEFING (LINES 1000 THROUGH 1130)
140 REM DEFS1 (LINES 2000 THROUGH 2100)
150 REM DEFS2 (LINES 3000 THROUGH 3090)
160 REM DEFS3 (LINES 4000 THROUGH 4120)
170 REM DEFED1 (LINES 5000 THROUGH 5070)
180 REM DEFED2 (LINES 6000 THROUGH 6110)
190 REM DEFED3 (LINES 7000 THROUGH 7130)
200 REM ********************
```

Continued-->

```
210 CALL CLEAR
220 PRINT "THIS PROGRAM IS USED TO"
230 PRINT "FIND THE PROPER TRUNCATION"
240 PRINT "VALUE FOR ADDING SUFFIXES"
250 PRINT "TO SPEECH WORDS.": :
260 FOR DELAY=1 TO 300::NEXT DELAY
270 PRINT "CHOOSE WHICH SUFFIX YOU"
280 PRINT "WISH TO ADD.": :
290 FOR DELAY=1 TO 200::NEXT DELAY
300 CALL MENU(8,CHOICE)
310 DATA 'ING','S' AS IN CATS,'S' AS IN CADS,'S' AS IN WISHES,
'ED' AS IN PASSED,'ED' AS IN CAUSED,'ED' AS IN HEATED,END
320 IF CHOICE=0 OR CHOICE=8 THEN STOP
330 INPUT "WHAT IS THE WORD? ":WORD$
340 ON CHOICE GOTO 350,370,390,410,430,450,470
350 CALL DEFING(D$)
360 GOTO 480
370 CALL DEFS1(D$)!CATS
380 GOTO 480
390 CALL DEFS2(D$)!CADS
400 GOTO 480
410 CALL DEFS3(D$)!WISHES
420 GOTO 480
430 CALL DEFED1(D$)!PASSED
440 GOTO 480
450 CALL DEFED2(D$)!CAUSED
460 GOTO 480
470 CALL DEFED3(D$)!HEATED
480 REM TRY VALUES
490 CALL CLEAR
500 INPUT TRUNCATE HOW MANY BYTES? ":L
510 IF L=0 THEN 300
520 CALL SPGET(WORD$,B$)
530 L=LEN(B$)-L-3
540 C$=SEG$(B$,1,2)&CHR$(L)&SEG$(B$,4,L)
550 CALL SAY(,C$&D$)
560 GOTO 500
```

The data has been given in short DATA statements to make it as easy as possible to input. It may be consolidated to make the program shorter.

Continued-->

```
1000 SUB DEFING(A$)
1010 DATA 96,0,52,174,30,65
1020 DATA 21,186,90,247,122,214
1030 DATA 179,95,77,13,202,50
1040 DATA 153,120,117,57,40,248
1050 DATA 133,173,209,25,39,85
1060 DATA 225,54,75,167,29,77
1070 DATA 105,91,44,157,118,180
1080 DATA 169,97,161,117,218,25
1090 DATA 119,184,227,222,249,238,1
1100 RESTORE 1010
1110 A$=""
1120 FOR I=1 TO 55::READ
A::A$=A$&CHR$(A)::NEXT I
1130 SUBEND

2000 SUB DEFS1(A$)!CATS
2010 DATA 96,0,26
2020 DATA 14,56,130,204,0
2030 DATA 223,177,26,224,103
2040 DATA 85,3,252,106,106
2050 DATA 128,95,44,4,240
2060 DATA 35,11,2,126,16,121
2070 RESTORE 2010
2080 A$=""
2090 FOR I=1 TO 29::READ
A::A$=A$&CHR$(A)::NEXT I
2100 SUBEND

3000 SUB DEFS2(A$)!CADS
3010 DATA 96,0,17
3020 DATA 161,253,158,217
3030 DATA 168,213,198,86,0
3040 DATA 223,153,75,128,0
3050 DATA 95,139,62
3060 RESTORE 3010
3070 A$=""
3080 FOR I=1 TO 20::READ
A::A$=A$&CHR$(A)::NEXT I
3090 SUBEND
```

Continued-->

```
4000 SUB DEFS3(A$)!WISHES
4010 DATA 96,0,34
4020 DATA 173,233,33,84,12
4030 DATA 242,205,166,55,173
4040 DATA 93,222,68,197,188
4050 DATA 134,238,123,102
4060 DATA 163,86,27,59,1,124
4070 DATA 103,46,1,2,124,45
4080 DATA 138,129,7
4090 RESTORE 4010
4100 A$=""
4110 FOR I=1 TO 37::READ
A::A$=A$&CHR$(A)::NEXT I
4120 SUBEND

5000 SUB DEFED1(A$)!PASSED
5010 DATA 96,0,10
5020 DATA 0,224,128,37
5030 DATA 204,37,240,0,0,0
5040 RESTORE 5010
5050 A$=""
5060 FOR I=1 TO 13::READ A::A$=A$&CHR$(A)::NEXT I
5070 SUBEND

6000 SUB DEFED2(A$)!CAUSED
6010 DATA 96,0,26
6020 DATA 172,163,214,59,35
6030 DATA 109,170,174,68,21
6040 DATA 22,201,220,250,24
6050 DATA 69,148,162,166,234
6060 DATA 75,84,97,145,204
6070 DATA 15
6080 RESTORE 6010
6090 A$=""
6100 FOR I=1 TO 29::READ
A::A$=A$&CHR$(A)::NEXT I
6110 SUBEND
```

Continued-->

```
7000 SUB DEFED3(A$)!HEATED
7010 DATA 96,0,36
7020 DATA 173,233,33,84,12
7030 DATA 242,205,166,183
7040 DATA 172,163,214,59,35
7050 DATA 109,170,174,68,21
7060 DATA 22,201,92,250,24
7070 DATA 69,148,162,38,235
7080 DATA 75,84,97,145,204
7090 DATA 178,127
7100 RESTORE 7010
7110 A$=""
7120 FOR I=1 TO 39::READ A::A$=A$&CHR$(A)::NEXT I
7130 SUBEND


10000 SUB MENU(COUNT,CHOICE)
10010 CALL CLEAR
10020 IF COUNT>22 THEN PRINT "TOO MANY ITEMS" :: CHOICE=0
 :: SUBEXIT
10030 RESTORE
10040 FOR I=1 TO COUNT
10050 READ TEMP$
10060 TEMP$=SEG$(TEMP$,1,25)
10070 DISPLAY AT(I,1):I;TEMP$
10080 NEXT I
10090 DISPLAY AT(I+1,1):"YOUR CHOICE: 1"
10100 ACCEPT AT(I+1,14)BEEP VALIDATE(DIGIT)SIZE(-2):CHOICE
10110 IF CHOICE<1 OR CHOICE>COUNT THEN 10100
10120 SUBEND
```

Continued-->

You can use the subprograms in any program once you have determined the number of bytes to truncate.

The following program uses the subprogram DEFING in lines 1000 through 1130 to have the computer say the word DRAWING using DRAW plus the suffix ING Note that it was found that DRAW should be truncated by 41 characters to produce the most natural sounding DRAWING. The subprogram DEFING in lines 1000 through 1130 is the program you saved with the merge option.

```
100 CALL DEFING(ING$)
110 CALL SPGET("DRAW",DRAW$)
120 L=LEN(DRAW$)-3-41! 3 BYTES OF SPEECH OVERHEAD,
41 BYTES TRUNCATED
130 DRAW$=SEG$(DRAW$,1,2)&CHR$(L)&SEG$(DRAW$,4,L)
140 CALL SAY("WE ARE",DRAW$&ING$,"A1 SCREEN")
150 GOTO 140
1000 SUB DEFING(A$)
1010 DATA 96,0,52,174,30,65
1020 DATA 21,186,90,247,122,214
1030 DATA 179,95,77,13,202,50
1040 DATA 153,120,117,57,40,248
1050 DATA 133,173,209,25,39,85
1060 DATA 225,54,75,167,29,77
1070 DATA 105,91,44,157,118,180
1080 DATA 169,97,161,117,218,25
1090 DATA 119,184,227,222,249,238,1
1100 RESTORE 1010
1110 A$=""
1120 FOR I=1 TO 55::READ A::A$=A$&CHR$(A)::NEXT I
1130 SUBEND
```

(Press FCTN 4 to stop the program.)

APPENDIX J

ERROR MESSAGES

The following lists all the error messages that MYARC Extended BASIC II gives. The first list is alphabetical by the message that is given, and the second list is numeric by the number of the error that is returned by CALL ERR. If the error occurs in the execution of a program, the error message is often followed by IN line-number.

Sorted by Message

#	Message	Descriptions of Possible Errors
74	BAD ARGUMENT	* Bad value given in ASC, ATN, COS, EXP, INT, LOG, SIN, SOUND, SQR, TAN, or VAL. * An array element specified in a SUB statement. * Bad first parameter or too many parameters in LINK.
61	BAD LINE NUMBER	* Line number less than 1 or greater than 32767. * Omitted line number. * Line number outside the range 1 through 32767 produced by RES.
57	BAD SUBSCRIPT	* Use of too large or small subscript in an array. * Incorrect subscript in DIM.
79	BAD VALUE	* Incorrect value given in AND, CHAR, CHR$, CLOSE, EOF, FOR, GOSUB, GOTO, HCHAR, INPUT, MOTION, NOT, OR, POS, PRINT, PRINT USING, REC, RESTORE, RPT$, SEG$, SIZE, VCHAR, or XOR. * Array subscript value greater than 32767. * File number greater than 255 or less than zero. * More than three tones and one noise generator specified in SOUND. * A value passed to a subprogram is not acceptable in the subprogram. For example, a sprite velocity value less than -128 or a character value greater than 143. * Value in ON...GOTO or ON...GOSUB greater than the number of lines given. * Incorrect position given after the AT clause in ACCEPT or DISPLAY.
67	CAN'T CONTINUE	* Program has been edited after being stopped by a breakpoint. * Program was not stopped by a breakpoint.
69	COMMAND ILLEGAL IN PROGRAM	* BYE, CON, LIST, MERGE, NEW, NUM, OLD, RES, or SAVE used in a program.
84	DATA ERROR	

* READ or RESTORE with data not present or with a string where a number value is expected.
* Line number after RESTORE is higher than the highest line number in the program.
* Error in object file in LOAD.

109 FILE ERROR

* Wrong type of data read with a READ statement.
* Attempt to use CLOSE, EOF, INPUT, OPEN, PRINT, PRINT USING, REC, or RESTORE with a file that does not exist or does not have the proper attributes.
* Not enough memory to use a file.

44 FOR-NEXT NESTING

* The FOR and NEXT statements of loops do not align properly.
* Missing NEXT statement.

130 I/O ERROR

* An error was detected in trying to execute CLOSE, DELETE, LOAD, MERGE, OLD, OPEN, RUN, or SAVE.
* Not enough memory to list a program. 16 ILLEGAL AFTER SUBPROGRAM

* Anything but END, REM, or SUB after a SUBEND.

36 IMAGE ERROR

* An error was detected in the use of DISPLAY USING, IMAGE, or PRINT USING.
* More than 10 (E-format) or 14 (numeric format) significant digits in the format string.
* IMAGE string is longer than 254 characters.

28 IMPROPERLY USED NAME

* An illegal variable name was used in CALL, DEF, or DIM.
* Using a MYARC Extended BASIC II reserved word in LET.
* Using a subscripted variable or a string variable in a FOR.
* Using an array with the wrong number of dimensions.
* Using a variable name differently than originally assigned.
  A variable can be only an array, a numeric or string variable, or a user defined function name.
* Dimensioning an array twice.
* Putting a user defined function name on the left of the equals sign in an assignment statement.
* Using the same variable twice in the parameter list of a SUB statement.

81 INCORRECT ARGUMENT LIST

* CALL and SUB mismatch of arguments.

83 INPUT ERROR

* An error was detected in an INPUT.

60 LINE NOT FOUND

* Incorrect line number found in BREAK, GOSUB, GOTO, ON ERROR, RUN, or UNBREAK, or after THEN or ELSE.
* Line to be edited not found.

62 LINE TOO LONG

* Line too long to be entered into a program.

39 MEMORY FULL

* Program too large to execute one of the following: DEF, DELETE, DIM, GOSUB, LET,LOAD, ON...GOSUB, OPEN, or SUB.
* Program too large to add a new line, insert a line, replace a line, or evaluate an expression.

49 MISSING SUBEND

* SUBEND missing in a subprogram.

47 MUST BE IN SUBPROGRAM

* SUBEND or SUBEXIT not in a subprogram.

19 NAME TOO LONG

* More than 15 characters in variable or subprogram name.

43 NEXT WITHOUT FOR

* FOR statement missing, NEXT before FOR, incorrect FOR-NEXT nesting, or branching into a FOR-NEXT loop.

78 NO PROGRAM PRESENT

* No program present when issuing a LIST, RESEQUENCE, RESTORE,RUN, or SAVE command.

10 NUMERIC OVERFLOW

* A number too large or too small resulting from a *,+,-,/ operation or in ACCEPT, ATN, COS, EXP, INPUT, INT, LOG, SIN, SQR, TAN, or VAL.
* A number outside the range -32768 to 32767 in PEEK or LOAD.

70 ONLY LEGAL IN A PROGRAM

* One of the following statements was used as a command: DEF, GOSUB, GOTO, IF, IMAGE, INPUT, ON BREAK, ON ERROR, ON...GOSUB, ON...GOTO, ON WARNING, OPTION BASE, RETURN, SUB, SUBEND,or SUBEXIT.

25 OPTION BASE ERROR

* OPTION BASE executed more than once, or with a value other than 1 or zero.

97 PROTECTION VIOLATION

* Attempt to save, list, or edit a protected program.

48 RECURSIVE SUBPROGRAM CALL

* Subprogram calls itself, directly or indirectly.

51 RETURN WITHOUT GOSUB

* RETURN without GOSUB or an error handled by the previous execution of an ON ERROR statement.

56 SPEECH STRING TOO LONG

* Speech string returned by SPGET is longer than 255 characters.

40 STACK OVERFLOW

* Too many sets of parentheses.
* Not enough memory to evaluate an expression or assign a value.

54 STRING TRUNCATED

* A string created by RPT$, concatenation ("&" operator), or a user defined function is longer than 255 characters.
* The length of a string expression in the VALIDATE clause is greater than 254 characters.

24 STRING-NUMBER MISMATCH

* A string was given where a number was expected or vice versa in a MYARC Extened BASIC II supplied function or subprogram.
* Assigning a string value to a numeric value or vice versa.
* Attempting to concatenate ("&" operator) a number.
* Using a string as a subscript.

135 SUBPROGRAM NOT FOUND

* A subprogram called does not exist or an assembly language subprogram named in LINK has not been loaded.

14 SYNTAX ERROR

* An error such as a missing or extra comma or parenthesis, parameters in the wrong order, missing parameters, missing keyword , misspelled keyword, keyword in the wrong order, or the like was detected in a MYARC Extended BASIC II command, statement, function, or subprogram.
* DATA or IMAGE not first and only statement on a line.
* Items after final ")".
* Misssing "#" in SPRITE.
* Missing ENTER, tail comment symbol (!), or statement separator symbol (::).
* Missing THEN after IF.
* Missing TO after FOR.
* Nothing after CALL, SUB, FOR, THEN, or ELSE.
* Two E's in a numeric constant.
* Wrong parameter list in a MYARC Extended BASIC II supplied subprogram.
* Going into or out of a subprogram with GOTO, GOSUB, ON ERROR, etc.
* Calling INIT without the Memory Expansion peripheral attached.
* Calling LINK or LOAD without first calling INIT.
* Using a constant where a variable is required.
* More than seven dimensions in an array.

17 UNMATCHED QUOTES

* Odd number of quotes in an input line.

20 UNRECOGNIZED CHARACTER

* An unrecognized character such as ? or % is not in a quoted string.
* A bad field in an object file accessed by LOAD.

Error Messages (concluded)

Sorted by Number

#	Message
10	NUMERIC OVERFLOW
14	SYNTAX ERROR
16	ILLEGAL AFTER SUBPROGRAM
17	UNMATCHED QUOTES
19	NAME TOO LONG
20	UNRECOGNIZED CHARACTER
24	STRING-NUMBER MISMATCH
25	OPTION BASE ERROR
28	IMPROPERLY USED NAME
36	IMAGE ERROR
39	MEMORY FULL
40	STACK OVERFLOW
43	NEXT WITHOUT FOR
44	FOR-NEXT NESTING
47	MUST BE IN SUBPROGRAM
48	RECURSIVE SUBPROGRAM CALL
49	MISSING SUBEND
51	RETURN WITHOUT GOSUB
54	STRING TRUNCATED
56	SPEECH STRING TOO LONG
57	BAD SUBSCRIPT
60	LINE NOT FOUND
61	BAD LINE NUMBER
62	LINE TOO LONG
67	CAN'T CONTINUE
69	COMMAND ILLEGAL IN PROGRAM
70	ONLY LEGAL IN A PROGRAM
74	BAD ARGUMENT
78	NO PROGRAM PRESENT
79	BAD VALUE
81	INCORRECT ARGUMENT LIST
83	INPUT ERROR
84	DATA ERROR
97	PROTECTION VIOLATION
109	FILE ERROR
130	I/O ERROR
135	SUBPROGRAM NOT FOUND

The error number is returned when using CALL ERR

APPENDIX K

HIGH-RESOLUTION MODE

In order to stay as compatible as possible with TI Extended BASIC, certain restrictions are in affect when operating in the High-Resolution Mode. To insure proper execution of your program when programming in this mode, please refer to the restrictions and conventions listed below.

1. Only one floppy disk file may be kept open at any given time. If you wish to open a different floppy disk file you must first close any currently open floppy disk file. This restriction does not apply to other peripherals (RS232, RD, PIO,...etc.).

   When your program executes a CALL GRAPHICS(3), ALL open files are CLOSED and a CALL FILES(1) is invoked.

2. Valid character codes extend from character ASCII 0 to 215. Characters 216 to 255 are not accessible.

3. Valid character sets accordingly are 0-23. Character sets 24-28 are not accessible.

4. In High Resolution mode the VDP is not available to load PROGRAM files before they are moved into expansion ram.. To load a PROGRAM file when in High Resolution mode, the program MUST be in IV254 format, not PROGRAM format.
   You can save any program in IV254 format by saving it as: SAVE "DSK2.NAME", INTERNAL

5. ACCEPT and DISPLAY have no effect in High-Resolution Mode.

6. INPUT, LINPUT, PRINT, and PRINT USING can only be used in file access. Attempting to display characters on the screen with these commands/statements will have no effect.

7. WRITE, although somewhat limited, will allow you to display strings on the screen. You may also use HCHAR or VCHAR for screen displays in the High-Resolution Mode.

APPENDIX L

PRESCAN - !@P+ !@P- !@P*

After you enter RUN to start a program, you may notice a pause before the program actually begins. This pause is the time the computer takes to "pre-scan" your program to establish memory space for variables,arrays and data. Then the computer proceeds through each instruction, performs the appropriate functions, and establishes variable values.

Since the time required to pre-scan depends on the length of the program, you may want to decrease the pre-scan pause, particularly if you have a long program.

Extended Basic's pre-scan commands, !@P- and !@P+ and !@P*, allow you to control which instructions will not be pre-scanned. Because the purpose of the pre-scan is to set memory space for variables, only those instructions which contain the first reference to the variables need to be pre-scanned. Therefore, many other instructions in your program do not require a pre-scan.

Careful program planning is required to minimize the statements that need the pre-scan.

When certain types of statements (as explained here) are used in your program, the procedures listed below should be included in the pre-scan.

i. Enter your first DATA statement within the pre-scan.
ii. Include the first use of each variable and/or array.
(Also include the OPTION BASE statement, if used).
iii. Include the first reference to each CALL statement of any subprogram.
iv. Include all DEF statements for user-defined functions.
v. Include all SUB statements and SUBEND statements in the pre-scan.

Note that a variable in a user-defined (SUB) subprogram is considered to be unique from any other variable used elsewhere in your program, even though the name and value may be the same. Therefore, each variable used in a user-defined subprogram must be included in the pre-scan.

To use the pre-scan option, first be certain that your completed program runs successfully. Then, at the beginning of a group of function statements, use the !@P- command to "turn off" the pre-scan. The following statements will not be pre-scanned, allowing the execution of your program to begin more quickly. Any statements related to variable names (not previously referenced during pre-scan) return a syntax error if the pre-scan is "off".

Note that !@P- cannot be followed by another statement in a multiple statement.

To resume the pre-scan, simply enter the command !@P+. This command causes the pre-scan to "turn on" and memory space for variables may be set. Remember to use the !@P+ command before a SUB or SUBEND statement and do not incorporate this command as a part of a multiple statement.

Continued-->

You may choose to use the pre-scan feature several times throughout your program. By turning the pre-scan on and off, your program can begin to execute more efficiently. The effectiveness of the pre-scan is more noticeable in large programs than small programs. Note that when using the TI-99/4A Computer, the commands, !@P- and !@P+, may also be entered with a lower-case "p" character.
The following examples illustrate how to include the pre-scan statements in an existing program. The final example demonstrates the most efficient use of the pre-scan feature by making use of a GOTO statement.

Examples:

Original program

```
100 CALL CLEAR
110 CALL CHAR(96,"FFFFFFFFFFFFFFFF")
120 CALL CHAR(42,"0F0F0F0F0F0F0F0F")
130 .
140 .
150 .
160 CALL HCHAR(12,17,42)
170 CALL VCHAR(14,17,96)
180 DELAY = 0
190 FOR DELAY=1 TO 500
200 NEXT DELAY
210 DATA 3
220 .
230 .
```

With pre-scan control added:

```
 10 DATA 3
100 CALL CLEAR
110 CALL CHAR(96,"FFFFFFFFFFFFFFFF")
120 CALL CHAR(42,"0F0F0F0F0F0F0F0F")
125 !@P-
130 .
140 .
150 .
155 !@P+
160 CALL HCHAR(12,17,42)
170 CALL VCHAR(14,17,96)
180 DELAY=0
185 !@P-
190 FOR DELAY=1 TO 500
200 NEXT DELAY
210 .
220 .
230 .
```

Notice that the first DATA statement has been moved to the beginning of the program so that it is included in the pre-scan. By including statements 125, 155 and 185, the pre-scan is turned off and on and off again. This causes the program to begin to execute more quickly.

Continued-->

With GOTO added:
You have the added ability to "trick" the computer into establishing memory space for CALL statements, as well as variable-related statements, without actually performing those statements. To do this, simply use a GOTO instruction in your program.
The following example demonstrates the original program adapted with a pre-scan and a GOTO statement.

```
 10 DATA 3
 20 GOTO 100 :: DELAY :: CALL CHAR :: CALL CLEAR ::
      CALL HCHAR :: CALL  VCHAR :: !@P-
100 CALL CLEAR
110 CALL CHAR(96,"FFFFFFFFFFFFFFFF")
120 CALL CHAR(42,"0F0F0F0F0F0F0F0F")
130 .
140 .
150 .
160 CALL HCHAR(12,17,42)
170 CALL VCHAR(14,17,96)
180 DELAY=0
190 FOR DELAY=1 TO 500
200 NEXT DELAY
210 .
220 .
230 .
```

Note that the GOTO method causes the necessary memory space to be reserved in line 20. However, the statements in line 20 do not execute until they are encountered further on in the program. Thus, as shown in the preceding and following examples, you can put all of your variable references together and your subprogram calls do not have to be syntactically correct. This can be the most efficient use of the pre-scan option.

```
100 GOTO 180 :: X,Y,ALPHA,BETA,Z=DELTA :: DIM B(10,10)
110 CALL KEY :: CALL HCHAR :: CALL CLEAR :: CALL MYSUB
120 DATA 1,3,STRING
130 DEF F(X)=1-X*SIN(X)
140 .
150 .
160 .
170 !@P-
180 .
190 .
200 .
```

The command !@P- stops the variable scan but syntax checking scans continue- for example checking correct FOR-NEXT loops.
When you are certain that all syntax is correct in all circumstances, you can reduce the prescan time even further by using !@P*
The command !@P* stops all prescan.

APPENDIX M

RELATIONAL AND LOGICAL EXPRESSIONS, BITWISE OPERATIONS

Relational: < > = Logical: AND NOT OR XOR

IF X=6 OR B=8 AND C<8 B=NOT 3=4 AND (NOT 6=5 XOR 2=2)

Relational expressions are most often used in the IF-THEN-ELSE statement, but may be used anywhere that numeric expressions are allowed. A relational expression has a value of -1 if it is true and a value of 0 if it is false. Relational operations are performed, from left to right, after all arithmetic operations are completed and before string concatenation (the ampersand operator). The relational expressions are:

Equal to (=)	Not equal to (<>)
Less than (<)	Less than or equal to (<=)
Greater than (>)	Greater than or equal to (>=)

The following examples illustrate the use of relational expressions:
>100 IF X<Y THEN 200 ELSE GOSUB 420
This line will next execute line 200 if X is less than Y.
If X is greater than or equal to Y, then the statement GOSUB 420 is executed.

>100 IF L(C)=12 THEN C=S+1 ELSE COUNT=COUNT+1::GOTO 140
This line will set C equal to S plus 1 if L(C) equals 12.
If L(C) is not equal to 12, then COUNT is set equal to COUNT plus 1 and
Line 140 is executed next.

>100 A=2<5
This line sets A equal to -1 as it is true that 2 is less than 5.

> 100 PRINT "THIS"="THAT"
This line prints 0 as it is not true that "THIS" is equal to "THAT".

> 100 A=B=7
This line A equal to -1 if B is equal to 7, and to 0 if B is not equal to 7.
There is no effect on B.

Logical expressions are used with relational expressions. The logical operators are AND, OR, NOT, and XOR. If true, logical expressions are given a value of -1.
If false, they are given a value of 0.
The order of precedence for logical expressions, from highest to lowest,
is NOT, XOR, AND, and OR.
A logical expression using AND is true if both its left and right clauses are true.
A logical expression using OR is true if either its left clause is true, its right clause is true, or both its left and right clauses are true.
A logical expression using NOT is true if the clause following it is not true.
A logical expression using XOR (exclusive or) is true if either its left or its right clause is true, but not both its left and right clauses are true.

Continued-->

The following examples illustrate the use of logical expressions:

>100 IF 3<4 AND 5<6 THEN L=7
sets L equal to 7 since 3 is less than 4 and 5 is less than 6.

>100 IF 3<4 AND 5>6 THEN L=7
does not set L equal to 7 because 3 is less than 4, but 5 is not greater than 6.

>100 IF 3<4 OR 5>6 THEN L=7
sets L equal to 7 because 3 is less than 4.

>100 IF 3<4 XOR 5>6 THEN L=7
L equal to 7 because 3 is less than 4 and 5 is not greater than 6.

>100 IF 3<4 XOR 5<6 THEN L=7
does not set L equal to 7 because 3 is less than 4 and 5 is less than 6.

> 100 IF NOT 3=4 THEN L=7
L equal to 7 because 3 is not equal to 4.

>100 IF NOT 3=4 AND (NOT 6=5 XOR 2=2) THEN 200
does not pass control to line 200 because while it is true that 3 is not equal to 4, it is true that both 6 is not equal to 5 and 2 is equal to 2, so the clause in parentheses is not true.

>100 IF (A OR B) AND (C XOR D) THEN 200
passes control to Line 200 if either A or B or both A and B are true (equal to -1), and C or D, but not both C and D are true (equal to -1).

BITWISE OPERATORS

The logical operators can also be used directly on numbers.
They convert the numbers to binary notation, perform the designated operation on a bit level, and then convert the result back to decimal representation.

The numbers must be from -32,768 to 32,767, represented in binary notation as from 1000000000000000 to 0111111111111111, with negative numbers given in 2's complement form signified by a 1 in the most significant bit.

In binary notation, each place is an additional power of 2 rather than an additional power of 10 as in decimal notation.

```
512 256 128  64 32 16 8 4 2 1
 0   0   0   0   0  0 0 0 0 1  = 1
 0   0   0   0   0  0 0 1 1 0  = 6
 0   0   0   0   0  1 1 0 0 1  = 25
```

AND places a 1 in the corresponding binary position if there is a 1 in both the number preceding and following it.
Otherwise it places a zero.

OR places a 1 in the corresponding binary position if there is a 1 in either the number preceding it or following it or both.
Otherwise it places a zero.

Continued-->

XOR places a 1 in the corresponding binary position if there is a 1 in either the number preceding it or following it but not both. Otherwise it places a zero.

NOT places a 1 in the corresponding binary position if there is a zero in the number following it. Otherwise it places a zero.

The following illustrate the result of the logical operators when used on numbers

	Decimal	Binary	Decimal	Binary
A:	1	0000000000000001	1	0000000000000001
B:	2	0000000000000010	3	0000000000000011
A AND B:	0	0000000000000000	1	0000000000000001
A:	6	0000000000000110	47	0000000000101111
B:	5	0000000000000101	62	0000000000111110
A AND B:	4	0000000000000100	46	0000000000101110

	Decimal	Binary	Decimal	Binary
A:	1	0000000000000001	1	0000000000000001
B:	2	0000000000000010	3	0000000000000011
A OR B:	3	0000000000000011	3	0000000000000011
A:	6	0000000000000110	47	0000000000101111
B:	5	0000000000000101	62	0000000000111110
A OR B:	7	0000000000000111	63	0000000000111111

	Decimal	Binary	Decimal	Binary
A:	1	0000000000000001	1	0000000000000001
B:	2	0000000000000010	3	0000000000000011
A XOR B:	3	0000000000000011	2	0000000000000010
A:	6	0000000000000110	47	0000000000101111
B:	5	0000000000000101	62	0000000000111110
A XOR B:	3	0000000000000011	17	0000000000010001

	Decimal	Binary	Decimal	Binary
A:	1	0000000000000001	2	0000000000000010
NOT A:	-2	1111111111111110	-3	1111111111111101
A:	6	0000000000000110	47	0000000000101111
NOT A:	-7	1111111111111001	-48	1111111111010000

There is a User Group where members with a 99/4 sets bit 1, members with a 99/4a sets bit 2, members with a printer sets bit 3, members with a disk drive sets bit 4. If a member has all 4 and all 4 bits are set the value of binary 1111 is 1+2+4+8 = 15.
Does the member have a printer (bit 3) ? Print the members number AND 0100 eg AND 4.
12 AND 4 = 4 7 AND 4 = 4 9 AND 4 = 0
where 12 is binary 1100 which has bit 3 set. 9 is binary 1001 which does not have bit 3 set.
If the result is 0 the member does not have that equipment.

APPENDIX N

NUMERICAL ACCURACY

This text is from the US version of the Users Reference guide and did not appear in European versions. It describes how the TI99/4A stores and handles numbers.

Accuracy information - Displayed results versus accuracy

Computers, like all other devices, must operate with a fixed set of rules within preset limits. The TI computer uses especially powerful internal notation to represent numbers. The mathematical tolerance of the computer is controlled by the number of digits it uses for calculations.

The computer appears to use 10 digits as shown by the display, but actually uses more to perform all calculations. When rounded for display purposes, these extra digits help maintain the accuracy of the values presented. Example:

1/3 × 3 = .9999999999 (inaccurate)

The example shows that 1/3=.3333333333, when multiplied by 3, produces an inaccurate answer. However, a 13-digit string of nines, when rounded to 10 places, will equal 1.0000000000.
The higher order mathematical functions use iterative and polynomial calculations.

The cumulative rounding error is usually maintained below the 10-digit display so that no effect can be seen.
The 13-digit representation of a number is three orders of magnitude from the displayed tenth digit. In this way the display assures that results are rounded accurately to ten digits.

Normally there is no need to even consider the undisplayed digits. On certain calculations, as with any computer, these digits may appear as an answer when not expected.

The mathematical limits of a finite operation (word length, truncation and rounding errors) do not allow these digits to always be completely accurate.
Therefore, when subtracting two expressions which are mathematically equal, the computer may display a non-zero result. Example:

```
X = 2/3 - 1/3 - 1/3
PRINT X
1E-14
```

The final result indicates a discrepancy in the fourteenth digit.
The above fact is especially important when writing your own programs.
When testing a calculated result to be equal to another value, precautions should be taken to prevent improper evaluation. For the above example, the statement

```
X = 1E-10*(INT(X*1E10))
```

will truncate the undisplayed digits of the variable X leaving only the rounded display value for further use.

Continued-->

Technical information on number representation

Technically speaking, your computer uses a 7-digit Radix-100 mantissa for internal calculations. A single Radix-100 digit has a range of value from 0 to 99 in base-10 arithmetic. This means that a 7-digit Radix-100 number will correspond to decimal precision of 13 to 14 digits, depending on the value.

Radix-100 exponents range in value from -64 to +63 which yield decimal values of 10-128 to 10+126.
The Radix-100 mantissa and exponent combine to provide an equivalent decimal range of from -9.999999999999E127 through -1.000000000000E-128; zero;
and then +1.000000000000E-128 on through +9.999999999999E127.

The internal format of each numerical value consists of eight bytes.
The first byte contains the exponent and its sign, biased by 40 hex.
The remaining bytes contain the mantissa, with the most significant digit first.
The number is normalized so that the decimal point is immediately after the most significant digit.
If the number is negative, then the first two bytes are complemented.

```
Examples
The number 12710 is represented as:
    EXP   MSD                              LSD
    41    01 1B       00   00   00   00   00
```

```
The fraction 0.510 is represented as:
    3F    32   00     00   00   00   00   00

 The value of π/2 is represented as:
    40    01   39     07   60   20   43   5F

 The value of -π/2 is:
    BF    FF   39     07   60   20   43   5F
```

APPENDIX O

FUNCTION KEYS

This text is adapted from the TI Extended Basic manual for Version 100 for the TI99/4.

Special key functions

The following are the keys that have a special function when pressed at the same time as the FCTN key:
E, D, S, X, 8, 3, 2, 1, 4, =. Each of these keys is discussed below.

FCTN E (UP) is used in the Edit Mode. If you are not in the Edit Mode, you may enter it by typing a line number and then pressing FCTN E (UP). The line specified is then displayed on the screen and may be edited. If you are already in the Edit Mode, pressing FCTN E (UP) enters the present line as you have changed it and displays the next lower numbered line in the program. Pressing FCTN E (UP) when you are at the lowest numbered line in the program returns you to the Command Mode. If you are entering a line in the Command Mode, FCTN E (UP) has the same effect as ENTER.

FCTN D (RIGHT) moves the cursor one space to the right. The cursor does not erase or change the characters as it passes over them. At the end of a line on the screen, the cursor wraps around to the next screen line. When the cursor is at the end of an input line, it does not move.

FCTN S (LEFT) moves the cursor one space to the left. The cursor does not erase or change characters as it passes over them. If the cursor is at the beginning of a line, the cursor does not move. If the cursor is at the left margin but not at the beginning of an input line, the cursor goes to the right margin of the screen line above it.

FCTN X (DOWN) is used in the Edit Mode. If you are not in the Edit Mode, you may enter it by typing a line number and then pressing FCTN X (DOWN). The line specified by the line number is then displayed on the screen and may be edited. If you are in the Edit Mode, pressing FCTN X (DOWN) enters the present line as you have changed it and displays the next higher numbered line in the program.
Pressing FCTN X (DOWN) when you are at the highest numbered line in the program returns you to the Command Mode. If you are entering a line in the Command Mode, FCTN X (DOWN) has the same effect as ENTER.

FCTN 8 (REDO) causes the characters on the line previously input to reappear on the screen. Thus if you wish to enter a line similar to the most recently entered line, press FCTN 8 (REDO). If you enter a line and make a mistake, you can recall the line using FCTN 8 (REDO) and correct it using the Edit Mode features. This key lets you avoid retyping a long line.

FCTN 3 (ERASE) erases all characters on the current line, but leaves the cursor on that line. If you are in the Command Mode, the cursor returns to the left margin of the screen and you may enter a new line, including the line number. However, if you are editing a line or the computer is providing the line numbers (through the use of NUM), the line number is not erased.

FCTN 2 (INSERT) instructs the computer to accept inserted characters. Each subsequent key that you type is inserted at the cursor position and the character at the cursor position and all characters to the right of the cursor are shifted one position to the right. Insertion continues with each character typed until ENTER or one of the other special function keys is pressed. Characters at the end of a long input line may be lost.

Continued-->

FCTN 1 (DELETE) deletes the character that the cursor is on and shifts all characters to the right of the cursor one position to the left.

FCTN 4 (CLEAR) performs different functions depending on the mode that you are in. If you are in the Edit Mode, any changes that were made to the line are ignored, including FCTN 3 (ERASE), and the computer returns to Command Mode. If you are in Run Mode, the program is stopped with a breakpoint.
If you are in Command Mode, the characters that you have typed on the current line are deleted. When using FCTN 4 (CLEAR) to stop a program, hold the keys down until TI Extended Basic recognizes the breakpoint.

FCTN = (QUIT) returns the computer to the master title screen. When you press FCTN = (QUIT), all data and program material are erased from the computer's memory. If you are using a disk system, some of your data files may be lost. Leave TI Extended Basic by entering BYE instead of FCTN = (QUIT).

ENTER indicates that you have finished the information on the current line and are ready for the computer to process it.

Appendix P MYARC XBII AND ASSEMBLY LANGUAGE

Most TI Assembly programs intended to be loaded with Editor Assembler Option 5 (PROGRAM files on the disk) can be RUN from Myarc XBII - e.g. RUN "DSK1.CARWARS".
Extended Basic programs with embedded assembly (such as prepared with ACE or SYSTEX) will not operate as the programs will be in CPU ram not VDP ram.

Assembly language support routines detailed on Pages 415-416 of the Editor Assembly Manual are supported EXCEPT for routines that manipulate data in VDP ram. Myarc XBII uses the VDP memory area quite differently to TI Extended Basic in order to allow for larger programs and bit map graphics.
If the following routines are invoked using an XML they will return as a NOOP:
NEXT, COPCT, GETSTR, MEMCHK, VPUSH, VPOP, ASSGNV, VGWITE, GVWITE.

Memory mapping for VDP RAM can be found at the back of the Manual in Appendix A on page 218.

Myarc XBII uses a similar loader to the Editor Assembler module and therefore can load object code in both compressed and uncompressed format.

The following symbols are predefined and can be used in your software using the REF directive:
PAD, GPLWS, SOUND, VDPRD, VDPSTA, VDPWD, VDPWA, SPCHRD, SPCHWT, GRMRD, GRMRA, GRMWD, GRMWA, SCAN, XMLLNK, KSCAN, VSBW, VSBR, VMBW, VMBR, VWTR, DSRLNK, LOADER, NUASG, NUMREF, STRASG, STRREF.

All of the returns in Editor Assembler Manual 24.11 are supported, but if you use the alternative return of 24.11.3, you must NOT alter the value at memory location >8300 as this contains the return linkage to XBII.

From Version 2.11 the Myarc Floppy Disk contains a file called TIVDP. This utility was developed to solve many of the problems loading assembly language from Extended Basic (CALL LOADing DF80 files).The utility causes VDP ram and VDP registers to be the same as used in TI Extended Basic. A side effect is that when invoked the screen will blank.
If you invoke the utility from a running program, this will not be a problem:
200 CALL INIT :: CALL LOAD("DSK1.TIVDP") :: CALL INIT
then load the DF80 files in the usual way with CALL LOAD...

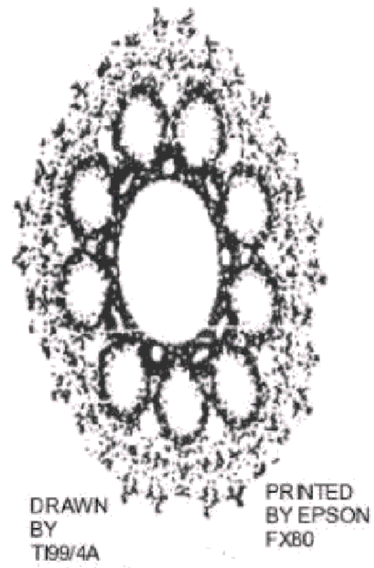
If the DF80 assembly is a standalone self starting program you may type at the command line:

CALL INIT :: CALL LOAD("DSK1.TIVDP") :: CALL INIT :: CALL LOAD("DSK2.PROGRAM")
- if there is an error and you have a blank screen, just type in NEW then press the ENTER key and the VDP will be restored to normal Myarc XB state.

The MGR3 file of DM1000 assumes a 40 column screen and can be loaded with:
CALL GRAPHICS(2) :: OLD "DSK2.MGR3" while Funlweb can be loaded with the FWLOAD file as the usual XB LOAD program contains embedded machine code.

TI Forth can be loaded if you have the version to be loaded with the Mini Memory module.

Note that programs that require an interrupt such as a screen dump routine may not function - however a screen dump that uses eg "CALL LINK("DUMP")" may work properly.




```
 2 !  EXPLORING THE MARTIN SET
 3 !  from Dr Barry Martin, Aston University
 4 !  with alternate sub set from J de Riva
 5 !   Stephen Shaw UK 1989
 20 ON ERROR 10000
 40 RANDOMIZE
 60 CALL GRAPHICS (3)
 80 Q= INT(RND*2)+1
 100 CALL WRITE(1,24,28,STR$(Q))
 120 ON Q GOTO 1000,2000
 1000 REM
 1020 A=(RND*5000-RND*5000)*RND*RND :: B=15*RND*RND*RND :: C=(RND*5500-
RND*5500)*RND*RND
 1040 CALL WRITE(1,2,3,STR$(A),2,9," " &STR$(B),2,18," " &STR$(C))
 1060 X,Y=0
 1070 GOSUB 5000
 1080 FOR L= 1 TO 8000+INT(RND*5000)-(FLAG=1)*5000
 1100 CALL POINT(1,INT(X*XS+XO),INT(Y*YS+YO))
 1120 XX=Y+SGN(X)*SQR(ABS(B*X-C)):: Y=A-X :: X=XX :: NEXT L :: GOSUB 12000 :: RUN
 2000 REM
 2020 A= (RND*4000-RND*4000)*RND*RND :: B=15*RND*RND*RND :: C=(RND*3000-
RND*3000)*RND*RND
 2040 X,Y=0
 2050 GOSUB 6000
 2060 FOR L= 1 TO 8000+RND*6000-(FLAG=1)*5000
 2080 CALL POINT(1,INT(X*XS+XO),INT(Y*YS+YO))
 2100 XX=Y-SGN(X)*SQR(ABS(B*X-C)) :: Y=A-X :: X=XX :: NEXT L :: GOSUB 12000 :: RUN
 5000 CALL WRITE(1,12,2,"one moment..."):: FOR L=1 TO 200
 5010 GOSUB 9000
 5020 XX=Y+SGN (X) *SQR (ABS (B*X -C)):: Y=A-X :: X=XX :: NEXT L ::
GOSUB 9500
 5030 CALL WRITE(1,12,2, "                    ") :: RETURN
 6000 FOR L=1 TO 200
 6010 GOSUB 9000
 6020 XX=Y-SGN (X) *SQR(ABS(B*X-C)) :: Y=A-X :: X=XX :: NEXT L :: GOSUB 9500 ::
 RETURN
 9000 REM SUB SCALE
 9001 CALL WRITE(1,14,4, "WORKING. . . ")
 9002 MINX=MIN(MINX,X) :: MAXX=MAX(MAXX,X) :: MINY=MIN(MINY,Y) :: MAXY=MAX(MAXY,Y)
 9004 SUMX=SUMX+X :: SUMY=SUMY+Y :: RETURN
 9500 AVX=SUMX/200 :: AVY=SUMY/200
 9505 SX=MAXX-MINX :: SY=MAXY-MINY
 9510 CALL WRITE(1,14,4,"                                        ")
 9520 XS=(192/SX)*0.5 :: YS=(256/SY)*0.5
 9521 IF XS+YS <  0.6 AND XS+YS >  0.35 THEN XS=XS*1.4 :: YS=YS*1.4
 9525 XO=96-AVX*XS :: YO=128-AVY*YS
 9526 IF XS+YS <  0.44 THEN XS=XS*3 :: YS=YS*3 :: FLAG=1
 9600 RETURN
 10000 ON ERROR 10000
 10001 RETURN NEXT
 10002 END
```

More graphics programs follow -->

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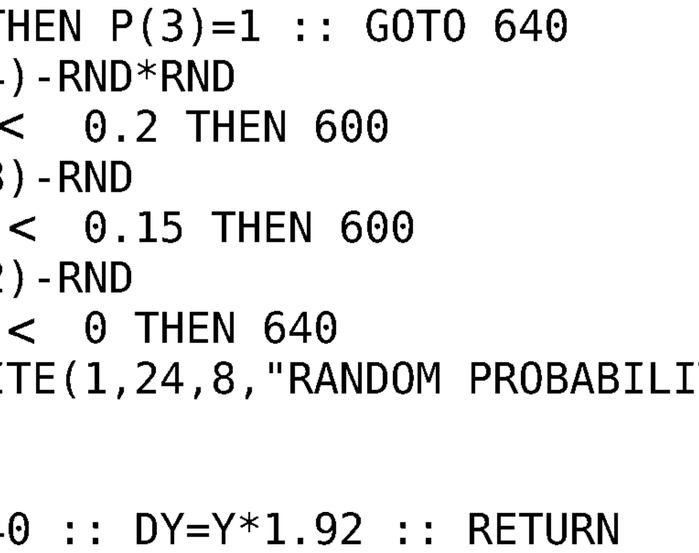
```
1 ! MYARC XB FRACTAL PROG 2
2 !  SQUARE TRIANGLE TREE AND
3 ! FERN using Random Iter-
4 ! ation AlGorithm
5 ! From FRACTALS EVERYWHERE
6 ! by Michael Barnsley
7 ! SPIRAL from FRACTAL
8 ! REPORT 2, Keith Wood
9 ! Q=8 by S Shaw
10 ! Stephen Shaw UK 1989
100 RANDOMIZE
110 ON ERROR 780
120 CALL GRAPHICS(3)
130 Q=INT(RND*8)+1
140 IF Q>4 AND Q    7 AND RND>0.5
THEN 130
150 ON Q GOTO 160,170,180,19
0,200,210,220,230
160 RESTORE 240 :: GOTO 320
! TRIANGLE
170 RESTORE 250 :: GOTO 320
180 RESTORE 260 :: GOTO 320
190 RESTORE 270 :: GOTO 320
200 RESTORE 280 :: GOTO 320
210 RESTORE 290 :: GOTO 320
220 RESTORE 300 :: GOTO 320
230 RESTORE 310 :: GOTO 320
240 DATA 0.5,0,0,0.5,1,1,0.3
3,0.5,0,0,0.5,1,50,0.33,0.5,
0,0,0.5,50,50,0.34,,,
250 DATA 0.5,0,0,0.5,1,1,0.2
5,0.5,0,0,0.5,50,1,0.25,0.5,
0,0,0.5,1,50,0.25,0.5,0,0,0.
5,50,50,0.25
260 DATA 0,0,0,0.16,0,0,0.01
,0.85,0.04,-0.04,0.85,0,1.6,
0.85,0.2,-0.26,0.23,0.22,0,1
.6,0.07,-0.15,0.28,0.26,0.24
,0,0.44,0.07,,
270 DATA 0,0,0,0.5,0,0,0.05,
0.42,-0.42,0.42,0.42,0,0.2,0
.4,0.42,0.42,-0.42,0.42,0,0.
2,0.4,0.1,0,0,0.1,0,0.2,0.15,,
280 DATA 0,0.5,0.5,0,0,0,0.2
5,0.5,0,0,0.5,0.0.5,0.25,0.5
,0,0,0.5,0.5,0.5,0.25,0,-0.5
,-0.5,0,1,0.5,0.25,,,
290 DATA 0.5,0,0,0.5,1,1,0.1
,0.5,0,0,0.5,50,1,0.2,0.5,0,
0,0.5,1,50,0.3,0.5,0,0,0.5,5
0,50,0.4,,,
300 DATA 0.846,-0.308,0.308,
0.846,0,0,0.9,-0.163,-0.163,
0.163,-0.163,1,-1,0.1,0,0,0
,0,0,0,0,0,0,0,0,0,0,0,,,
310 DATA 0.45,0,0,0.45,0.55,
0,0.25,0.45,0,0,0.45,0,0.55,
0.25,0.45,0,0,0.45,0.55,0.55
,0.25,0.45,0,0,0.45,0,0,0.25,,,,
320 FOR Z=1 TO 4+(Q=1)
330 READ A(Z),B(Z),C(Z),D(Z)
,E(Z),F(Z),POSS
340 P(Z)=P(Z-1)+POSS :: NEXT Z
350 IF RND <  0.15 THEN GOSUB 590
360 REM
370 CALL WRITE(1,1,12,STR$(Q))
380 IF Q=6 THEN Q=2
390 X,Y=0 :: NUMITS=10000
400 FOR N=1 TO NUMITS
410 REM
420 REM
430 K=RND+0.00000001
440 IF K <  (1) THEN K=1 :: GOTO 480
450 IF K <  (2) THEN K=2 :: GOTO 480
460 IF IF K <  P(3) THEN K=3 :: GOTO 480
470 K=4
490 REM
490 REM
500 NEWX=A(K)*X+B(K)*Y+E(K)
510 NEWY=C(K)*X+D(K)*Y+F(K)
520 X=NEWX :: Y=NEWY
530 IF DX  >  390 OR DY>390 THEN RUN
540 IF N  <  11 THEN 570
550 ON Q GOSUB 710 ,720,730,740,750,
750,760,770
560 CALL POINT (1,DY,DX)
570 NEXT N
580 CALL SOUND (200,200,1) :: RUN
590 REM DIFFERENT PROBABILITIES- RANDOM
600 P(4)=1
610 IF Q=1 THEN P(3)=1 :: GOTO 640
620 P(3)=P(4)-RND*RND
630 IF P(3) <  0.2 THEN 600
640 P(2)=P(3)-RND
650 IF P(2) <  0.15 THEN 600
660 P(1)=P(2)-RND
670 IF P(1) <  0 THEN 640
680 CALL WRITE(1,24,8,"RANDOM PROBABILITY")
690 RETURN
700 STOP
710 DX=X*2+40 :: DY=Y*1.92 :: RETURN
720 DX=X*1.3+40 :: DY=Y*1.3+50 :: RETURN
730 DX=X*40+120 :: DY=193-Y*19+5 :: RETURN
740 DX=120-X*250 :: DY=200-Y*380 :: RETURN
750 DX=X*150+60 :: DY=Y*150+30 :: RETURN
760 DX=190-X*98 :: DY=80-75*Y :: RETURN
770 DX=X*160+30 :: DY=Y*160+25 :: RETURN
780 ON ERROR 780 :: RETURN NEXT
790 END
```



MORE PROGRAMS-->

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```
1 REM FREEFORM ART BY STEPHEN SHAW 1982 FOR MYARC XB NOV 1989
2 REM BASED ON WORK BY JEREMY RUSTON
3 REM
4 RANDOMIZE
5 XX=INT(RND*110+40) :: YY=INT(RND*110+40) :: LL=INT(RND*110+40) :: MM=INT
(RND*110+40) :: UU=10-RND*20 :: VV=10-RND*20
6 PP=10-RND*20 :: QQ=10-RND*20
7 CALL GRAPHICS (3)
8 FOR K=1 TO 30
9 X2=XX :: Y2=YY :: X3=LL :: Y3=MM :: GOSUB 16
10 IF XX+UU>150 OR XX+UU<40 THEN UU=-UU
11 IF YY+VV>150 OR YY+VV<41 THEN VV=-VV
12 IF LL+PP>150 OR LL+PP<39 THEN PP=-PP
13 IF MM+QQ>148 OR MM+QQ<38 THEN QQ=-QQ
14 XX=XX+UU :: YY=YY+VV :: LL=LL+PP :: MM=MM+QQ ::  NEXT K :: CALL WRITE
(1,24,3, "SPACE FOR ANOTHER")
15 CALL KEY(0,A,B) :: IF A=32 THEN RUN ELSE 15
16 DX=X3-X2 :: DY=Y3-Y2 :: IF (DX=0)+(DY=0) THEN 20
17 IF ABS(DX)>ABS(DY) THEN 19
18 FOR LCV=Y2 TO Y3 STEP SGN
(DY) ::  R=INT(.5+LCV) :: C=
INT(0.5+X2+DX/DY*(LCV-Y2)) :
: CALL DOT(R,C) :: NEXT LCV
:: RETURN
19 FOR LCV=X2 TO X3 STEP SGN
(DX) :: C=INT(0.5+LCV) :: R=
INT(0.5+Y2+DY/DX*(LCV-X2)) :
: CALL DOT(R,C) :: NEXT LCV
:: RETURN
20 IF (DX=0)-(DY=0) THEN 21 ELSE RETURN
 21 IF DY=0 THEN 23
 22 C=INT(0.5+X2) :: FOR LCV=Y2 TO Y3 STEP SGN(DY) :: R=INT(0.5+LCV) ::
  CALL DOT(R, C) :: NEXT LCV :: RETURN
 23 R=INT(0.5+Y2) :: FOR LCV=X2 TO X3 STEP SGN(DX) :: C=INT(0.5+LCV) ::
  CALL DOT(R, C) :: NEXT LCV :: RETURN
 24 STOP
 25 SUB DOT(R,C) :: CALL POINT(1,R,C) :: SUBEND
 26 END
```

Notes:
Line 16 IF (DX=0)+DY=0) THEN is the same as saying IF (DX=0) OR (DY=0)

Line 20 IF (DX=0)-(DY=0) will not transfer to 21 if DX and DY are either both zero, or both not zero. If either has a value other than zero, the transfer to 21 takes place. In modern parlance the minus is here a bitwise XOR operator.
Another way to program this would be:

```
20 IF (DX=0) AND (DY=0) THEN
 RETURN ELSE IF (DX<>0) AND (D
Y<>0) THEN RETURN
```

More--->

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AT&T have a graphic routine to demo their DMD5620 terminal. and Peter Maurer (a mathematician of AT&T) published the algorithm in The American Mathematical Monthly, Vol 94. pages 631 to 645. This was in turn picked up by Keith Devlin and published in The Guardian on June 2nd 1988.

There is a Wikipedia article on the MAURER ROSE

Good values to input are: N=4, D=43 or N=5, D=97.

The code to 'draw' or 'line' etc is in the Form : X * SCALE + ORIGIN.

Some plots are utterly simplistic -possibly just a point!- while others can be remarkably complex, and all done with nothing but STRAIGHT LINES!

```
100 CALL GRAPHICS(1)
110 DEFINT N,D,A
120 DISPLAY AT(7,11)ERASE ALL : "N=" ::
 DISPLAY AT(9,11) : "D="
130 ACCEPT AT(7,13)5IZE(3)VALIDATE (DIGIT) : N ::
IF N<1 OR N>359 THEN 130
140 ACCEPT AT(9,13)SIZE(3)VALIDATE (DIGIT) : D ::
 IF D<1 OR D>359 THEN 140
150 A=0
160 CALL GRAPHICS(3)
170 CALL POINT (0,122,92)
180 REM LOOP
190 A=A+D
200 A=(A/360-INT(A/360))*360
210 X=N*INT(A) :: X=(X/360-I
NT(X/360))*6.283185307
220 R=SIN(X)
230 T=A*0.0174532925
240 NEWX=R*SIN(T)*86+122 :: NEWY=R*COS(T)*86+92
250 CALL DRAWTO(1,NEWY,NEWX)
260 IF A<0.0001 THEN 280
270 GOTO 180
280 CALL WRITE(2,1,29,"ANY K
EY T0 CONTINUE")
290 CALL KEY (0,S,D) :: IF D<>1 THEN 290
300 RUN
```

Stephen Shaw 1989

SERVICE INFORMATION

IN CASE OF DIFFICULTY

If MYARC Extended BASIC II does not appear to be working properly, check the folowing:

1. Did you insert a high-quality Memory Expansion Card with a minimum of 128 kbytes of RAM storage into your peripheral expansion box, AND did you ALSO REMOVE the 32K Memory Expansion Card from the PEB?

   To use MYARC Extended BASIC II in your 99/4A:

   You MUST have 128 Kbytes minimum of memory expansion.

   AND

   You MUST NOT have a 32K Memory Expansion Card in the PEB together with the larger capacity Memory Expansion Card.

2. Power--Be sure all devices are plugged in. Then turn on the power to the units in the proper sequence: Peripheral devices first (if you have them), followed by the console and monitor.

3. Connector Separation--Check for proper alignment of the console and any accessory devices such as the Disk Drive Controller, Speech Synthesizer, and RS232 Interface. Remove and reinsert the MYARC Extended BASIC II module.

4. If none of the above procedures corrects the difficulty, consult "If You Have Questions or Need Assistance" or see the "Service Information" portion of the User's Reference Guide that came with your computer.

IF YOU HAVE QUESTIONS OR NEED ASSISTANCE

If you have questions concerning MYARC Extended BASIC II operation or repair, contact first the dealer from whom you purchased the equipment.

Your dealer will be able to quickly answer most questions. If your dealer doesn't have an immediate answer, the dealer will either contact MYARC or suggest you contact us directly by mail or phone.

Our address and telephone number are:

MYARC, INC.
P. O. BOX 140
Basking Ridge, NJ 07920

(201)766-1701

Please Note: This telephone number is not a toll-free number and collect calls cannot be accepted.