



# **B 1000 Systems**

## **Interactive BASIC (IBASIC)**

### **REFERENCE MANUAL**

**RELATIVE TO MARK 9.0 RELEASE**

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## SECTION 1 INTRODUCTION

### PURPOSE OF MANUAL

The purpose of this manual is to provide a description of the Interactive BASIC System (IBASIC) as implemented on the Burroughs B 1000 systems. The name BASIC is an acronym for Beginners All-purpose Symbolic Instruction Code. BASIC was initially developed at Dartmouth College in New Hampshire. The American National Standards Institute (ANSI) developed a standard for BASIC using the original Dartmouth BASIC plus additional features. Burroughs Corporation has implemented the minimal BASIC language and significant extensions to BASIC according to the standard developed by ANSI. In this manual, the term IBASIC refers to the entire interactive system, that is, all of the programs and files necessary to run IBASIC, while the term BASIC refers only to the BASIC language.

The BASIC language is designed for use not only by individuals who have little previous knowledge of computers but also by individuals with considerable programming experience. BASIC can be used in educational, engineering, and scientific environments. A distinct advantage of BASIC is that the rules of form and grammar are easily learned.

Burroughs IBASIC is implemented in a conversational mode: the user enters BASIC statements and interactive commands through a terminal to the IBASIC system, whereupon IBASIC processes the input and responds with (1) the output for the command, (2) a request for more input, or (3) a message informing the user of any syntax errors. Burroughs IBASIC is especially suited for the learning process because response is nearly immediate for many of the errors commonly made by novice programmers.

### ORGANIZATION OF MANUAL

The organization and writing of this manual was influenced by two fundamental considerations: (1) that many of the users of Burroughs IBASIC would be using the BASIC language and, possibly, a computer for the first time, and (2) that the user base would also include experienced BASIC users who would need a reference manual only to describe the syntax of a particular command or statement, to learn the commands that comprise the interactive portion of Burroughs IBASIC, or to learn about a command or statement that the programmer never had the opportunity to use before.

The organization of this manual is designed to facilitate learning and using IBASIC.

Section 1 is the introduction to the manual and should be read at least once by all users.

Section 2, entitled Beginning IBASIC, introduces the use of IBASIC.

Sections 3 through 10 provide detailed information about BASIC language syntax.

Sections 11 and 12 describe the IBASIC system commands and capabilities.

Appendices A through F contain the glossary, information on how to set up IBASIC, and other technical information that is generally beyond the interest of the average IBASIC user.

When statements, commands, and syntax are described, the following format is used.

1. The name of the item being described.
2. A brief functional description.
3. The railroad syntax and any necessary verbal description of that syntax.
4. The semantics, which may be omitted depending on the complexity of the item. If this section is omitted, the semantic description of the item is the brief functional description that follows the item name.
5. Examples and explanations of the examples, if necessary.

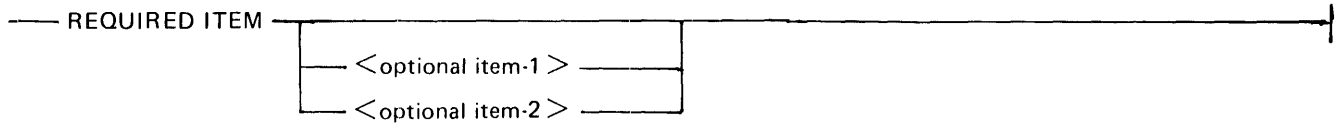




## OPTIONAL ITEMS

Items shown as a vertical list indicate that the user must make a choice of the items specified. An empty path through the list allows the optional item to be absent.

Example:



G50053

The following valid statements may be constructed from the above diagram:

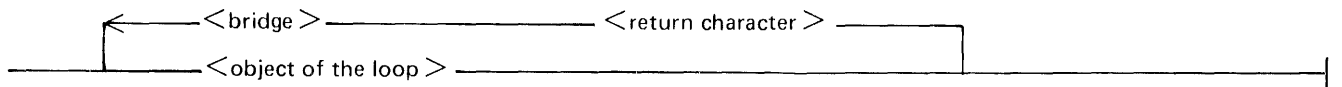
REQUIRED ITEM

REQUIRED ITEM <optional-item-1>

REQUIRED ITEM <optional-item-2>

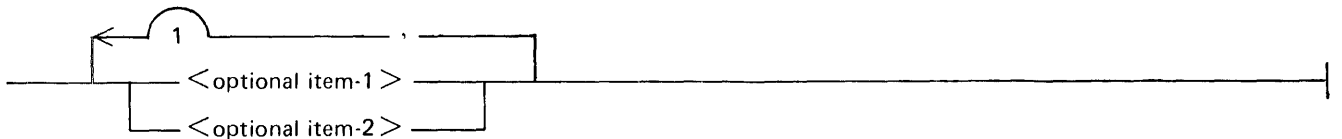
## LOOPS

A loop is a recurrent path through a railroad diagram and has the following general format:



G50054

Example:



G50055

The following statements can be constructed from the railroad diagram in the example.

<optional-item-1>

<optional-item-2>

<optional-item-1>,<optional-item-1>

<optional-item-1>,<optional-item-2>

<optional-item-2>,<optional-item-1>


<optional-item-2>,<optional-item-2>

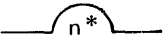
A <loop> must be traversed in the direction of the arrow heads, and the limits specified by bridges cannot be exceeded.

## BRIDGES

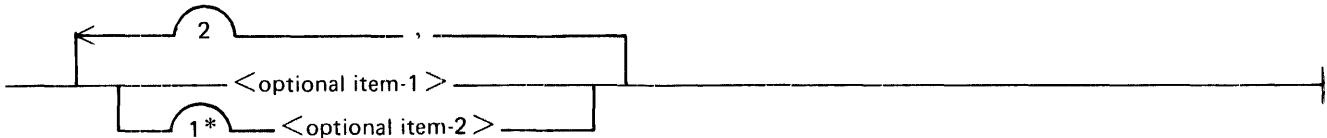
A bridge illustrates the minimum or maximum number of times a path may be traversed in a railroad diagram.

There are two forms of <bridges>.

 n is an integer which specifies the maximum number of times the path may be traversed.

 n\* is an integer which specifies the minimum number of times the path must be traversed.

Example:



G50057

The loop may be traversed a maximum of two times; however, the path for <optional-item-2> must be traversed at least one time.

The following statements can be constructed from the railroad diagram in the example.

<optional-item-1>,<optional-item-2>

<optional-item-2>,<optional-item-2>,<optional-item-1>

<optional-item-2>

## RELATED DOCUMENTATION

The following manuals are referenced in this document:

B 1000 Systems Command and Edit (CANDE) Language User's Manual, form number 1090586.

B 1000 Systems Supervisory Message Control System (SMCS) Reference Manual, form number 1108891.

B 1700/B 1800 Systems System Software Operation Guide, Volume 2, form number 1108966.

## SECTION 2

### BEGINNING IBASIC

The purpose of this section of the manual is to help beginners as well as those who need a review of the fundamental commands in the use of IBASIC. After some introductory comments about IBASIC, this section guides the user through several examples that teach most of the fundamental commands of IBASIC. For maximum benefit, the user should have access to a terminal through which the commands and statements presented in this section can be entered. After the user becomes familiar with the commands used in this section, this manual will generally be needed only as a reference document.

The easiest way to learn about IBASIC is to use it. Its use is easily learned because IBASIC "talks" to the user. As the user enters information to IBASIC, IBASIC tells the user whether the input is correct by responding with the corresponding output or with an error message. This dialogue is referred to in this manual as "interaction."

Two fundamental types of instructions can be presented to IBASIC: (1) system commands, and (2) BASIC language commands and statements. With system commands, the user requests information about the program currently being written, requests that a particular interactive operation be performed, or requests other information concerning the IBASIC system. Some examples are RUN, MAKE, LIST, and DELETE.

BASIC language statements and commands are instructions that are carried out by that portion of IBASIC that executes or performs specified operations of the BASIC language. BASIC statements are entered and stored for later execution (Entry mode). BASIC commands are executed immediately (Command mode). These two modes are used in the examples in this section. They are briefly explained under Command Mode in this section, and are fully described in Section 11 under BASIC Commands and BASIC Statement Entry. Examples of BASIC language commands and/or statements are PRINT, READ, GOTO, and LET.

Through entry of BASIC commands and statements, the user changes the set of data upon which the IBASIC system operates. This set of data is referred to as the BASIC environment. It consists of two parts: (1) the set of BASIC statements that make up a program and (2) the data that is stored in BASIC variables, that is, data names whose value can be changed. Many of the commands and statements that enable the user to operate on this environment are introduced in this section. The statements and commands in this section were tested on a Burroughs TD832 terminal. Output may be slightly different for other types of terminals.

### IBASIC USE

The paragraphs that follow guide the user through the fundamental commands of IBASIC and teach some of the commands and statements from the BASIC language. When asked to enter a command, the user must type the command on one of the three uppermost lines of the terminal, most conveniently beginning in the upper left-hand corner, and then press the transmit (XMT) key. For each operation that the user is asked to perform, the manual explains exactly what is taking place.

### EXECUTING IBASIC

There are several ways to initiate execution of IBASIC. Only one method is shown in this section. A description of all methods is found in Appendix B. (Appendix B should be consulted in order to initially configure IBASIC for the examples in this section as well as for normal execution. In this section, it is assumed that IBASIC has been configured to be executed under the Supervisory Message Control System (SMCS) using the SIGN ON syntax as shown in Appendix B.)

To start execution of IBASIC, enter the following from a terminal:

```
USER <usercode>/<password> ON IBASIC
```

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Beginning IBASIC

The computer responds with several messages. The ones pertinent to IBASIC are similar to the following:

```
MESSAGE QUEUED FOR "IBASIC": WAITING STARTUP SIGNED ON TO "IBASIC",  
SIGNAL = * B1000 BASIC MARK IX.0.4I (04/14/80 14:07) (<usercode>) logged on at 15:24:29.2
```

These are some of the initial messages displayed when the SMCS SIGN ON command is used to start up IBASIC. It is not necessary to understand exactly what they mean in order to use IBASIC.

After these initial messages, a status line is displayed on the bottom line of the terminal and a number sign (#) is displayed in the upper left-hand corner of the terminal. The status line tells the user what the IBASIC system is doing. The number sign signifies that the system has finished a previous instruction and is waiting to receive input.

NOTE

If the status line is not displayed on the bottom line of the terminal, or if the number sign is not in the upper left-hand corner, the status line option must be switched off. Refer to STATUSLINE in Section 12.

## MAKING A FILE

To begin writing a BASIC program, enter the following:

```
MAKE PROGRAM1
```

This command creates a workfile named PROGRAM1 into which user-entered program statements are stored. After the number sign (#) is displayed again, the system is ready for entry of BASIC language statements.

Enter the following statements one line at a time, pressing the transmit key (XMT) after typing each line. Be sure to include the line numbers (10, 20, 30, 40) as they appear below.

```
10 PRINT "PROGRAM1 ADDS TWO NUMBERS AND PRINTS THE RESULT."  
20 LET A = 9 + 4  
30 PRINT "9 + 4 =";A  
40 END
```

Each of these statements is entered into the workfile PROGRAM1 after transmission. They are stored there until the user explicitly removes one or more of the statements or until the workfile is removed. These statements comprise a BASIC program. When the program is run, the first PRINT statement causes display of the string of characters that appears between the quotation marks. The LET statement adds 9 and 4 and assigns the sum to variable A. The second PRINT statement causes display of the string between quotation marks and the value assigned to variable A. The END statement signifies the end of the program.

Before instructing the computer to execute PROGRAM1, the user should consider what happens in the case of an accidentally misspelled BASIC keyword, one of the predefined words which make up the BASIC language. Assume that the keyword PRINT was accidentally entered as PINT on line 30. To see the effects, enter the following:

```
30 PINT "9 + 4 =";A
```

The user statement and the output will look like the following:

```
#30 PINT "9 + 4 =";A  
---->  
error 20 - incomprehensible statement
```

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The arrow points to the beginning of the portion of the statement that contains the error. The error message will help the user to determine exactly what is wrong with the statement. In this case IBASIC could not understand what statement was entered since PINT is not a BASIC keyword. This new statement 30 replaced the old statement 30, even though the new statement was in error. Enter the following to list PROGRAM1 and see the erroneous statement in relation to the correct statements:

LIST

The LIST command lists the program statements. The statement in error is highlighted. In order to correct the error, re-enter the line as follows.

```
30 PRINT "9 + 4 =";A
```

The program is now the same as it was originally.

There are many errors that can be detected upon transmission of a line. Each of them is accompanied by a descriptive message to help the user determine the cause.

### EXECUTING A BASIC PROGRAM

In order to instruct the computer to execute the program just written, enter the following:

RUN

The RUN command initiates execution of the program. In PROGRAM1, the first statement executed is the PRINT statement on line 10. Line 20 is executed next, then line 30, and line 40 last. The flow of execution continues in this manner unless the programmer specifies that it be changed. Statements that change the flow are described in detail in Section 7. One of these statements, the GOTO statement, is briefly mentioned in this section.

The output from the RUN command previously entered is similar to the following:

```
running "PROGRAM1" from line 10 at 11:06:46.4
PROGRAM1 ADDS TWO NUMBERS AND PRINTS THE RESULT.
9 + 4 = 13
end run of "PROGRAM1" at line 40
```

### EDITING A PROGRAM

It is obvious that PROGRAM1 executes correctly, since there were no errors and the output was what was expected, but one hardly needs a computer to find the sum of 9 and 4. The program can easily be changed to handle more significant problems by the addition and deletion of a few statements. The following paragraphs direct the user to change or edit this program in such a way that it will compute and display the sum of almost any two numbers. The numbers it will not be able to compute are those that are too large for the computer to store.

First, do a LIST command to see exactly what the program looks like.

Line 20 is not needed because it only works with the integers 9 and 4. So, delete it by entering the following:

```
DELETE 20
```

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This command deletes line 20 from the file currently being written. Now replace the deleted statement with the following:

```
20 INPUT A
```

This statement allows the user to enter a numeric value into variable A from a terminal. The DELETE command was not really necessary since re-entering a new line 20 would have written over the old line 20. The DELETE command is included here so that the user would become familiar with it. To allow a second input value, enter the following statement:

```
25 INPUT B
```

This statement performs the same operation as line 20, except that the input value is assigned to variable B. Enter another LIST command to see what has been done.

Notice that the IBASIC system automatically put the two lines into their proper numerical order. Now, re-enter the PRINT statement on line 30 in the following way:

```
30 PRINT A; "+"; B; "="; A + B
```

When run, this PRINT statement causes display of the value stored in variable A, a plus sign (+), the value stored in variable B, an equal sign (=), and the value A + B. Now add the following statement so that the addition can be done repeatedly:

```
35 GOTO 20
```

Now execute the program again by entering the RUN command.

A question mark (?) is displayed in the upper left-hand corner of the terminal. This is a prompt, issued as a result of the appearance of the INPUT statement. A prompt tells the user to enter the required data. In this case, the data is a number. Enter a number. Enter a second number when the next prompt is displayed. The program displays the sum. Enter several pairs of numbers to make sure that the program works correctly.

## STOPPING EXECUTION OF A BASIC PROGRAM

This program would go on forever, if allowed, but the user probably has better things to do. To stop the program, depress the SPCFY key on the keyboard of a TD series terminal. For other types of terminals, refer to the Pseudo BREAK Feature subsection in Section 11.

IBASIC responds with a message similar to the following:

```
>>> BREAK received - INPUT terminated at line 20
```

## A MORE COMPLEX EXAMPLE

Remove PROGRAM1 and make a new file with a name of your choice by entering the following two instructions.

```
SCRATCH
```

```
MAKE <file-name>
```

<file-name> must be created by the user. For example, the first or last name of the user will probably be valid. The maximum length allowed is ten characters.

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Beginning IBASIC

The following sample program calculates the greatest common divisor (GCD) of two integers. Enter the following statements. As before, transmit after each statement is entered. If a line of input is too long for one line on the terminal, continue typing onto the next terminal line – IBASIC allows up to 256 characters to be entered per line.

```
10 PRINT "THIS PROGRAM CALCULATES THE GREATEST COMMON DIVISOR OF  
TWO INTEGERS. IT IS ONLY ACCURATE UP TO 16,777,215."  
20 PRINT  
30 PRINT "ENTER THE FIRST INTEGER."  
40 INPUT A  
50 LET C = A  
60 PRINT "ENTER THE SECOND INTEGER."  
70 INPUT B  
80 LET D = B  
90 IF A = B THEN 150  
100 IF A < B THEN 130  
110 LET A = A - B  
120 GOTO 90  
130 LET B = B - A  
140 GOTO 90  
150 PRINT "THE GREATEST COMMON DIVISOR OF"; C; "AND"; D; "IS"; A  
160 PRINT  
170 PRINT "DO YOU WANT TO CONTINUE? Y OR N"  
180 INPUT E$  
190 IF E$ = "Y" THEN 30  
200 IF E$ = "N" THEN 230  
210 PRINT "COME ON, Y OR N CANNOT BE THAT HARD...TRY AGAIN."  
220 GOTO 180  
230 END
```

Before proceeding to an explanation of the new statements used in this program, enter the RUN command to see how it works.

Instructions for the program are displayed by the program on the user's terminal. Follow these instructions and enter several pairs of integers to validate the correctness of the program and to become familiar with it.

Unlike the previous example in which outside intervention (BREAK) was necessary to stop execution, the GCD program can be stopped programmatically. In other words, the user can instruct the program to stop itself without any outside intervention. Stop the program by following the instructions displayed by the program.

Each of the statements in the current program – program that is currently loaded into the BASIC environment – is now briefly described. In order to see each statement as it is described, do a LIST in the following manner:

```
LIST 10 TO 200
```

The PRINT statement on line 10 causes display of the string between the quotation marks. This string contains instructions for the operator of the program. Notice that the string of characters in the sample program is too long to fit on one terminal line so it has been continued on the next terminal line.

The PRINT statement on line 20 causes display of a blank line to improve readability of the program as it is executed.

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The PRINT statement on line 30 causes display of the string between the quotation marks. This quoted string (string within quotation marks) instructs the user to enter an integer value.

Line 40 contains the INPUT statement that allows input to the program. It also causes the prompt character (?) to be displayed on the terminal.

Line 50 causes the contents of variable A to be assigned to variable C.

The PRINT statement on line 60 causes display of the string within the quotation marks. The string contains additional instructions.

Line 70 accomplishes the same task that line 40 did, except that variable B is used.

Line 80 causes the contents of variable B to be assigned to variable D.

Line 90 contains a statement that has not yet been described, the IF statement. The IF statement tests a condition to see whether it is true or false. In this case, the condition is "Is A equal to B?" If the condition is true, the statement following the word THEN is executed. When this statement is a line number, the next statement executed is the statement whose line number appears after the word THEN. Line 90 is read in the following way: If the contents of variable A are equal to the contents of variable B, then go to line number 150. If A is not equal to B, the statement following the IF statement is executed.

Line 100 contains another IF statement. This statement is read as follows: If the contents of variable A are less than the contents of variable B, then go to line number 130. If A is not less than B, the statement on line 110 is executed.

On line 110, the contents of B are subtracted from the contents of A and the difference is stored in variable A.

Line 120 jumps execution back to line 90.

On line 130, the contents of A are subtracted from the contents of B and the difference is stored in variable B.

Line 140 is a duplicate of line 120.

The PRINT statement on line 150 causes the answer to be displayed.

The PRINT statement on line 160, like line 20, is for readability.

Line 170 asks if the program is to be continued.

Line 180 contains another INPUT statement. This time, though, a dollar sign (\$) comes after the variable. The variables that have been used up to now (A, B, C, D) only allow the use of numbers with them. A variable with a dollar sign following it allows the use of alphabetic characters. Variable E\$ receives the N or Y that the user enters.

Line 190 tests the contents of variable E\$. If E\$ contains a Y, then the program continues at line 30.

Line 200 also tests the contents of variable E\$. If E\$ contains an N, then line 230 is executed next.

Do another LIST:

LIST 210 TO 230

Now the remainder of the statements can be seen.



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Line 210 displays an instructive message to the user. This line is executed only if E\$ does not contain an N or a Y.

Line 220 causes execution to continue with line 180.

Line 230 ends the program.

Even though all the statements have been discussed separately, the user may still not understand how the program actually calculates the GCD of two integers. In order to understand this, each statement must be understood in relation to the other statements in the program. This exercise, left to the user, entails simulating the computer; that is, thinking through what the computer would do with each statement of the program.

### PROGRAM DEBUGGING COMMANDS

There are two additional types of commands described in this section. The first type, IBASIC debugging commands, involves several more IBASIC commands. The second, command mode, involves using the BASIC language statements in a different manner than they have been used up to this point in the manual. The GCD program is used to explain these features.

#### Some IBASIC Commands for Debugging

Enter the RUN command again. Now enter the integers 16777215 and 16777214. The user will certainly tire of waiting for this answer, but the delay will give us time to examine the two types of commands mentioned. Begin by depressing the SPCFY key as in the previous example. The use of the SPCFY key in this manner is known as a BREAK. The user will now be guided in the use of several commands useful in examining the execution of a program.

First, find out where execution was terminated by entering the following IBASIC command:

```
WHERE
```

IBASIC responds with a message similar to the following:

```
you are stopped - ready to continue at line 130
```

After a program is stopped, it may be executed one statement at a time with the STEP command. The STEP command may be entered in two ways: (1) by explicitly entering the word STEP, or (2) by pressing the SPCFY key. Enter the STEP command if it has not been entered already.

IBASIC executes the next statement, displays it, and stops before the execution of the subsequent statement. An entire program may be executed in this manner, if desired. STEP is useful when the execution of sections of code need to be closely observed. To resume normal execution, use the CONTINUE command.

```
CONTINUE
```

Before this program terminates, stop execution again by using the BREAK feature (SPCFY key).

#### Command Mode

As mentioned in the first part of this section, BASIC language statements may be entered in two ways: Command mode and Entry mode. All of the BASIC statements entered up to this point in the manual have been in the Entry mode. Entry mode statements are entered into a file and stored for subsequent use and are characterized by a line number at the beginning of the line.

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In Command mode, the line number is omitted. This omission tells IBASIC that the statement is to be executed immediately. Many of the BASIC statements may be used in Command mode. A list of the statements that cannot be used in Command mode appears in BASIC Commands in Section 11. To understand how Command mode can help in analyzing a program, enter the following:

```
PRINT A; B
```

The values displayed are the current values of the variables A and B from the GCD program. They are only of value to those users who understand how the program calculates the greatest common divisor. These users know that A is continually subtracted from B, or vice versa, until the two variables are equal. As one can see from the output of the PRINT statement previously entered in command mode, one of the variables has the value 1 and the other contains a very large number. Obviously, the program takes quite a while to run to termination. The time necessary for this program to finish can be reduced if the larger of the two variables is made smaller. So, using another BASIC statement in Command mode, change the value of the larger variable. You can determine which of the two variables is the larger by using the PRINT command (Command mode).

Change the value of the larger variable to 1000 by entering the following statement:

```
LET <larger variable> = 1000
```

Resume execution by entering the CONTINUE command. The program will terminate quite rapidly.

## SAVE, SCRATCH, AND BYE COMMANDS

The last three commands that the user will want to learn about before leaving the terminal are the SAVE, SCRATCH, and BYE commands.

If you want to save the program for later use, enter the following:

```
SAVE
```

The SAVE command creates a copy of the current workfile and stores it on disk. If you do not want to SAVE the program, enter the following:

```
SCRATCH
```

The SCRATCH command, as previously shown, removes the current program.

In order to terminate the IBASIC system, enter the following command:

```
BYE
```

The BYE command causes termination of the IBASIC system. The output is similar to the following:

```
connect time = 00:05:36.0, cpu time = 2 units  
(<usercode>) logged off at 15:27:29.6  
goodbye  
REMOTE FILE CLOSED BY "IBASIC".
```

In order to sign off SMCS, enter BYE again.

## SECTION 3 PROGRAM COMPOSITION

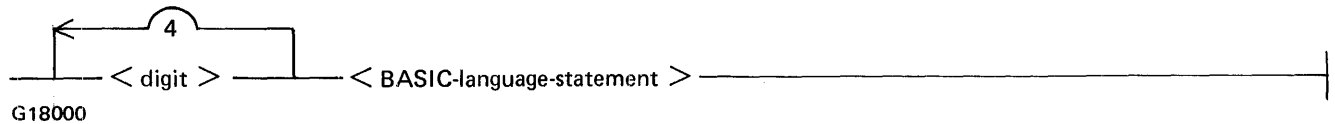
A BASIC program is made up of a number of lines. Each line consists of characters from the character set for BASIC. The concepts of lines, characters, and the fundamental rules for combining these elements in order to write BASIC programs are described in this section.

### STATEMENT LINES

A statement line consists of a line number followed by a BASIC language statement. The maximum length allowed for a statement line is 256 characters. There may be a maximum of 1979 statement lines in a program.

Unless otherwise specified, the term "line" in this manual is not synonymous with the same term as used in relation to a terminal or a printer. For example, one statement line may occupy three "lines" on a terminal.

Syntax:



<digit> is any decimal digit. At least one <digit> must be nonzero. Leading zeros have no effect, other than counting as a digit in the line number. <BASIC-language-statement>s are described in Sections 4 through 10.

Examples of statement lines:

```

99999 PRINT A
  1 REM THIS IS THE START OF THE PROGRAM.
 0001 PRINT "ENTER YOUR NAME."
02340 LET A$(X *Y) = "25" & A1$
 100 BREAK
    
```

#### NOTE

Line numbers are generally omitted from statement lines in the examples in this manual. However, they must be included in all statements entered to BASIC programs.

### CHARACTER SET

A BASIC statement line consists of characters from the character set for BASIC. The standard character set for BASIC is contained in the International Reference Version of ISO Standard 646, 7-Bit Input/Output Coded Character Set, 4th Edition. Table E-1 in Appendix E contains this character set. BASIC can also use the EBCDIC character set if the user desires (refer to the OPTION statement in Section 5). Table E-2 in Appendix E contains this character set. All lower-case characters are translated directly to their upper-case equivalent everywhere within the IBASIC system except for strings enclosed within quotation marks (for example, print a,b is equivalent to PRINT A,B).

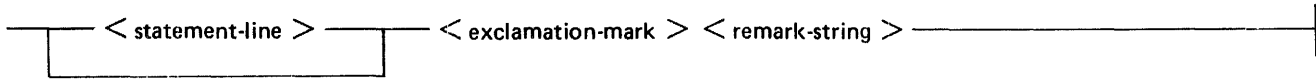
### PROGRAM DOCUMENTATION

BASIC programs may be documented with tail comments at the end of statement lines or with a separate statement called a REM statement.

## TAIL COMMENTS

A tail comment can be entered at the end of a line in order to provide a clear description of what a BASIC statement or a group of BASIC statements does. Tail comments have no effect on the execution of a program.

Syntax:



G18001

<statement-line> is described under Statement Lines in this section. <exclamation-mark> indicates the beginning of the tail comment. <remark-string> is any string of characters that the programmer chooses in order to explain the statements of the program.

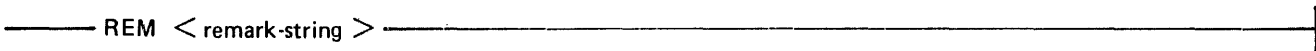
Examples of tail comments:

```
PRINT A, B, C    ! PRINT THE ANSWERS
LET T = T2 - T1 ! SUB INITIAL TIME FROM TERMINAL TIME
```

## REM STATEMENT

The REM statement must occur on a line by itself. It serves to document a program and has no effect on the execution of the program.

Syntax:



G18002

<remark-string> is any string of characters that the programmer chooses in order to explain the statements of the program.

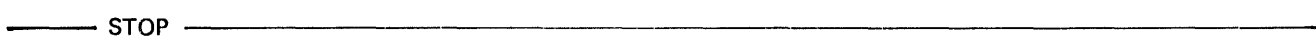
Examples of REM statements:

```
REM THIS PROGRAM CALCULATES THE GREATEST COMMON DIVISOR
REM OF TWO INTEGERS.
```

## STOP STATEMENT

The STOP statement causes termination of the program.

Syntax:



G18003

The STOP statement may occur anywhere within a program.

## END STATEMENT

The END statement marks the physical end of the program and causes termination of execution of the program when encountered.

Syntax:

----- END -----

G18004

The END statement may occur only at the physical end of the main program.

## GENERAL SYNTAX RULES

The following rules must be observed in writing a BASIC program.

1. Each statement of a program must begin with a unique, positive, nonzero line number and must contain one BASIC statement.
2. Spaces must not occur within keywords, within the word TAB in a tab call, within numeric constants, within line numbers, within variable names, or within multicharacter relation symbols ( $\geq$ ,  $\leq$ ). Spaces may occur anywhere else within a program to enhance readability. For example:

```
15 GO TO 245
15 GO TO 245
15GOT0245
15 G 0 TO 2 4 5
```

### NOTE

It is strongly recommended that spaces be used surrounding keywords since spaces in these positions may be required in the future.

3. Each program must terminate with an END statement.
4. Lines are executed in sequential order, starting with the first line in the program, and continuing until some other action is dictated by execution of a control statement, until a STOP or END statement is executed, or until the occurrence of a fatal error (an error which stops the execution of a program).
5. Upper-case and lower-case characters are interchangeable. Lower-case characters are translated to their upper-case equivalents everywhere within the IBASIC system except in strings within quotation marks.

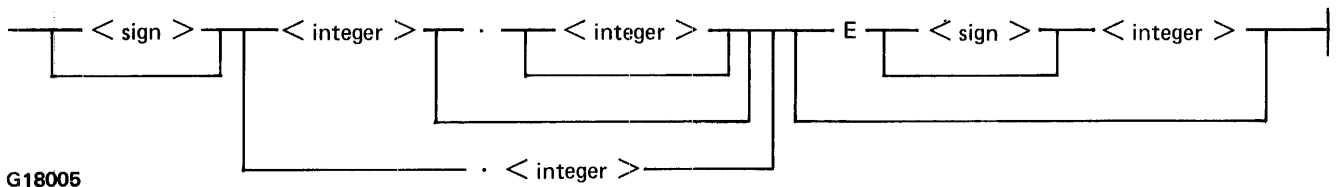
## SECTION 4 NUMERIC DATA CONSTRUCTS

There are two data types in BASIC: numeric and string. Associated with each of these data types are constants, variables, and intrinsic functions from which expressions can be formed. This section deals with data type numeric and the expressions that can be formed from the fundamental numeric constructs. Strings are explained in Section 5.

### NUMERIC CONSTANTS

Numeric constants are used to denote numeric values. Unlike some programming languages, BASIC does not distinguish between numbers containing a decimal point (real numbers) and those written without a decimal point (integers): all numeric values in IBASIC are stored internally in floating-point form, that is, as a sign, exponent, and fraction, and are handled as real numbers.

Syntax:



G18005

<sign> is a plus sign (+) or a minus sign (-). <integer> is a series of decimal digits.

Semantics:

Numeric values are maintained with a precision of at least six decimal digits (21 to 24 binary digits depending on the value). They may range from approximately 5.39761E-79 to 7.23701E+75.

E signifies "times ten to the power." For example, 2.145E-4 is read as 2.145 times ten to the power -4 and represents the value .0002145. If the <sign> is omitted, plus (+) is assumed.

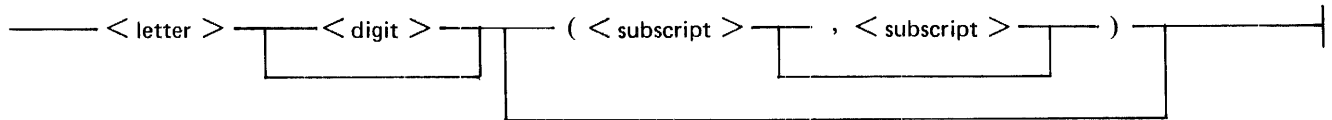
Examples of numeric constants:

-21.  
1E10  
5E-2  
.4E+1  
500  
1  
.255

## NUMERIC VARIABLES

A numeric variable is a symbolic name used to represent a numeric value which may be changed during program execution by a numeric assignment statement. (Refer to Numeric Assignment Statement in this section.) Numeric variables may either be simple or subscripted. All numeric variables, whether simple or subscripted, are of type real. A subscripted variable is one element of an array. Arrays are described in Section 6.

Syntax:



G18006

`<letter>` is any English alphabet character (A through Z). `<digit>` is any decimal digit (0 through 9). The same `<letter>` or `<letter>` `<digit>` combination cannot be used as the name of both a simple numeric variable and a numeric array, nor the name of both a 1-dimensional (one `<subscript>`) and a 2-dimensional (two `<subscript>`s) numeric array. `<subscript>` is any numeric expression. It is an index into the array. `<subscript>` is always rounded to the nearest integer. The rounded value is defined as  $\text{INT}(\text{<subscript>} + .5)$ , where INT signifies "the largest integer not greater than." A `<subscript>` must be in the allowable range of subscripts for the array being referenced.

Semantics:

Explicit declarations of numeric variables in BASIC are not necessary except in the case of certain subscripted numeric variables. These declarations are described in Section 6. Numeric variables with no explicit declaration are implicitly declared through their appearance in a program unit. Of these implicitly declared numeric variables, those followed by one or two subscripts are numeric arrays whose subscripts can range in value from zero, or one, to ten. A subscripted numeric variable refers to the element in the 1- or 2-dimensional array selected by the value(s) of the subscript(s). A numeric variable that has no subscripts and does not occur in a MAT statement (refer to Section 6) is a simple variable.

The initial value of each numeric variable at execution time is zero.

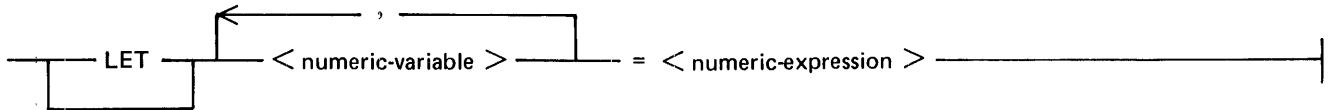
Examples of numeric variables:

X  
A5  
V(4)  
W(X,X+Y/2)

## NUMERIC ASSIGNMENT STATEMENT

The numeric assignment statement is used to assign a computed value to a list of simple or subscripted variables.

Syntax:



G18007

<numeric-variable> is described under Numeric Variables in this section. Simple and subscripted variables may appear in the same list of <numeric-variable>s. <numeric-expression> is any numeric expression valid in BASIC.

Semantics:

A numeric assignment statement is evaluated in the following manner: The subscripts, if any, of variables in the <numeric-variable> list are evaluated in sequence from left to right. Next, the expression on the right of the equal sign (=) is evaluated. Finally, the value of that expression is assigned to each variable in the <numeric-variable> list.

Examples of numeric assignment statements:

```

LET P = 3.14159           ! P gets an approximation of PI.
LET A(X,3) = SIN(X) * Y + 1 ! Array element A(X,3) is
                           ! assigned the expression value.
LET A, Y(I), Z = I + 1    ! A, Y(I), and Z are assigned
                           ! I + 1.

A = B                     ! A is assigned the value of B.

LET T(I,J), I, J = I + J  ! The listed variables are
                           ! assigned the sum of I and J.
    
```

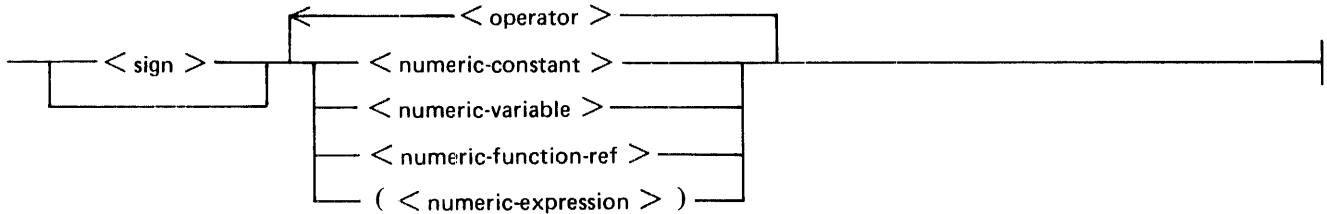
In the last example, understanding the order of evaluation of a numeric assignment statement is necessary in order to fully understand the statement. Assume that variables I and J have the values 1 and 2 respectively. The subscripts, I and J, in the reference to array T are evaluated first. Thus, the array element being referenced is T(1,2). The numeric expression, I + J, is then evaluated. Its value is 3. Thus, the assignment statement results in the assignment of 3 to variables T(1,2), I, and J. In contrast, if subscripts in the <numeric-variable> list were evaluated after the <numeric expression> had been assigned to I and J, the array element referenced would have been T(3,3).



## NUMERIC EXPRESSIONS

A numeric expression is any numeric constant, numeric variable, numeric function reference, or a combination of these separated by the operators representing addition, subtraction, multiplication, division, and exponentiation.

Syntax:



G18008

<operator> is one of the following:

Operator and Name	Meaning
^ Circumflex accent	Exponentiation
** Double asterisk	Exponentiation
+ Unary plus	No action
- Unary minus	Negation
* Asterisk	Multiplication
/ Solidus	Division
+ Plus sign	Addition
- Minus sign	Subtraction

<numeric-constant> is defined under Numeric Constants in this section. <numeric-variable> is defined under Numeric Variables in this section. <numeric-function-ref> includes the intrinsic numeric functions as defined under Intrinsic Numeric Functions in this section and the user-defined numeric functions as defined under User-Defined Functions in Section 8. User-defined functions must be defined in the program unit in which they are referenced. The appearance of a <numeric-expression> between parentheses signifies that a numeric expression may be used as an operand in a larger numeric expression which encompasses the numeric expression in parentheses.

Semantics:

The rules for formation and evaluation of numeric expressions follow normal algebraic rules. There are four levels of precedence. These levels, listed in order from highest precedence to lowest, follow.

1. Exponentiation
2. Unary plus and minus
3. Multiplication and division
4. Addition and subtraction

The order of evaluation can be changed by the use of parentheses. Operations within parentheses are performed first. Operations on the same precedence level are performed left to right unless parentheses dictate otherwise. Refer to the examples that follow in this subsection for detailed explanations of specific cases.

When numeric overflow or underflow occurs, that is, when a numeric value either exceeds or is less than the allowable limits for numeric values, the condition is reported and execution continues. The resultant value when overflow occurs is the largest representable value, 7.237E+75. The resultant value when underflow occurs is zero. Division by zero, and zero raised to a negative power are treated as overflows. 0\*\*0 is defined as 1. When a negative number is raised to a nonintegral power a fatal error occurs.

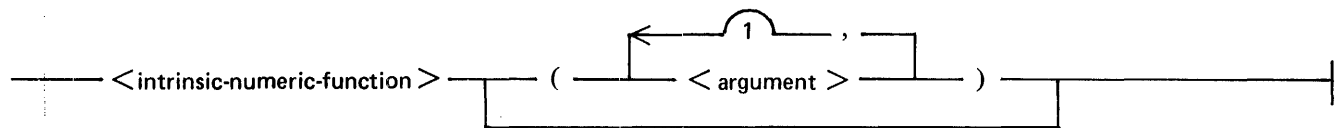
Examples of numeric expressions:

$3 * X - Y ** 2$	! Y squared is subtracted from the ! product of 3 and X.
$A(1) + A(2) + A(3)$	! The array elements listed are added.
$-X / Y$	! Negative X divided by Y.
$2 ** (-X)$	! 2 raised to the negative Xth power.
$SQR(X ** 2 + Y ** 2)$	! The square root of the sum of X ! squared and Y squared.
$A - B - C$	! (A - B) - C
$A ** B ** C$	! (A ** B) ** C
$A / B / C$	! (A / B) / C
$-A ** B$	! - (A ** B)

## INTRINSIC NUMERIC FUNCTIONS

Predefined functions are supplied as part of the IBASIC system for the evaluation of commonly used numeric functions. The general syntax for the intrinsic numeric functions follows.

Syntax:



G18009

Semantics:

A description of each of the <intrinsic-numeric-function>s with its meaning follows. Zero, one, or two <argument>s can be included depending on the function. In all cases, X and Y represent numeric expressions and A represents a numeric or string array.

## ABS(X)

The absolute value of X.

Example:

```
LET X = 25.5
PRINT "ABSOLUTE VALUE OF A =";ABS(X)
PRINT "ABSOLUTE VALUE OF -123.45 =";ABS(-123.45)
```

When the statements in this example are run, the following output is produced.

```
ABSOLUTE VALUE OF A = 25.5
ABSOLUTE VALUE OF -123.45 = 123.45
```

## ACOS(X)

The arccosine of X in radians, where  $0 \leq \text{ACOS}(X) \leq \text{PI}$ ; X must be in the range  $-1 \leq X \leq 1$ ,  $\text{PI} = 3.14159$ .

## ANGLE(X,Y)

The angle in radians between the positive x-axis and the vector joining the origin to the point with coordinates (X,Y), where  $-\text{PI} < \text{ANGLE}(X,Y) \leq \text{PI}$ . The values of X and Y cannot both be zero.

Example:

```
PRINT "ANGLE BETWEEN (1,0) AND (1,1) IS";ANGLE(1,1)
```

Execution of this example causes the following to be displayed.

```
ANGLE BETWEEN (1,0) AND (1,1) IS .785398
```

## ASIN(X)

The arcsine of X in radians, where  $-\text{PI}/2 \leq \text{ASIN}(X) \leq \text{PI}/2$ ; X must be in the range  $-1 \leq X \leq 1$ .

## ATN(X)

The arctangent of X in radians; that is, the angle whose tangent is X, where  $-\text{PI}/2 < \text{ATN}(X) < \text{PI}/2$ .

## CEIL(X)

The smallest integer not less than X.

Examples:

```
PRINT "CEIL OF 1.5 IS";CEIL(1.5)
PRINT "CEIL OF -1.5 IS ";CEIL(-1.5)
```

Execution of these statements gives the following output:

```
CEIL OF 1.5 IS 2
CEIL OF -1.5 IS -1
```

## **COS(X)**

The cosine of X, where X is in radians.

## **COSH(X)**

The hyperbolic cosine of X, where X is in radians.

## **COT(X)**

The cotangent of X, where X is in radians.

## **CSC(X)**

The cosecant of X, where X is in radians.

## **DATE**

The current date in decimal form YYDDD, where YY is the last two digits of the year and DDD is the number of days elapsed in the year.

Example:

```
PRINT DATE
```

If the date was May 17, 1980, this example would give the following output:

```
80138
```

## **DEG(X)**

The number of degrees in X radians.

Examples:

```
PRINT "DEG OF PI IS";DEG(PI)
PRINT "DEG OF PI/6 IS";DEG(PI/6)
```

Execution of these examples gives the following output:

```
DEG OF PI IS 180
DEG OF PI/6 IS 30
```

## **EPS**

The smallest positive nonzero number that can be represented by the machine: 5.39761E-79

## **EXP(X)**

The exponential of X; that is, the value of the base of natural logarithms (2.71828) raised to the power X.

## FP(X)

The fractional part of X, FP(X), is equivalent to  $X - IP(X)$ , where IP signifies "integer part of."

Example:

```
PRINT "FP OF 17.358795 IS";FP(17.358795)
```

Execution of this example produces the following output:

```
FP OF 17.358795 IS .358795
```

## INF

The largest positive number that can be represented by the machine:  $7.237E+75$

## INT(X)

The largest integer not greater than X.

Example:

```
A = 6.9  
B = 6  
C = -6.14  
PRINT "LARGEST INTEGER NOT GREATER THAN"; A;" IS"; INT(A)  
PRINT "LARGEST INTEGER NOT GREATER THAN"; B;" IS"; INT(B)  
PRINT "LARGEST INTEGER NOT GREATER THAN ";C;" IS "; INT(C)  
PRINT "LARGEST INTEGER NOT GREATER THAN -2 IS "; INT(-2)
```

Execution of the above example causes the following to be displayed.

```
LARGEST INTEGER NOT GREATER THAN 6.9 IS 6  
LARGEST INTEGER NOT GREATER THAN 6 IS 6  
LARGEST INTEGER NOT GREATER THAN -6.14 IS -7  
LARGEST INTEGER NOT GREATER THAN -2 IS -2
```

## IP(X)

The integer part of X. IP(X) is equivalent to  $SGN(X) * INT(ABS(X))$ .

Examples:

```
PRINT "IP OF -6.14 IS";IP(-6.14)  
PRINT "IP OF 6.9 IS";IP(6.9)
```

Execution of these examples causes the following to be displayed.

```
IP OF -6.14 IS -6  
IP OF 6.9 IS 6
```

## LDIM(A,X)

The lower bound for the Xth subscript of array A.

Example:

```
DIM A(10,10)
PRINT "LDIM OF THE 2ND SUBSCRIPT OF ARRAY A IS";LDIM(A,2)
```

Execution of this example gives the following output:

```
LDIM OF THE 2ND SUBSCRIPT OF ARRAY A IS 0.
```

## LOG(X)

The natural logarithm of X. X must be greater than zero.

## LOG10(X)

The common logarithm of X. X must be greater than zero.

## LOG2(X)

The base 2 logarithm of X. X must be greater than zero.

## MAX(X,Y)

The larger of X and Y.

## MIN(X,Y)

The smaller of X and Y.

## MOD(X,Y)

The modulo function, MOD(X,Y), is equivalent to  $X - Y * \text{INT}(X/Y)$  if Y is nonzero, and is equivalent to 0 if Y is zero.

Example:

```
PRINT "MOD OF 100 AND 90 IS";MOD(100,90)
PRINT "MOD OF 10 AND -4 IS ";MOD(10,-4)
```

Execution of this example causes the following to be displayed.

```
MOD OF 100 AND 90 IS 10
MOD OF 10 AND -4 IS -2
```

## PI

The constant 3.14159, which is the ratio of the circumference of a circle to its diameter.

## RAD(X)

The number of radians in  $X$  degrees.

Example:

```
PRINT "RAD OF 30 DEGREES IS";RAD(30)
```

Execution of this example gives the following output:

```
RAD OF 30 DEGREES IS .523599
```

## REM(X,Y)

The remainder function.  $REM(X,Y)$  is equivalent to  $X - Y * IP(X/Y)$  if  $Y$  is nonzero, and is equivalent to 0 if  $Y = 0$ .

Examples:

```
PRINT "REM OF 100 AND 90 IS";REM(100,90)  
PRINT "REM OF 10 AND -4 IS";REM(10,-4)
```

Execution of these examples causes the following to be displayed.

```
REM OF 100 AND 90 IS 10  
REM OF 10 AND -4 IS 2
```

## RND

The next pseudo-random number in the sequence of pseudo-random numbers uniformly distributed in the range  $0 \leq RND < 1$ . The `RANDOMIZE` statement can be used in conjunction with the `RND` function to initiate a different and unpredictable sequence of pseudo-random numbers. Refer to the subsection entitled `RANDOMIZE` statement in this section.

## SEC(X)

The secant of  $X$ , where  $X$  is in radians.

## SGN(X)

The sign of  $X$ ,  $SGN(X)$ , is  $-1$  if  $X < 0$ , is  $0$  if  $X = 0$ , and is  $+1$  if  $X > 0$ .

## SIN(X)

The sine of  $X$ , where  $X$  is in radians.

## SINH(X)

The hyperbolic sine of  $X$ , where  $X$  is in radians.

## SQR(X)

The nonnegative square root of  $X$ .  $X$  must be nonnegative.

## TAN(X)

The tangent of X, where X is in radians.

## TANH(X)

The hyperbolic tangent of X, where X is in radians.

## TIME

The time elapsed since the previous midnight, expressed in seconds; for example, the value of TIME at 11:15 AM is 40500.

Example:

```
T = TIME
FOR X = 1 TO 5E5
  LET A = X
NEXT X
PRINT "ELAPSED TIME IS";TIME - T;"SECONDS."
```

Execution of this program segment causes the following to be displayed.

```
ELAPSED TIME IS 123 SECONDS.
```

## UDIM(A,X)

The upper bound for the Xth subscript of array A.

Example:

```
DIM B(100,10)
PRINT "UDIM OF THE 1ST SUBSCRIPT OF B IS";UDIM(B,1)
```

Execution of this partial program causes the following to be displayed.

```
UDIM OF THE 1ST SUBSCRIPT OF B IS 100
```

As with numeric expressions, in case of an overflow or underflow in a numeric function, the condition is reported, the appropriate value (the largest machine value for overflow and zero for underflow), is substituted and execution continues.

The result of evaluating a numeric function is a scalar numeric value (quantity characterized by a single value) which replaces the <numeric-function-ref> in the numeric expression.

## RANDOMIZE STATEMENT

The RANDOMIZE statement overrides the normal sequence of pseudo-random numbers used as values for the RND function, generating a different and unpredictable sequence of pseudo-random numbers used subsequently by the RND function.

Syntax:

---

RANDOMIZE

G18010



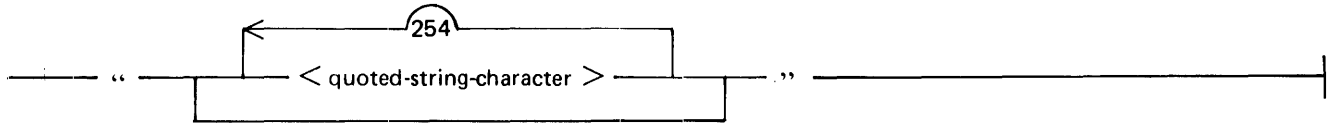
## SECTION 5 STRING DATA CONSTRUCTS

There are two data types in BASIC: numeric and string. Numeric constructs are described in Section 4. Strings may contain arbitrary sequences of characters, and their lengths are variable. The constructs used with strings are described in detail in this section.

### STRING CONSTANTS

A string constant is a string of characters enclosed within quotation marks ("").

Syntax:



G18011

<quoted-string-character> is any character in Table E-1, Appendix E, except those characters in ordinal positions 0 through 31, 34, 64, 91 through 93, 96, and 123 through 127. A quotation mark, ordinal position 34, may be included in a string constant by representing it by two adjacent quotation marks. The length of a string constant is limited to 255 bytes.

Examples:

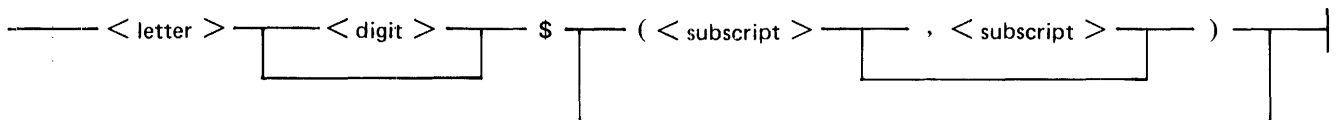
```

"XYZ"
"1E10"
"He said, ""Don't.""      ! Two adjacent quotation marks,
                          ! used to represent one quotation
                          ! mark inside the string.
    
```

### STRING VARIABLES

A string variable is a symbolic name used to represent a string value. A string variable may be changed during program execution by a string assignment statement (refer to String Assignment Statement in this section). String variables may either be simple or subscripted. The proper syntax for a string variable follows.

Syntax:



G18012

<letter> is any English alphabet character (A through Z). <digit> is any decimal digit (0 through 9). The same <letter> or <letter> <digit> combination cannot be used as the name of both a simple string variable and a string array, nor as the name of both a 1-dimensional and a 2-dimensional string array. <subscript>

is any numeric expression. <subscript> is always rounded to the nearest integer. The rounded value is defined as INT(<subscript>+.5). A <subscript> must be in the allowable range of subscripts for the array being referenced.

Semantics:

The length of the character string associated with a string variable can vary during the execution of a program from a length of zero characters, signifying the null or empty string, to a maximum length of 255 characters, or to the length defined in a string declaration. Refer to String Declarations in this section for further information on length specification of a string variable.

Explicit declarations of string variables in BASIC are not necessary except when it is desired to set a maximum assignable length for the string to a value less than 255. Declarations involving subscripts are described in Section 6. The description of the method for declaring a specific length is under String Declarations in this section.

String variables with no explicit declaration are implicitly declared through their appearance in a program. Of these implicitly declared string variables, those followed by one or two subscripts are string arrays whose subscripts can range in value from zero or one to ten. A subscripted string variable refers to the element in the 1- or 2-dimensional array selected by the value(s) of the subscript(s). A string variable with no subscripts is a simple variable.

The initial value of each string variable at execution time is the null string ("").

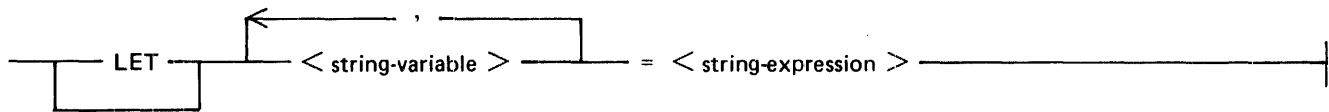
Examples of string variables:

K\$  
R2\$  
A\$(4)  
B1\$(I,J)

## STRING ASSIGNMENT STATEMENT

The string assignment statement is used to assign a string value to a list of simple or subscripted variables.

Syntax:



G18013

<string-variable> is described under String Variables in this section. Simple and subscripted variables may appear in the same list of <string-variable>s. <string-expression> is any valid string expression in BASIC.

Semantics:

A string assignment statement is evaluated in the following manner: The subscripts, if any, of variables in the <string-variable> list are evaluated in sequence from left to right. Next, the expression on the right of the equal sign (=) is evaluated. Finally, the value of that expression is assigned to each variable in the <string-variable> list.

If the assignment of a string to a string variable causes an overflow of that variable, which means that more characters have been assigned to the variable than are allowed, an error message is displayed and program execution terminates.

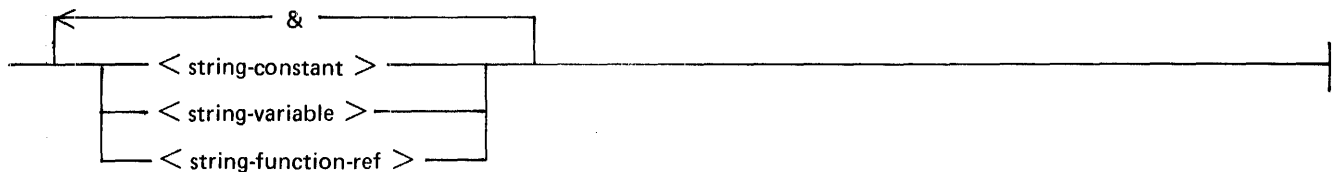
Examples of string assignment statements:

LET A\$ = "ABC"	! String constant ABC is assigned to A\$.
LET C\$(I) = B\$	! Ith element of array C\$ gets contents ! of B\$.
A\$,B\$ = "NEGATIVE" & "DISCRIMINANT"	! A\$ and B\$ get the value ! of the string expression.

## STRING EXPRESSIONS

A string expression is any string constant, string variable, string function reference, or concatenation of these.

Syntax:



G18014

<string-constant> and <string-variable> are defined in this section under String Constants and String Variables, respectively. <string-function-ref> includes the intrinsic string functions as defined under Intrinsic String Functions in this section, and the user-defined string functions defined in Section 8 under User-Defined Functions. The ampersand character (&) signifies concatenation.

Semantics:

Concatenation is the joining of the end of one string to the beginning of another.

If the result of a string operation is longer than 255 characters, a fatal error occurs.

Examples of string expressions:

"SOONER OR"	! String constants are string expressions.
X\$(1,3)	! String variables are string expressions.
A\$ & B\$	! Following text gives explanation.
B\$ & A\$	! Following text gives explanation.
A2\$ & B\$ & "223"	! Concatenation of two string variables ! with a string constant.

The third example, A\$ & B\$, shows the use of the concatenate operator (&). Assume that A\$ contains the constant "COME " and that B\$ contains the constant "IN". A\$ & B\$ gives "COME IN".

For the fourth example, B\$ & A\$, assume that A\$ and B\$ contain the same values as before. B\$ & A\$ gives "INCOME ".

Example:

```
A$ = "FIRST ---"  
B$ = "SECOND ---"  
C$ = A$ & B$ & "THIRD"  
PRINT C$
```

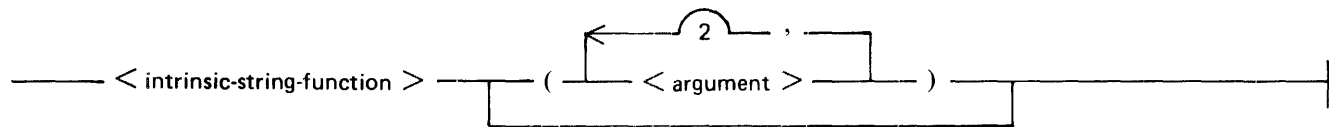
Execution of this example gives the following output:

```
FIRST ---SECOND ---THIRD
```

## INTRINSIC STRING AND STRING-RELATED FUNCTIONS

Predefined functions are supplied as part of the IBASIC system for the evaluation of commonly used string-valued functions and numeric-valued functions whose arguments (parameters passed to a function) are strings. The general syntax for the intrinsic string functions follows.

Syntax:



G18015

The number of <argument>s depends on the function.

Semantics:

A description of each of the <intrinsic-string-function>s follows. In each of the descriptions, M represents an index, that is, the rounded integer value of some numeric expression; X represents a numeric expression, and A\$ and B\$ represent string expressions.

The result of evaluating a string function is a character string which replaces the <string-function-ref> in the string expression.

### CHR\$(M)

The 1-character string consisting of the character occupying ordinal position M in the collating sequence for the declared character set. (Refer to Tables E-1 and E-2 for the possible collating sequences). M must be greater than zero and less than the number of characters in the declared character set.

Example:

```
OPTION COLLATE STANDARD  
PRINT "THE 53RD CHARACTER IS";CHR$(53)  
PRINT "THE 65TH CHARACTER IS";CHR$(65)
```

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Execution of this partial program causes the following to be displayed.

```
THE 53RD CHARACTER IS 5
THE 65TH CHARACTER IS A
```

### DATE\$

The date in the string representation YY/MM/DD.

Example:

```
PRINT DATE$
```

If the date was May 17, 1980, this example would give the following output:

```
80/05/17
```

### LEN(A\$)

The number of characters in the value associated with A\$.

Example:

```
READ A$,B$,C$,D$
PRINT "A$ = ";A$;" LENGTH OF A$ =";LEN(A$)
PRINT "B$ = ";B$;" LENGTH OF B$ =";LEN(B$)
PRINT "C$ = ";C$;" LENGTH OF C$ =";LEN(C$)
PRINT "D$ = ";D$;" LENGTH OF D$ =";LEN(D$)
DATA ABC, DEFGH,IJKLMNOPQRST,U V W X Y Z ! DATA statement is
! described in
! Section 9.
```

Execution of the above example causes the following to be displayed.

```
A$ = ABC LENGTH OF A$ = 3
B$ = DEFGH LENGTH OF B$ = 5
C$ = IJKLMNOPQRST LENGTH OF C$ = 12
D$ = U V W X Y Z LENGTH OF D$ = 11
```

### LWRC\$(A\$)

The lower-case equivalent of the value of A\$.

Example:

```
A$ = "ABCDEF123"
PRINT LWRC$(A$)
```

Execution of this example gives the following output:

```
abcdef123
```

## ORD(A\$)

The ordinal position of the character associated with A\$ in the collating sequence of the declared character set, where the first member of the character set is in ordinal position zero. The acceptable values of A\$ are the single character graphics of the character set and the 2- and 3-character mnemonics of the character set. The acceptable values for the character sets are shown in Tables E-1 and E-2. If the character associated with A\$ is not an acceptable value, a fatal error occurs.

Example:

```
OPTION COLLATE STANDARD
PRINT "THE ORDINAL POSITION OF BS IS";ORD("BS")
PRINT "THE ORDINAL POSITION OF A IS";ORD("A")
PRINT "THE ORDINAL POSITION OF 5 IS";ORD("5")
PRINT "THE ORDINAL POSITION OF SOH IS";ORD("SOH")
```

Execution of the above example produces the following output:

```
THE ORDINAL POSITION OF BS IS 8
THE ORDINAL POSITION OF A IS 65
THE ORDINAL POSITION OF 5 IS 53
THE ORDINAL POSITION OF SOH IS 1
```

## POS(A\$,B\$)

The character position in A\$ where B\$ occurs. The leftmost character in A\$ is position 1. If B\$ does not occur within A\$, then POS(A\$,B\$) is 0. POS(A\$, "") is 1 unless A\$ is the null string, in which case POS(A\$, "") is 0.

Example:

```
PRINT "CD OCCURS IN ABCDE AT POSITION"; POS("ABCDE","CD")
A$ = "FOUR SCORE AND SEVEN YEARS AGO..."
PRINT "R OCCURS IN A$ AT POSITION";POS(A$,"R")
```

Execution of this example causes the following to be output.

```
CD OCCURS IN ABCDE AT POSITION 3
R OCCURS IN A$ AT POSITION 4
```

## POS(A\$,B\$,M)

Same as the previous POS function except that M-1 positions are skipped before the scan of A\$ begins; that is, scanning begins with the Mth character. The value of the function is  $M'-1 + \text{POS}(A$(M:\text{LEN}(A$)),B$)$ , where  $M'$  equals  $\text{MAX}(1,\text{MIN}(M,\text{LEN}(A$)))$ , and  $A$(M:\text{LEN}(A$))$  signifies the Mth character position in A\$ through the end.

Example:

```
LET A$ = "GRANDSTANDING"
PRINT POS(A$,"AN",1)
PRINT POS(A$,"AN",4)
PRINT POS(A$,"AN",9)
```

Execution of this example produces the following output:

```
3  
8  
0
```

## STR\$(X)

The character string which is the numeric representation of the value associated with X. No leading or trailing spaces are included in the character string.

Example:

```
PRINT STR$(123.5)  
PRINT STR$(-3.14)
```

Execution of this example gives the following output:

```
123.5  
-3.14
```

## TIMES

The time of day in 24-hour notation. For example, the value of TIMES\$ at 3:15 PM is 15:15:00.

## UPRC\$(A\$)

The upper-case equivalent of the value of A\$.

Example:

```
A$ = "abcdef123"  
PRINT UPRC(A$)
```

Execution of this example gives the following output:

```
ABCDEF123
```

## VAL(A\$)

Performs the inverse of STR\$; has the value of the number associated with A\$ if the string associated with A\$ is a number. Leading and trailing spaces in the string are ignored. If the evaluation of the number results in a value which causes an underflow, the value returned is zero. If an overflow occurs, the largest possible value is supplied. In either case execution continues.

Examples:

```
PRINT VAL(" 123.5 ") * 10  
PRINT VAL("-3.14") * 10  
PRINT VAL("2.E-99")
```

Execution of these statements gives the following output:

```
1235  
-31.4  
error 15 - numeric underflow  
0
```





## SECTION 6 ARRAYS

Arrays are indexed collections of numbers or strings. The indices, referred to as subscripts in this manual, are used to reference one of the elements of the array. Array elements can be manipulated one at a time or an entire array can be manipulated by MAT statements. The keyword MAT derives from the word matrix. A matrix is a 2-dimensional array, but is used in this manual to denote both 1- and 2-dimensional arrays.

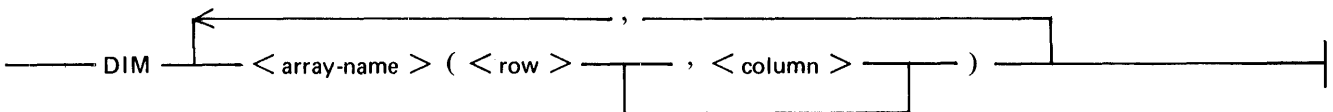
### ARRAY DECLARATIONS

Array declarations may be used to specify the dimension bound(s) of an array. There are two statements used to declare array dimension bounds: the DIM statement and the OPTION statement.

#### DIM STATEMENT ARRAY SIZE DECLARATION

The DIM statement is used to specify the upper-dimension bound(s) of the subscript(s) of an array and/or to limit the maximum length of a string variable. The use of the DIM statement with string variables is described under DIM Statement String Size Declaration. The syntax for the DIM statement when used with arrays follows.

Syntax:



G18018

<array-name> follows the same formation rules as a simple variable name; that is, a letter, optionally followed by a digit, followed by a dollar sign (\$) if the array is to contain string data. <row> and <column> must be nonnegative integers. If both <row> and <column> are present, they must be greater than or equal to the base for arrays in the program. Refer to the OPTION statement in this section for more information on the base for arrays.

The declaration for an array, if present, must occur in a lower-numbered line than any reference to that array or to one of its elements. An array may be dimensioned only once in a DIM statement in each program.

Semantics:

Each array declaration occurring in a DIM statement declares the array named to be either 1- or 2-dimensional, according to whether one or two <integer>s are specified within the parentheses following the array name. These <integer>s specify the upper bounds of the array, the maximum values that subscripts for the array may have. There may be a maximum of two subscripts for any array. The first subscript represents the rows, the second represents the columns.

If the declaration for a string array in a DIM statement contains a string size declaration as described under DIM Statement String Size Declaration in Section 5, the maximum length of any character string associated with any element of that string array is the specified value.

Arrays that are not declared in any DIM statement are declared implicitly to be 1- or 2-dimensional according to their use in the program: if one subscript appears in an array reference, the array is 1-dimensional; if two

subscripts appear, the array is 2-dimensional. The upper-dimension bound on implicitly-declared arrays is 10. The lower-dimension on arrays is 0 unless the BASE option in an OPTION statement has declared it to be 1. Refer to the OPTION Statement for Arrays in this section for more information on the BASE option.

Examples of DIM statements:

```

OPTION BASE 1           ! Lower-dimension bound is 1.

DIM A(6), B(9,10)      ! A is 1-dimensional with 6 elements.
                       ! B is 2-dimensional with 9*10 elements.
                       ! Refer to Figure 6-1. Element
                       ! (8,2) is marked.

DIM A$(4,4), B$(100)*5 ! A$ is 2-dimensional with 4*4
                       ! elements. B$ is 1-dimensional
                       ! with 100 elements.

DIM P$(10,10)*10, C(50,2) ! String array P$ is 2-dimensional
                           ! with 10*10 elements. Maximum
                           ! element size is 10. Numeric
                           ! array C is 2-dimensional
                           ! with 50*2 elements.
  
```

	1	2	3	4	5	6	7	8	9	10
1										
2										
3										
4										
5										
6										
7										
8		XX								
9										

G18019

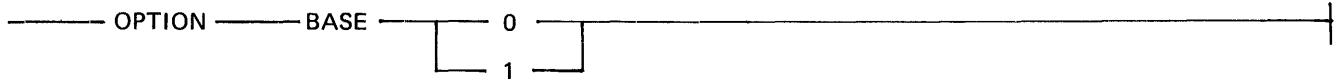
Element (8,2) is marked.

Figure 6-1. Representation of a 9 by 10 Array (OPTION BASE 1)

## OPTION STATEMENT FOR ARRAYS

The OPTION statement may be used to change the value of the lower-dimension bounds for arrays in a program. The syntax follows.

Syntax:



G18020

Semantics:

If an **OPTION** statement specifies that the lower bound for array subscripts is 1, then no **DIM** statement in the program can specify an upper bound of 0.

The **OPTION** statement with a **BASE** option, if present, must occur in a lower-numbered line than any **DIM** statement or any reference to an array in the program. Only one **BASE** option may occur in a program. If no **OPTION BASE** occurs in the program, the base defaults to zero.

Examples of **OPTION** statements:

```

OPTION BASE 1           ! Lower dimension bound for arrays is 1.
OPTION COLLATE NATIVE, BASE 1 ! Collating sequence used
                           ! in string comparisons
                           ! is EBCDIC. Lower-dimension
                           ! bound is 1.
    
```

## NUMERIC ARRAY MANIPULATION

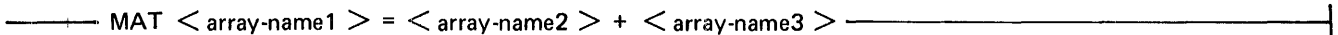
**BASIC** provides several statements to manipulate an entire array, rather than just one array element at a time. The statements available for numeric array manipulation are explained in this subsection. These statements follow normal rules of matrix algebra.

In all numeric array manipulation statements, overflow and underflow are reported to the user and program execution continues. With overflow, the value 7.237E+75 is substituted. With underflow, zero is substituted.

### MAT ADDITION STATEMENT

The purpose of the **MAT** addition statement is to add two numeric arrays and to assign the sum to a third array. The syntax follows.

Syntax:



G18021

<array-name1>, <array-name2>, and <array-name3> follow the same formation rules as a simple variable name.

Semantics:

<array-name1> is assigned the sum of <array-name2> and <array-name3>. If <array-name1> does not have the same dimensions as <array-name2> and <array-name3>, it may be redimensioned. Rules for redimensioning are described under the **MAT** assignment statement in this section. <array-name2> and <array-name3> must have the same dimensions. <array-name1> and <array-name2> may be the same array.

Examples of the use of the MAT addition statement:

```
OPTION BASE 1
DIM A(3,3) B(3,3), C(3,3)
MAT READ A,B
DATA 1,2,3
DATA 4,5,6
DATA 7,8,9
DATA 1,4,7
DATA 2,5,8
DATA 3,6,9
PRINT "ARRAY A IS"
MAT PRINT A;           ! MAT PRINT statement - Section 9
PRINT
PRINT "ARRAY B IS"
MAT PRINT B;
PRINT
PRINT "ARRAY C IS"
MAT C = A + B
MAT PRINT C;
```

Execution of the above example causes the following to be displayed.

```
ARRAY A IS
 1  2  3
 4  5  6
 7  8  9

ARRAY B IS
 1  4  7
 2  5  8
 3  6  9

ARRAY C IS
 2  6 10
 6 10 14
10 14 18
```

## MAT ASSIGNMENT STATEMENT

The purpose of the MAT assignment statement is to move the elements of one array to the elements of another array.

Syntax:

———— MAT < array-name1 > = < array-name2 > —————

G18022

<array-name1> and <array-name2> follow the same naming conventions as simple numeric variables.

**Semantics:**

<array-name1> and <array-name2> must have the same number of dimensions but not necessarily the same upper bounds on those dimensions. If the upper-dimension bounds are different, <array-name1> may be re-dimensioned to match <array-name2>. This is known as dynamic re-dimensioning. Dynamic re-dimensioning takes place only if (1) the original total number of elements in <array-name1> is greater than or equal to the total number of elements in <array-name2> and (2) the number of dimensions of <array-name1> and <array-name2> are the same. Otherwise, a fatal error occurs.

When a numeric array is re-dimensioned dynamically, the current upper bound for each subscript is changed to match the size of its new value and the current lower bound for each subscript stays the same.

Example of a numeric array assignment statement with re-dimensioning:

```
DIM B(4,4)
MAT READ A(2,2)
DATA 1,2,3,4
MAT B = A
MAT PRINT B;
```

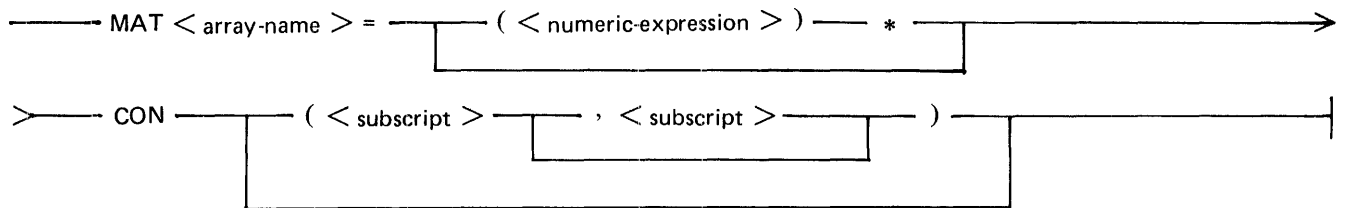
Execution of the example above causes the following to be displayed.

```
1 2
3 4
```

## MAT CON STATEMENT

The MAT CON statement initializes all of the data elements of an array to the numeric constant 1 or to the value of a numeric expression. The MAT CON statement may also be used to re-dimension an array. The syntax of the MAT CON statement follows.

**Syntax:**



G18023

<array-name> follows the same naming conventions as simple numeric variables. <numeric-expression> is described under Numeric Expressions in Section 4.

**Semantics:**

If present, the <numeric-expression> is evaluated and used in place of the numeric constant 1 to initialize each element of the array.

The <subscript>s must be greater than or equal to the lower-dimension bound for arrays in the program unit where the MAT CON statement occurs. If one or both of the <subscript>s are present, a redimension is implied. Arrays are redimensioned in the same manner as described for the MAT assignment statement in this section.

Example of the use of the MAT CON statement:

```
OPTION BASE 1
DIM A(3,5)
MAT A = CON
MAT PRINT A;
PRINT
MAT A = (2) * CON(3,3)
MAT PRINT A;
```

Execution of this example gives the following output:

```
1 1 1 1 1
1 1 1 1 1
1 1 1 1 1

2 2 2
2 2 2
2 2 2
```

## DOT FUNCTION

The DOT function produces the dot product of two 1-dimensional arrays.

Syntax:

\_\_\_\_\_ DOT ( < array-name > , < array-name > ) \_\_\_\_\_  
G18024

<array-name>s follow the same formation rules as a simple numeric variable and must be singly subscripted numeric arrays.

Semantics:

The dot product is the sum of the products of each of the corresponding elements of the arrays.

Example of the use of the DOT function:

```
OPTION BASE 1
DIM A(2), B(2)
DATA 2,3,4,3
MAT READ A, B
PRINT DOT(A,B)
```

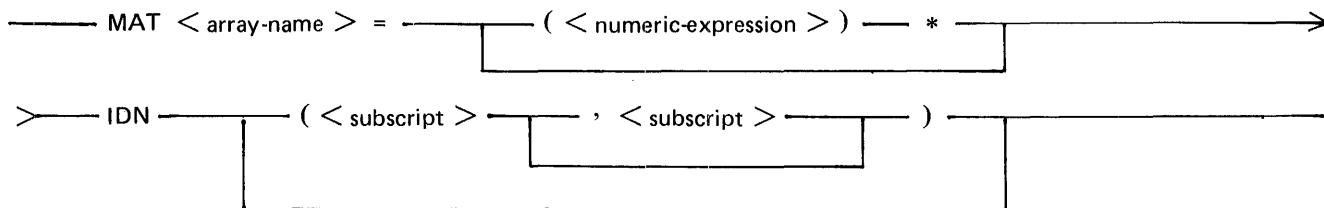
Execution of this example produces the following output:

17

## MAT IDN STATEMENT

The MAT IDN statement zeros a square array and places the integer 1 or the value of a numeric expression in each element on the main diagonal.

Syntax:



G18025

<array-name> follows the same naming conventions as simple numeric variables. <array-name> must be a square array or must be redimensioned to be a square array. In a square array, the upper-dimension bounds are equal to each other. <numeric-expression> is described under Numeric Expressions in Section 4.

Semantics:

<numeric-expression>, if present, is evaluated and used as the value for each element of the array instead of the integer 1. The <subscript>s must be greater than or equal to the lower-dimension bound for arrays in the program unit where the MAT IDN statement occurs. The subscripts, if present, imply a redimension of <array-name>.

Examples of MAT IDN statements:

```

OPTION BASE 1
DIM X(3,3)
MAT X=IDN
MAT Y=(10)*IDN(4,4)
MAT PRINT X; Y;
  
```

Execution of this example causes the following to be displayed.

```

1 0 0
0 1 0
0 0 1

10 0 0 0
0 10 0 0
0 0 10 0
0 0 0 10
  
```

## MAT MULTIPLICATION STATEMENT

The purpose of the MAT multiplication statement is to multiply two numeric arrays and to assign the product to a third array.

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Syntax:

———— MAT < array-name1 > = < array-name2 > \* < array-name3 > —————

G18026

<array-name1>, <array-name2>, and <array-name3> follow the same formation rules as a simple variable name.

Semantics:

<array-name1> is assigned the product of <array-name2> and <array-name3>. If <array-name1> does not have the row dimension of <array-name2> and the column dimension of <array-name3>, it may be redimensioned. Rules for redimensioning are described under the MAT assignment statement in this section. The column dimension of <array-name2> must be the same as the row dimension of <array-name3>. <array-name1>, <array-name2>, and <array-name3> may be the same array.

When two arrays are multiplied, the dot product of the first row of the first array and of each column of the second array forms the first row in the answer; the dot product of the second row of the first array and each column of the second array forms the second row in the answer, and so on.

Example of the MAT multiplication statement:

```
OPTION BASE 1
DIM C(2,2)
MAT READ A(2,3), B(3,2)
DATA 1,2,3,4,5,6
DATA 1,2,3,4,5,6
MAT C = A * B
PRINT "MAT A ="
MAT PRINT A;
PRINT
PRINT "MAT B ="
MAT PRINT B;
PRINT
PRINT "MAT C ="
MAT PRINT C;
```

Execution of this example causes the following to be displayed.

```
MAT A =
 1  2  3
 4  5  6

MAT B =
 1  2
 3  4
 5  6

MAT C =
 22  28
 49  64
```



## MAT SCALAR MULTIPLICATION STATEMENT

The MAT scalar multiplication statement allows each element of an array to be multiplied by any scalar number.

Syntax:

———— MAT < array-name > = < sign > ( < numeric-expression > ) \* < array-name > —————

G18027

<array-name> follows the same naming conventions as simple numeric variables. The two <array-name>s may name the same array. <numeric-expression> is described under Numeric Expressions in Section 4.

Example of the use of MAT scalar multiplication statements:

```
OPTION BASE 1
DIM A(3,3),B(3,3)
MAT READ A
DATA 1,2,3,4,5,6,7,8,9
PRINT "ARRAY A IS"
MAT PRINT A;
PRINT
PRINT "ARRAY B IS"
MAT B = - (2) * A
MAT PRINT B;
```

Execution of this example gives the following output:

```
ARRAY A IS
 1  2  3
 4  5  6
 7  8  9

ARRAY B IS
-2 -4 -6
-8 -10 -12
-14 -16 -18
```

## MAT SUBTRACTION STATEMENT

The purpose of the MAT subtraction statement is to subtract one array from another array and to assign the difference to a third array.

Syntax:

———— MAT < array-name1 > = < array-name2 > < minus-sign > < array-name3 > —————

G18028

<array-name1>, <array-name2>, and <array-name3> follow the same formation rules as a simple variable name.

Semantics:

<array-name1> is assigned the difference of <array-name2> and <array-name3>. If <array-name1> does not have the same dimensions as <array-name2> and <array-name3>, it may be redimensioned. Rules for redimensioning are described under the MAT assignment statement in this section. <array-name2> and <array-name3> must have the same dimensions. <array-name1> and <array-name2> may name the same array.

Example of the use of the MAT subtraction statement:

```
OPTION BASE 1
DIM A(3,3), B(3,3), C(3,3)
MAT READ A,B
DATA 1, 2, 3, 4, 5, 6, 7, 8, 9, 2, 4, 6, 8, 1, 3, 5, 7, 9
PRINT "ARRAY A IS"
MAT PRINT A;
PRINT
PRINT "ARRAY B IS"
MAT PRINT B;
PRINT
PRINT "ARRAY C IS"
MAT C = A - B
MAT PRINT C;
```

Execution of this example gives the following output:

```
ARRAY A IS
 1  2  3
 4  5  6
 7  8  9

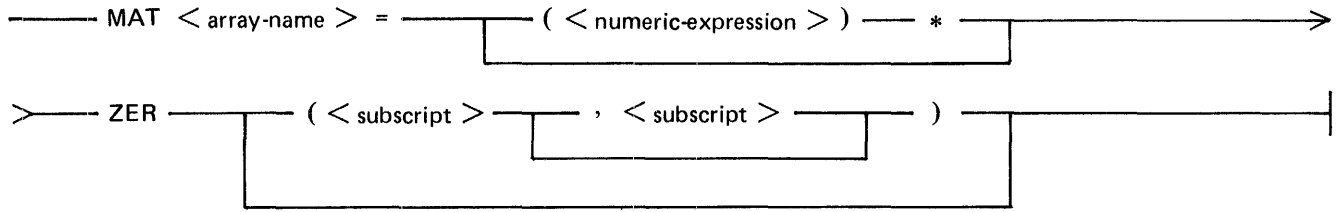
ARRAY B IS
 2  4  6
 8  1  3
 5  7  9

ARRAY C IS
-1 -2 -3
-4  4  3
 2  1  0
```

## MAT ZER STATEMENT

The MAT ZER statement initializes the elements of the specified numeric array to the numeric constant 0, and may optionally be used to redimension the array.

Syntax:



G18029

<array-name> follows the same naming conventions as simple numeric variables. <numeric-expression> is described in Section 4.

Semantics:

The <subscript>s must be greater than or equal to the lower-dimension bound for arrays in the program unit where the MAT ZER statement occurs. If one or both of the <subscript>s are present, a redimension is implied. Arrays are redimensioned in the same manner as described for the MAT assignment statement in this subsection. <numeric-expression> has no effect on the execution of this statement.

Examples of the MAT ZER statement:

```
OPTION BASE 1
DIM A(2,10)
MAT A = ZER
MAT PRINT A;
PRINT
MAT A = ZER(4,2)
MAT PRINT A;
```

Execution of this example gives the following output:

```
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0

0 0
0 0
0 0
0 0
```

## STRING ARRAY MANIPULATION

As with numeric arrays, an entire string array may be operated upon, rather than just one element. The statements available for string array manipulation are described in this subsection.

### MAT ASSIGNMENT STATEMENT

The purpose of the MAT assignment statement is to move the elements of one array to the elements of another array.

Syntax:

```
_____ MAT < array-name1 > = < array-name2 > _____
```

G18022

<array-name1> and <array-name2> follow the same naming conventions as simple string variables.

Semantics:

<array-name1> and <array-name2> must have the same number of dimensions but not necessarily the same upper bounds on those dimensions. If the upper-dimension bounds are different, <array-name1> is redimensioned to match <array-name2>. This takes place only if (1) the original total number of elements in <array-name1> is greater than or equal to the total number of elements in <array-name2> and (2) the number of dimensions of <array-name1> and <array-name2> are equal; otherwise, a fatal error occurs.

When a string array is redimensioned dynamically, the current upper bounds for its subscripts are changed to match the size of its new value and the current lower bounds stay the same.

Example of the use of a string array assignment statement:

```
OPTION BASE 1
DIM Z$(3,4)
DATA AARDVARK,NEXT STRING,123456789,FOURTH,ELEPHANT,TACK
DATA COZUMEL, WRITE RING,"NO CABO.!", "NO! NO QUEPO."
DATA "TU TAMPOCO?",END
MAT READ Z$
MAT Y$ = Z$
MAT PRINT Y$
PRINT "----*----1----*----2----*----3----*----4----*----5----*!"
```

Execution of this example gives the following output:

```
AARDVARK      NEXT STRING      123456789      FOURTH
ELEPHANT      TACK              COZUMEL        WRITE RING
NO.CABO.      NO! NO QUEPO.    TU TAMPOCO?    END
----*----1----*----2----*----3----*----4----*----5----*
```

## MAT NUL\$ STATEMENT

The MAT NUL\$ statement assigns the null string to each element of a string array. MAT NUL\$ may also be used to redimension an array.

Syntax:

———— MAT < array-name > = NUL\$ ( < subscript > , < subscript > )

G18030

<array-name> must follow the same naming conventions as simple string variables.

Semantics:

The <subscript>s must be greater than or equal to the lower-dimension bound for arrays in the program unit where the MAT NUL\$ statement occurs. If one or both of the <subscript>s are present, a redimension is implied. Arrays are redimensioned in the same manner as described for the MAT assignment statement in this subsection.

Examples of the MAT NUL\$ statement:

MAT A\$ = NUL\$	! Each element in A\$ gets the null string.
MAT B\$ = NUL\$(5,6)	! Each element in B\$ gets the null ! string and the array is redimensioned ! to a 5 by 6 array.

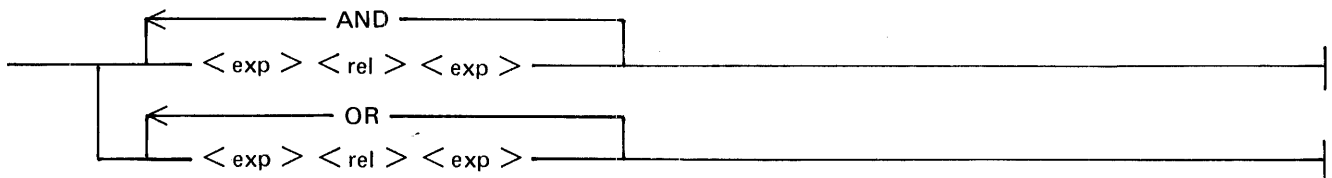
## SECTION 7 CONTROL STRUCTURES

Normally, the executable statements in a BASIC program are executed in line number sequence; that is, after one statement is executed, the statement immediately following it is executed. Control statements are used to alter the normal flow of a program. They may transfer the control to another part of the program, terminate program execution, or control iterative processes. The control structures available in Burroughs B 1000 BASIC and the expressions that are used in several of these structures are described in this section.

### RELATIONAL EXPRESSIONS

Relational expressions enable the values of expressions to be compared in order to influence the flow of control in a program unit.

Syntax:



G18031

<exp> is either a string or a numeric expression as described in Sections 4 and 5, respectively. <rel> is a relational symbol. Table 7-1 lists the valid relational symbols.

**Table 7-1. Relational Symbols**

Symbol(s)	Meaning
=	equal to
<> or ><	not equal to
<	less than
>	greater than
<= or =<	less than or equal to
>= or =>	greater than or equal to

Semantics:

Two numeric expressions are considered equal only if the expressions have the same value. Two string expressions are considered equal only if the values of the two expressions have the same length and contain identical sequences of characters.

In the evaluation of string relational expressions, the relation “less than” means “earlier in the collating sequence than,” and “greater than” means “later in the collating sequence than.” If two strings of different lengths occur in a relational expression and one is an initial leftmost segment of the other, the shorter string is less than the other. Otherwise, the relationship between two strings of unequal length is determined by the contents of the shorter string and the leftmost portion of the longer string which is the same length as the shorter string.

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The value of a relational expression involving the conjunction AND is true if the value of each separate relation is true. The value of a relational expression involving OR is true if the value of at least one of each separate relation is true. Each separate relational expression is evaluated from left to right until the truth or falsity of the entire relational expression can be determined.

Examples of relational expressions:

A < B	! A is less than B.
A >= C	! A is greater than or equal to C.
A <= X AND X <= B	! A is greater than or equal to X ! and X is less than or equal to B.
A\$ = B\$ OR A\$ = ""	! A\$ equals B\$ or A\$ equals null string.0
A<B AND B<C AND C<D	! A is less than B and B is less than ! C and C is less than D.
I <= 10 AND A(I) <> 0	! I is less than or equal to 10 ! and A(I) is not equal to 0. ! If I is greater than 10, the ! test A(I) <> 0 is not made.

## CONTROL STATEMENTS

Control statements permit the interruption of the normal sequence of execution of statements and cause execution to continue at a specified line, rather than at the line with the next line number in line number sequence.

### GOTO STATEMENT

The GOTO statement causes an unconditional transfer of control.

Syntax:

———— GOTO < line-number > ————— |  
G18032

< line-number > is described under Statement Lines in Section 3. Execution of a GOTO statement causes program execution to continue at the line with the specified < line-number >.

Semantics:

< line-number > must not cause a jump into a FOR NEXT loop (refer to FOR NEXT structure in this section) or a user-defined function.

Examples of GOTO statements:

```
GOTO 100  
GO TO 5550
```





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<index> is a numeric expression as described in Section 4. <index> is rounded to obtain an integer:  $\text{INT}(\text{<index>} + 0.5)$ . <line-number> is described under Statement Lines in Section 3. <statement>, if present, can be any BASIC statement except the following:

IF  
FOR or NEXT  
DIM  
OPTION  
DATA  
IMAGE  
DEF or FNEND  
END  
REM  
ON

Semantics:

When an ON GOTO statement is executed, the <index> is evaluated and used as an index into the list of <line-numbers>. The list of <line-number>s is numbered from left to right, starting with the integer 1. If an ELSE occurs, the <statement> following the ELSE is executed if the value of <index> is less than 1 or greater than the number of <line-number>s in the list. If there is no ELSE clause (ELSE part) and <index> is less than 1 or greater than the number of <line-number>s in the list, a fatal error occurs.

Examples of ON GOTO statements:

```
ON L+1 GOTO 400, 400, 500
ON X GOTO 100, 200, 150, 9999 ELSE LET A = 1
```

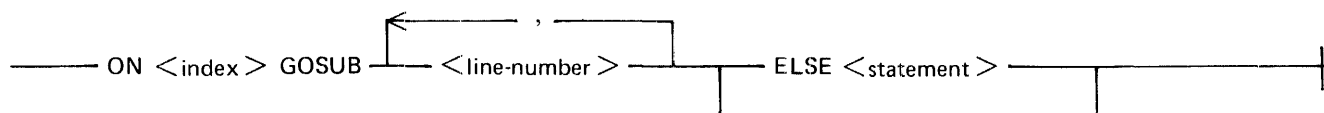
In the first statement, if  $L = 0$  or  $L = 1$ , line 400 is the next line executed. If  $L = 2$ , line 500 is executed next. Any other value for  $L$  causes a fatal error.

In the second statement, if  $X = 1$ , statement 100 is executed next. If  $X = 2$ , statement 200 is executed next. If  $X = 3$ , statement 150 is executed next. If  $X = 4$ , statement 9999 is executed next. If  $X$  is none of these values, variable  $A$  is assigned the value 1 and execution continues with the statement following the ON GOTO statement.

## ON GOSUB AND RETURN STATEMENTS

The ON GOSUB and RETURN statements allow control to be transferred to and from any one of a group of subroutines.

Syntax:



G18036

The syntax for the RETURN statement is the same as listed under GOSUB and RETURN Statements in this section.

<index> is a numeric expression as described in Section 4. <index> is rounded to obtain an integer:  $\text{INT}(\text{<index>} + 0.5)$ . <line-number> is described under Statement Lines in Section 3. <statement>, if present, can be any BASIC statement except the following:

IF  
FOR or NEXT  
DIM  
OPTION  
DATA  
IMAGE  
DEF or FNEND  
END  
REM  
ON

#### Semantics:

When an ON GOSUB statement is executed, the <index> is evaluated and used as an index into the list of <line-numbers>. The list of <line-number>s is numbered from left to right, starting with the integer 1. If an ELSE occurs, the <statement> following the ELSE is executed if the value of <index> is less than 1 or greater than the number of <line-number>s in the list. If there is no ELSE clause and <index> is less than 1 or greater than the number of <line-number>s in the list, a fatal error occurs.

Examples of ON GOSUB and RETURN statements:

```
ON A+7 GOSUB 1000, 2000, 7000, 4000
ON F1-2 GOSUB 4360, 4460, 4660 ELSE PRINT F1
```

In the first statement, if  $A = -6$ , line 1000 is executed next. If  $A = -5$ , line 2000 is executed next. If  $A = -4$ , line 7000 is executed next, and if  $A = -3$ , line 4000 is executed next. Any other value for A causes a fatal error.

In the second statement, if  $F1 = 3$ , line 4360 is executed next. If  $F1 = 4$ , line 4460 is executed next. If  $F1 = 5$ , line 4660 is executed next. If F1 is none of these values, variable F1 is displayed and execution continues with the statement following the ON GOSUB statement.

## LOOP STRUCTURES

Loop structures provide for the repeated execution of a sequence of statements. The loop structure available in Burroughs B 1000 BASIC is described in this section.

### FOR NEXT STRUCTURE

The FOR NEXT structure provides for the construction of counter-controlled loops.

Syntax for the FOR statement:

```
FOR <control-var> = <initial-value> TO <limit> STEP <increment>
```

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Syntax for the NEXT statement:

```
_____ NEXT <control-var> _____
```

G18038

The FOR and NEXT statements must occur in corresponding pairs. <control-var> is a simple numeric variable, and must be the same variable in corresponding FOR and NEXT statements. <initial-value>, <limit>, and <increment> are numeric expressions. If the STEP clause is omitted, <increment> defaults to 1.

There may be any number of BASIC statements between corresponding FOR and NEXT statements. These statements, plus the FOR and NEXT statements, comprise a FOR block. A FOR block may contain any BASIC statement except an END statement.

Semantics:

The FOR NEXT structure allows a group of statements to be executed a specified number of times. The action of the FOR NEXT structure can be defined in terms of other BASIC statements as follows.

FOR NEXT structure:

```
10 FOR C = I1 TO L STEP I2
   (BASIC statements)
100 NEXT C
```

Equivalent BASIC statements:

```
10 LET X1 = L
20 LET X2 = I2
30 LET C = I1
40 IF (C-X1) * SGN(X2) > 0 THEN GOTO 100
   (BASIC statements)
80 LET C = C + X2
90 GOTO 40
100 REM -- REMAINDER OF PROGRAM UNIT
```

Within the body of the FOR NEXT structure the value of <control-var> may be changed. Any such change may affect the number of times that the body is executed. The numeric expressions <initial-value>, <limit>, and <increment> may also be changed in the body if simple numeric variables are used for these expressions, but changes to these variables do not affect the number of times that the body is executed.

FOR NEXT structures may be nested, but nested FOR NEXT structures must use different <control-var>s. When nesting is used, the innermost structure must be completely terminated before any of the outer structures are terminated.

A line number within the body of a FOR NEXT structure cannot be referred to outside of that structure by a GOTO, GOSUB, ON, or IF statement.

Examples of FOR NEXT structures:

```
FOR I = 1 TO 10
  LET A(I) = I
NEXT I

FOR C7 = A TO B STEP -1
  C$(C7) = D$
  PRINT C$(C7)
NEXT C7
```

Example of the use of nested FOR NEXT structures:

```
OPEN #1: "INFILE", INTERNAL, INPUT !OPEN statement - Section 9
DIM A(100,100)
FOR I = 1 TO 100
  FOR J = 1 TO 100
    INPUT #1: A(I,J)
  NEXT J
NEXT I
```

The first FOR NEXT structure initializes elements one through ten of array A to the values 1 through 10.

The second FOR NEXT structure is similar to the first in that an array is being initialized, but in this example, the initial and limiting values are variables instead of constants as in the first example. This example also shows the use of the STEP clause with a negative increment.

The example of the nested FOR NEXT structures shows how a 2-dimensional array, A, can be easily loaded from a disk file. The description of statements used with disk files is in Section 9.

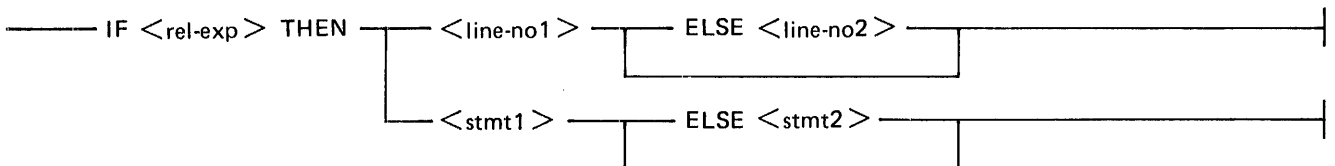
## DECISION STRUCTURES

Decision structures allow for the conditional execution of statements. One decision structure, the IF statement, is available in B 1000 BASIC.

### IF STATEMENT

The IF statement permits conditional transfer of control or conditional execution of a statement. The syntax of the IF statement follows.

Syntax:



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<rel-exp> is a relational expression as described under Relational Expressions in this section. <line-no1> and <line-no2> represent line numbers which refer to lines in the same program unit. <stmt1> and <stmt2> are any BASIC statements except the following:

- IF
- FOR or NEXT
- DIM
- OPTION
- DATA
- IMAGE
- DEF or FNEND
- END
- REM
- ON

Semantics:

With the line number construction of the IF statement, control is transferred to the line represented by <line-no1> if <rel-exp> is true. If <rel-exp> is false and the ELSE clause is present, control is transferred to the line represented by <line-no2>. If <rel-exp> is false and the ELSE clause is not present, the statement following the IF statement is executed next.

With the statement construction of the IF statement, <stmt1> is executed if <rel-exp> is true. If <rel-exp> is false and the ELSE clause is present, <stmt2> is executed. If <rel-exp> is false and the ELSE clause is not present, execution continues with the statement following the IF statement.

Examples of IF statements:

```
IF A < B THEN 100
IF A$ <> B$ THEN 250
IF A > 1 AND A < 2 THEN 100 ELSE 200
IF X => Y2 THEN GOSUB 900 ELSE GOSUB 2000
IF X$ <> "NO" OR X$ = "STOP" THEN LET A = 1
```

## SECTION 8 PROGRAM PARTITIONING

Burroughs B 1000 BASIC provides two facilities to partition programs. The first facility enables the user to define functions. These user-defined functions are used in numeric and string expressions in the same manner as the intrinsic numeric and string functions. The second facility, the CHAIN statement, enables separate programs to be executed sequentially without user intervention.

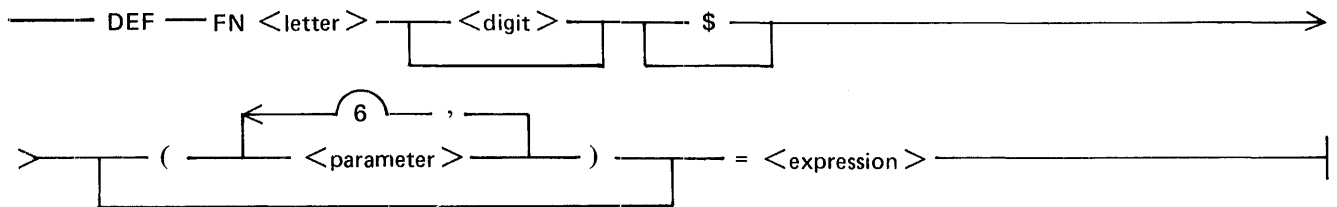
### USER-DEFINED FUNCTIONS

There are two types of user-defined functions: single-statement functions and multiple-statement functions. Each type may be either a numeric or a string function.

### SINGLE-STATEMENT FUNCTIONS

A single-statement function is a user-defined function that requires only one statement for its definition, the DEF statement. The function definition specifies the method of evaluating the user-defined function based on the values of the parameters, if any. The syntax of the DEF statement for a single-statement function definition follows.

Syntax:



G18040

<letter> is any English alphabet letter from A to Z. <digit> is any decimal digit. Spaces may not occur between FN and <letter>, between <letter> and <digit>, nor between <digit> and \$. The entities FN, <letter>, <digit>, and \$, are referred to as the function name. <parameter> is a simple variable. <expression> is either a string or numeric expression. <expression> may not reference the function being defined; that is, recursion is not allowed in single-statement functions.

Semantics:

When a user-defined function is referenced, that is, when its name occurs in an expression, any arguments in the function reference are evaluated and their values are assigned to the parameters which appear in the function definition (parameters are passed by value to functions). After the arguments are passed, the expression associated with the function is evaluated and its value is assigned as the value of the function.

A <parameter> is recognized only within the function definition in which it appears, that is, parameters are local to the function; it is distinct from any variable with the same name outside the function definition. All other variables in a function definition are recognized in the entire program, that is, they are global to the program.

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Program Partitioning

A function is executed only when its name is referenced. If a function definition statement is reached in some other fashion, the function is not executed, and execution proceeds to the next line.

Examples of single-statement function definitions:

```
DEF FNP = 3.14159           ! FNP is defined to be an
                           ! approximation of PI.

DEF FNA(X) = A * X + B

DEF FNC(A,B) = A * B + 1

DEF FNA$(S$,T$) = S$ & T$
```

The second example defines FNA as a numeric function with one parameter. The value of the function is the product of A and the parameter, X, added to B.

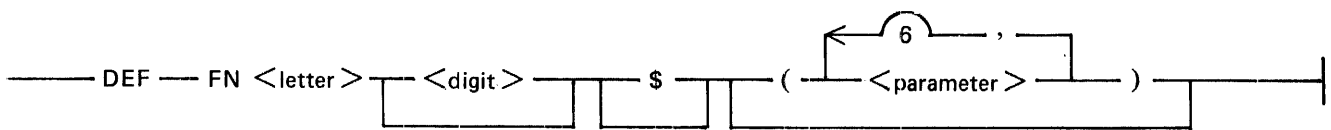
The third example defines FNC as a numeric function with two parameters. The value of the function is the product of the two parameters plus 1.

The fourth example defines FNA\$ as a string function with two parameters. The value of the function is the concatenation of the two parameters.

### MULTIPLE-STATEMENT FUNCTIONS

A multiple-statement function is a user-defined function that requires more than one statement for its definition. The function definition specifies the method of evaluating the user-defined function based on the value(s) of the parameter(s), if any. The two statements required for this definition are the DEF statement for multiple-statement functions and the FNEND statement. The syntax for these statements follows.

Syntax for the DEF statement:



G18041

Syntax for the FNEND statement:



G18042

<letter> is any English alphabet letter from A to Z. <digit> is any decimal digit. Spaces are not allowed between FN and <letter>, between <letter> and <digit>, nor between <digit> and \$. The entities FN <letter>, <digit>, and \$, are referred to as the function name. <parameter> is a simple variable.

Between the DEF statement and the FNEND statement, any BASIC statement may occur except another DEF statement or an END statement. These intermediate statements specify what actions the function performs. FOR NEXT statements must be entirely contained within the function. Recursive function calls are allowed.

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Semantics:

A user-defined function is referenced by using its name in an expression. The arguments in the function reference, if any, are evaluated and their values assigned to the parameters which appear in the function definition, that is, parameters are passed by value to functions. After the arguments are passed, the expression associated with the function is evaluated and its value is assigned as the value of the function.

A <parameter> is local to the function definition in which it appears; it is distinct from any variable with the same name outside the function definition. All other variables in a function definition are global to the program unit in which the function occurs.

A function is executed only when its name is referenced. If a function DEF statement is reached in some other fashion, the function is not executed; execution proceeds to the line following the FNEND statement.

A control statement must not transfer control to a line within a multiple-statement function definition from outside the definition, or to a line outside a multiple-statement function definition from a line within it.

Examples of multiple-statement function definitions:

```
100 DEF FNA(A$)
110     LET FNA = 1
120     IF A$ = "YES" THEN 140
130     LET FNA = 2
140 FNEND
```

```
100 DEF FNB1$(T)
110     LET FNB1$ = "YES"
120     IF T = 1 THEN 140
130     LET FNB1$ = "NO"
140 FNEND
```

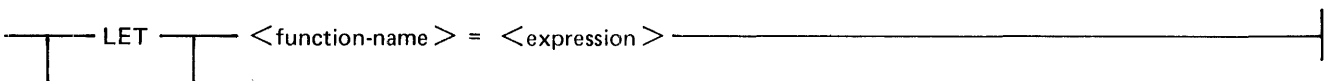
Both of these examples show the use of the LET statement with a multiple-statement function. The LET statement is used to assign a value to the function. If no LET statement occurs in a multiple-statement function, the value of the function is either zero or the null string depending on the type of the function. The assignment statement for multiple-statement functions is fully described in the following subsection.

These examples are very similar to one another: the first assigns a numeric value to the function according to the value of a string variable, A\$. The second does the converse of the first in that a string value is assigned to the function according to the value of a numeric variable.

### Assignment Statement For Multiple-Statement Functions

The assignment statement for multiple-statement functions resembles the assignment statement for numeric and string variables as described in Sections 3 and 4, respectively. However, there is one difference: the assignment statement, as used with multiple-statement functions, is used to assign a value to a function name rather than to a variable.

Syntax:



G18043



<function-name> must be a multiple-statement function. <expression> is any numeric or string expression. The assignment statement for multiple-statement functions must occur within a multiple-statement function.

For examples of the LET statement, refer to the previous subsection entitled Multiple-Statement Functions.

## CHAIN STATEMENT

The CHAIN statement allows separate BASIC programs to be run serially without programmer intervention.

Syntax:

```
_____ CHAIN <program-designator > _____|  
G18044
```

<program-designator> is a string expression which specifies the name of the next program to be run. <program-designator> must take the following form:

```
_____ <program-name > _____|  
          |  
          | ON <pack-name > _____|  
          |  
          |  
G18045
```

<program-name> must conform to the rules for MCP file names as described under Syntax Definitions in Section 11. <pack-name> is described in the same subsection.

Semantics:

When <program-designator> is evaluated, <program-name> is the name of a BASIC source program residing on disk. The ON option specifies the pack upon which the file resides. If ON is not specified, the default pack is assumed. The default pack is the pack associated with the currently logged-on usercode, or it is the system disk if no usercode is used.

Upon execution of a CHAIN statement, all files that are open (have an assigned channel number) in the currently executing program, are closed (disassociated from the channel number) and must be explicitly opened in the following program if they are to be used in that program. Variables in the program designated by <program-name> are independent of variables of the same name in the program containing the CHAIN statement; that is, all variables in <program-name> are initialized to zero or to the null string, depending on their type.

Execution of a CHAIN statement causes termination of the program containing the CHAIN statement. The CHAIN statement is not executed if the program containing the CHAIN statement has not been saved. Refer to the SAVE command in Section 11.

Examples of CHAIN statements:

```
CHAIN "PROG2"  
  
CHAIN A$           ! Chain to the program whose name is  
                   ! contained in A$.  
CHAIN "BASIC/PROG1 ON ! BASIC/PROG1 is on the  
PACK1"           ! pack named PACK1.
```

## SECTION 9 INPUT/OUTPUT

Input and output facilities provide for the interaction of a BASIC program with collections of data. Data may be obtained by a program from statements within the program, from a terminal, or from an external file. Output data may be directed to a terminal, a line printer, or an external file. This section describes the statements available in Burroughs B 1000 BASIC for input from and output to these sources and destinations. The section is divided into three major subsections: Program-internal Input, Terminal I/O, and File I/O Statements.

### PROGRAM-INTERNAL INPUT

Program-internal data is data that is obtained by a program from statements within the program. There are three statements associated with program-internal data: the DATA statement, the READ statement, and the RESTORE statement.

### DATA STATEMENT

The DATA statement supplies data to a READ statement.

Syntax:



<datum> is either a numeric constant, a string constant, or a string constant without the enclosing quotation marks. More than one DATA statement may appear in a program.

Semantics:

Data from all DATA statements in a program is logically grouped into one data block and is read from that block in the sequence in which the DATA statements appear in the program.

If the execution of a program reaches a line containing a DATA statement, execution proceeds to the next line with no other effect.

The DATA statement is always used in conjunction with the READ statement.

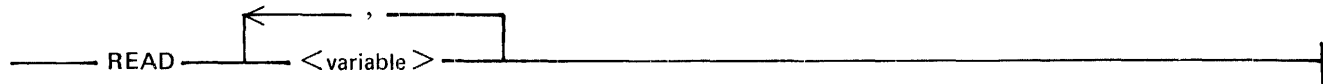
Examples of DATA statements:

```
DATA 5,12,50,1,8,734
DATA 3.14159, PI, 5E-30, ",",
DATA COMMAS CANNOT OCCUR IN UNQUOTED STRINGS.
```

## READ STATEMENT

The READ statement reads the data from the DATA statement(s).

Syntax:



G18047

<variable> can be any numeric or string variable.

Semantics:

Execution of a READ statement causes variables in the READ statement to be assigned values from the DATA statements in the program unit. If there are more <variable>s in the READ statement than there are data items in the DATA statement, a fatal error occurs.

The type of a <datum> in the DATA statements must correspond to the type of the variable to which it is to be assigned. Numeric variables require as data unquoted strings which are numeric constants, and string variables require quoted strings or unquoted strings as data. An unquoted string that is a valid numeric constant may be assigned by a READ statement to a string variable or to a numeric variable. If an attempt is made to assign a quoted string constant to a numeric variable or to assign an unquoted string constant to a numeric variable, a fatal error results.

Variables in the list of <variable>s for the READ statement are assigned values from left to right. Thus, any variables that appear as subscripts in the list of <variable>s are evaluated after values are assigned to the variables preceding (to the left of) the subscripted variable. Thus, a variable, I for example, may appear in a READ statement as a simple numeric variable, and then to the right of its first appearance, as the subscript for a subscripted variable (for example, READ I,A\$(I)).

If the assignment of a numeric <datum> causes an underflow, the value of the <datum> is replaced by the value 0. If an overflow occurs, the <datum> is replaced by the largest machine value. In both of these cases the condition is reported to the user and execution continues. If assignment of a string <datum> to a string variable results in a string overflow, a fatal error results.

Examples of READ and DATA statements:

```
READ A,B,C
READ Z$,Y$,X$
READ D(A), E1(B), F$(C), I
DATA 5,0,9,25,"THIS IS A QUOTED STRING."
DATA THIS IS AN UNQUOTED STRING.,1E+50,7,JOE SMITH,1
```

Execution of these statements has the same effect as the following assignment statements:

```
LET A = 5
LET B = 0
LET C = 9
LET Z$ = "25"
LET Y$ = "THIS IS A QUOTED STRING."
LET X$ = "THIS IS AN UNQUOTED STRING."
LET D(A) = 1E+50
LET E1(B) = 7
LET F$(C) = "JOE SMITH"
LET I = 1
```

## RESTORE STATEMENT

The RESTORE statement allows the data in DATA statements to be reread.

Syntax:

----- RESTORE -----|

G18048

Semantics:

Execution of a RESTORE statement causes subsequent READ statements to take data starting from the beginning of the block of data formed from all of the DATA statements in the program.

Example of READ, DATA, and RESTORE statements:

```
READ I,J,K,L
DATA 1,2,10,100
RESTORE
READ M,N,O
```

Execution of these statements is equivalent to the following assignment statements:

```
LET I = 1
LET J = 2
LET K = 10
LET L = 100
LET M = 1
LET N = 2
LET O = 10
```

## TERMINAL I/O

Terminal input and output statements provide for user interaction with a program by allowing variables to be assigned values supplied from a terminal. The various statements used in terminal I/O are described in this section.

### TERMINAL INPUT

There are two statements associated with terminal input: the INPUT statement and the LINPUT statement.

#### INPUT Statement

The INPUT statement allows the user to supply data from a terminal to variables within a program. The syntax for the INPUT statement and for the user's reply follow.

Syntax for the INPUT statement:

----- INPUT -----|  
PROMPT <string-expression> : <variable> ,

G18049

## B 1000 Systems Interactive BASIC (IBASIC) Reference Manual Input/Output

Syntax for the INPUT reply:



G18050

<string-expression> is any string expression as described in Section 5. <variable> is any numeric or string variable as described in Sections 4 and 5, respectively. The <datum> is either a numeric constant, a string constant, or an unquoted string (a string constant not enclosed in quotation marks). An unquoted string must be delimited by a comma if data follows it.

Semantics:

Execution of an INPUT statement causes program execution to be suspended until a valid reply is supplied. The user of a program is informed of the need to supply data by the output of a prompt. If the PROMPT option is not specified in the INPUT statement, the prompt is a question mark (?) followed by a space. If PROMPT is specified, the prompt is the <string-expression>.

Each <datum> from the user's reply must correspond to the type of the variable to which it is to be assigned. Numeric constants must correspond to numeric variables, and string constants or string constants not enclosed in quotation marks must correspond to string variables. Each <datum> must also be within the allowable range of values for that <datum>, and there must be an adequate number of data items for the list of <variable>s. No assignment of data is made until the preceding criteria are met. If these criteria are not met, IBASIC requests that the user resupply the data.

After this validation process is completed and valid data have been supplied, the variables in the INPUT statement are assigned values from the INPUT reply in the order in which they occur.

If an overflow occurs on a <datum>, whether numeric or string, IBASIC requests that the input be resupplied. If an underflow occurs on a numeric <datum>, its value is replaced by the value zero; execution then continues.

If neither the INPUT statement nor the corresponding reply contains a final comma, the number of data items in the reply must equal the number of variables in the INPUT statement.

If an INPUT statement contains a final comma, the number of data in the INPUT reply may exceed the number of variables requiring values. The remaining data in an INPUT reply are retained to serve as the next requested INPUT reply or LINPUT reply. Any such excess data are discarded upon execution of a PRINT statement.

A comma at the end of an INPUT reply signifies that more data will be supplied. After the values contained in the INPUT reply are assigned to variables in the INPUT statement, a prompt is reissued. Execution of the program remains suspended until each <variable> in the <variable> list has been supplied with a value.

Subscripts in the list of <variables> are evaluated after values are assigned to the variables preceding (to the left of) them in the list.

Examples of INPUT statements:

```
INPUT X
INPUT X, A$, Y(2)
INPUT PROMPT "What is your name? ": N$
INPUT X, Y,
```

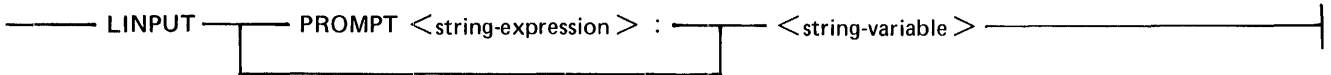
Examples of corresponding INPUT replies:

```
2
25 "ABOVE" 0.2
JOHN DOE
1,2,3,4,5,6
```

## LINPUT Statement

The LINPUT statement enables an entire line of input, including embedded spaces, commas, and quotation marks, to be assigned as the value of a string variable. Both the syntax for the LINPUT statement and for the reply to the LINPUT statement follow.

Syntax for the LINPUT statement:



G18051

Syntax for the LINPUT reply:



G18052

<string-expression> is any string expression as described in Section 5. <string-variable> is any string variable as described in Section 5. <character> is any character.

Semantics:

Execution of a LINPUT statement causes program execution to be suspended until a valid reply is supplied. The user of a program is informed of the need to supply data by the output of a prompt. If the PROMPT option is not specified in the LINPUT statement, the prompt is a question mark (?) followed by a space. If PROMPT is specified, the prompt is a <string-expression>. After the LINPUT reply is supplied, the string of <character>s is assigned to the <string-variable>.

Examples of LINPUT statements:

```
LINPUT A$
LINPUT PROMPT "": A$, B$      ! Prompt is the null string
```

Examples of LINPUT replies:

```
NOW IS THE TIME FOR ALL GOOD MEN TO COME TO THE AID OF THEIR PARTY.
```

```
!'"#$$%&'(=-\_\_.,?/<> +;,:*@
```

Any valid character, including commas, may occur in a LINPUT reply.

```
THIS IS A LINPUT REPLY.
```

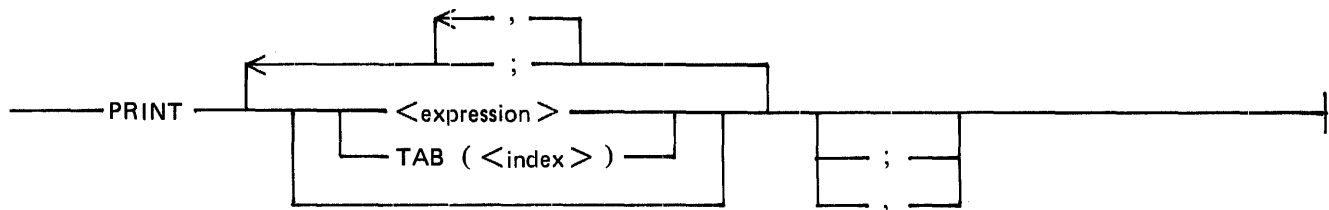
## TERMINAL OUTPUT

There are four statements associated with terminal output: the PRINT statement, the PRINT USING and IMAGE statements, and the MARGIN statement.

### PRINT Statement

The PRINT statement is used to generate output on a terminal.

Syntax:



G18053

<expression> is any numeric or string expression. <index> is a numeric expression which, when evaluated, is the columnar position on the terminal where the next <expression> is to be displayed. Columnar position is the number of print positions from the leftmost print position.

Semantics:

The execution of a PRINT statement generates a string of characters for transmission to a terminal. This string of characters is determined by the successive evaluation of each item in the PRINT statement as well as the type of separator used to delimit the items. Refer to Print Separators and TABs in this section.

Examples of PRINT statements:

```
PRINT X
PRINT X, Y
PRINT X, Y, Z,
PRINT ,,X
PRINT
PRINT "X EQUALS", 10
PRINT X; (Y*Z)/2
PRINT TAB(10); A$; "IS DONE."
```

The rules used for displaying the items in the PRINT statement are described in the four subsections that follow.

## *PRINTING NUMERIC VALUES*

Numeric expressions in a PRINT statement produce a string of characters consisting of a leading space if the number is positive, or a leading minus sign if the number is negative. This leading space or minus sign is followed by the decimal representation of the absolute value of the number. This sequence of characters is terminated by a trailing space. The possible decimal representations of a number are the same as those described for numeric constants in Section 4 and are used as follows:

1. A numeric value that is an integer in the range  $-16777215$  to  $+16777215$  is written as an integer, that is, a series of decimal digits without a decimal point or an exponent.
2. A numeric value that cannot be represented precisely as an integer is written as a real number, that is, a series of decimal digits with a decimal point. A real value that can be represented with six or less digits without losing accuracy is written without an exponent.
3. If accuracy would be lost by using only six digits, the value is displayed as a normalized decimal number with the necessary significant digits and with an exponent. For example,  $10^{**(-6)}$  is written as  $.000001$  and  $10^{*(-7)}$  is written as  $1.E-7$ . Exponents have a maximum of two decimal digits.

The maximum widths for each format follow.

<b>Format</b>	<b>Maximum width</b>
Integer	10 places: sign, 8 digits, trailing space
Real, no exponent	9 places: sign, 6 digits, decimal point, trailing space
Real, exponent	13 places: sign, 6 digits, decimal point, E, sign of exponent, 2-digit exponent, trailing space

Examples of numeric output:

```
1
5000
3.1415
6.283E+25
0
1.E-7
```

## *PRINTING STRING VALUES*

String expressions are evaluated to generate the corresponding string of characters.

### *PRINT SEPARATORS AND TABS*

A print separator is either a comma (,) or a semicolon (;) and is used to separate items in a PRINT or OUTPUT statement. These separators are shown in the syntax for the PRINT and OUTPUT statements in this section. TAB is also shown in the syntax for the PRINT and OUTPUT statements. The function of print separators and TABs is to specify what type of spacing is to be used between print items as they are displayed. A print item is an expression or TAB call occurring in a PRINT or OUTPUT statement.



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The evaluation of the semicolon separator generates the null string within the output. A null string is a string of zero length.

Example:

```
LET A, B = 4
PRINT "A+B="; A+B; "A*B="; 16
```

Execution of this example causes the following to be displayed.

```
A+B= 8 A*B= 16
```

The output from the evaluation of a comma separator or a TAB depends upon the string of characters already generated by the current or previous PRINT statements.

The use of the comma separator causes the columnar position to be advanced to the end of a predefined print zone. A print zone has a width of 15 print positions. In an 80-character print line there are five full-width print zones and one 5-character partial print zone. The length of the print line and, thus, the number of print zones may be changed by the MARGIN statement. For more information, refer to the description of the MARGIN statement in this section.

The evaluation of the comma print separator depends upon the current columnar position. One of three actions may be taken depending on this position. First, if the columnar position is neither in the last print zone on a line nor beyond the margin, one or more spaces are generated to set the columnar position to the beginning of the next print zone on the line.

Example:

```
LET A,B=4
PRINT "A+B=", A+B, "A*B=", 16
PRINT "-----1-----2-----3-----4-----5"
```

Execution of the above example causes the following to be displayed.

```
A+B=           8           A*B=           16
-----1-----2-----3-----4-----5
```

Second, if the current columnar position is in the last print zone on a line, an end-of-line character is generated by IBASIC and subsequent displaying continues on the next line. An end-of-line is a NUL, CR, LF, or ETX character, or the end of the record.

Example:

```
MARGIN 50 ! The MARGIN statement is described in Section 9.
PRINT 1,2,3,4,5,6,7
PRINT "-----1-----2-----3-----4-----5"
```

Execution of this example gives the following output:

```
1           2           3           4
5           6           7
-----1-----2-----3-----4-----5
```

Third, if the current columnar position is beyond the margin, as it would be if evaluation of the last print item exactly filled the line, an end-of-line character is generated and subsequent displaying begins in the first print zone on the new line.

Example:

```
MARGIN 50
PRINT 1,2,3,"FOUR",5,6,7
PRINT "-----1-----2-----3-----4-----5"
```

Execution of this example gives the following output:

```
      1           2           3           FOUR
      5           6           7
-----1-----2-----3-----4-----5
```

The TAB call sets the columnar position of the current line to the specified value. The current line is the string of characters generated by PRINT and OUTPUT statements since the last end-of-line character was generated. The syntax for the TAB call is shown in the PRINT statement syntax and also in the OUTPUT statement syntax.

When TAB is used in a PRINT statement, <index> is evaluated and rounded to an integer, n. If n is less than 1, an error message is displayed, n is replaced by 1, and execution continues. If n is greater than margin m, n is reduced by an integral multiple of m so that it is within the range  $1 \leq n \leq m$ ; that is, n is set equal to  $n - m * \text{INT}((n-1)/m)$ .

If the current columnar position of the current line is less than or equal to n, spaces are generated, if necessary, to set the columnar position to n. If the current columnar position of the current line is greater than n, an end-of-line character is generated followed by n-1 spaces to set the columnar position of the new current line to n.

If the value of a TAB expression is so large that significance is lost, a nonfatal error occurs. A nonfatal error is an error which causes an error message to be printed and allows execution to continue.

Example:

```
MARGIN 50
PRINT A; TAB(20); -1; TAB(40); B; TAB(65); C
PRINT "-----1-----2-----3-----4-----5"
```

Execution of this example gives the following output:

```
      0           -1           0
      0
-----1-----2-----3-----4-----5
```

### END-OF-LINE CONDITIONS

Under certain conditions an end-of-line character is generated by IBASIC before subsequent action to a print line. These conditions are described next.

Whenever the columnar position is greater than the integer 1 and the evaluation of the next print item would cause that position to exceed the margin by more than one position, an end-of-line character is generated prior to the characters generated by that print item.

During the evaluation of a print item whose length is greater than the margin length, if the generation of a character would cause the columnar position to exceed the margin by more than one position, an end-of-line character is generated before that character is displayed, resetting the columnar position to 1 on the following line.

An end-of-line character is generated when evaluation of a list of print items is completed, if that list does not end with a print separator. Otherwise, the rules for the print separator prevail.

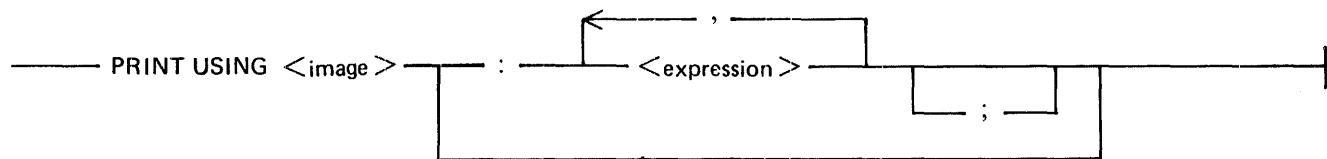
## Formatted Output

The PRINT USING statement is used to control the format of output by specifying an image to which that output must conform. The following two subsections describe the PRINT USING statement and the images used with it.

### *PRINT USING STATEMENT*

The PRINT USING statement uses a user-created image to format the print items on the print line.

Syntax:



G18054

<image> is either a string expression or a line number which references a separate IMAGE statement. <expression> is either a numeric or a string expression. The items following the colon (:) are referred to as the output list.

Semantics:

The execution of a PRINT USING statement generates a string of characters for transmission to a terminal. This string, which is generated from the list of <expression>s, is formatted according to the <image>. Possible values for the <image> are described next under Images.

Examples of PRINT USING statements:

```
PRINT USING 100: A, B      ! Image is located at line 100.
```

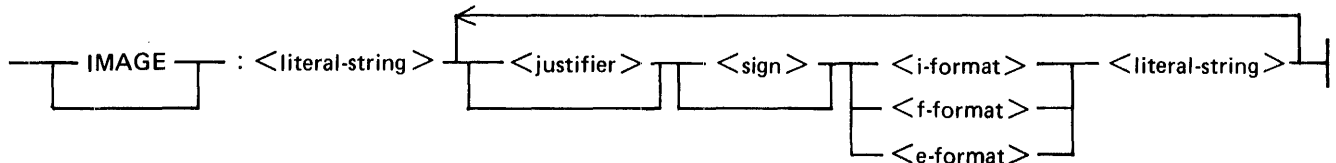
```
PRINT USING A$: D, E, F;  ! Image is located in string A$.
```

## *IMAGES*

Images are used in conjunction with PRINT USING statements. An <image> is either a line number which refers to an IMAGE statement containing a format string, or a string expression whose value is the format string. The syntax for a string expression used as an image is the same as for string expressions as described in Section 5. The syntax for a line number used as an image is the same as for line numbers as described

under Statement Lines in Section 3. The syntax for the IMAGE statement follows. The value for a string expression used as an image is also contained in the following syntax diagram, except that the word IMAGE and the colon (:) are excluded from the string expression.

Syntax:



G18055

<literal-string> is made up of any sequence of characters that may be used in a string constant except the following:

Character	Name
>	Greater than
<	Less than
#	Number sign
+	Plus sign
-	Minus sign
.	Period
^	Circumflex accent
"	Quotation mark

Even though these characters cannot be used in a <literal-string>, the same effect may be obtained by putting them in quoted strings in the output list.

<justifier> is either a greater than (>) or a less than (<) sign. <sign> is a plus (+) or a minus (-) sign. <circumflex-accent> is the circumflex accent character (^).

The format items, <i-format>, <f-format>, and <e-format>, are described in detail under Formatted Numeric Output in this section. All of the items following the colon in an image, which may include several format items and <literal-string>s, are referred to as the format string. Any spaces following the colon are part of the format string.

Semantics:

When the execution of a program encounters a line containing an IMAGE statement, execution proceeds to the next line with no other effect.

When a PRINT USING statement is executed, the associated format string is scanned. Any <literal-string>s are displayed exactly as they occur in the format string. Any format items generate an output field whose length equals the number of characters in the format item (including the <justifier>, <sign>, number sign (#), period (.), and <circumflex-accent>s). The contents of the output field depend upon the corresponding <expression> in the PRINT USING statement. <expression>s are displayed in the sequence in which they occur, according to the format item currently being scanned.

The <expression>s are displayed in the manner described in the following three main subsections: Formatted Numeric Output, Formatted String Output, and End-of-Line Conditions.

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If a PRINT USING statement contains an output list, but there is no format item in the associated format string, a fatal error occurs.

If the output from an <expression> in a PRINT USING statement is longer than its corresponding format item, the current line is terminated by an end-of-line character, the evaluated <expression> is displayed unformatted, and displaying continues according to the format. Refer to the second of the following five examples.

Examples of PRINT USING and IMAGE statements:

Assume X has the value 342 and Y has the value 42.021.

```
30 PRINT USING 40: X, Y
40 IMAGE:RATE OF LOSS #### EQUALS ####.## POUNDS
```

The output is the following:

```
RATE OF LOSS 342 EQUALS 42.02 POUNDS
```

Example of format item overflow:

```
5 PRINT USING "OVERFLOW FORMAT ITEM #STARTS NEW LINE":34564
```

The output is the following:

```
OVERFLOW FORMAT ITEM
34564 STARTS NEW LINE
```

Assume A, B, and C have the value 1.

```
10 LET A$ = "<#####.#####.#####^"
20 PRINT USING A$: A, B, C
```

The output is the following:

```
1 1.0000 1000.0000E-03
```

Use of the left justifier.

```
60 PRINT USING 70: "ONE", "TWO"
70 :Z<####<####Z
```

These two statements give the following output:

```
ZONE TWO Z
```

Use of both justifiers.

```
110 IMAGE :>##<##
120 PRINT USING 110: -2, -2
```

These two statements give the following output  
(the quotation marks are not displayed):

```
" -2-2 "
```

*Formatted Numeric Output*

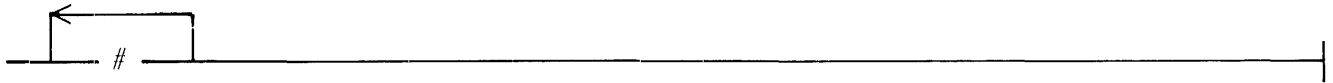
There are three steps in displaying formatted numbers: generating the value, generating the sign, and justifying the value.

The value is generated first. Numeric values are generated by being rounded and represented according to the format used. The three possible formats are the i-format, the f-format, and the e-format.

*i-format*

The i-format consists of a series of contiguous number signs (#). For the i-format, the corresponding value is rounded to the nearest integer and is represented using implicit-point, unscaled notation, with no superfluous leading zeros. Implicit-point notation means that the decimal point is not present. Unscaled notation means that there is no exponent part.

Syntax:



G18056

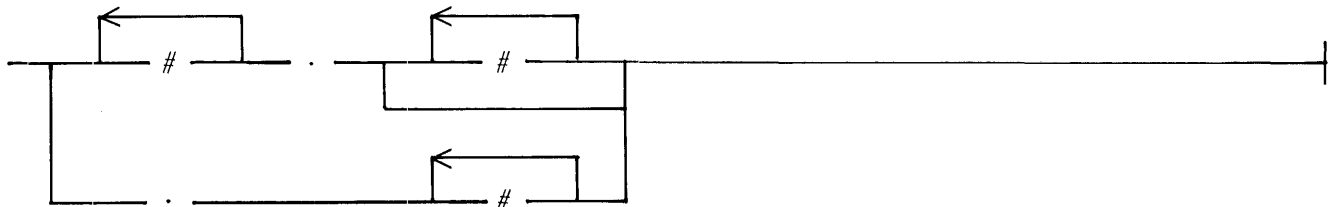
Example of an i-format:

###

*f-format*

The f-format consists of a series of contiguous number signs (#) and an explicit decimal point (.). The decimal point can occur at any point within, before, or after the string of number signs. For the f-format, the corresponding value is represented by explicit-point unscaled notation. Moreover, the representation is rounded or extended according to the number of number signs (#) following the decimal point in the format item. Zeros are not generated to the left of the decimal point unless the number is less than 1 and there is at least one number sign (#) to the left of the decimal point in the format item. In that case, a zero is generated immediately before the decimal point.

Syntax:



G18057

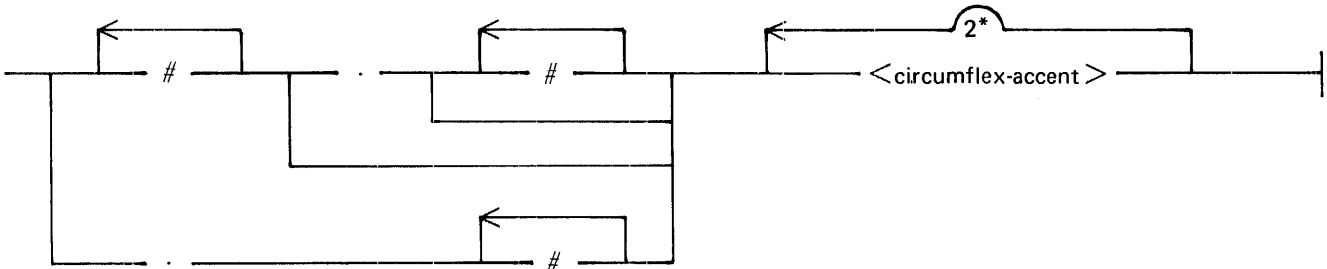
Examples of f-formats:

###.  
##.##  
.#####

*e-format*

The e-format consists of the i-format or the f-format followed by three or more circumflex accents (^). For the e-format, the corresponding value is represented by explicit- or implicit-point scaled notation, with as many digits to the left of the decimal point or within the integer as there are number signs (#) to the left of the decimal point in the format item. The representation is rounded or extended according to the number of number signs following the decimal point in the format item. A value of zero generates a single zero in the integer to the left of the decimal point. The number of <circumflex-accents> in an e-format determines the number of characters in the exponent. The first of these characters is the letter E, the next is a mandatory sign, and the remaining characters represent the value of the exponent, with leading zeros added to ensure that the exponent has the proper length. If the exponent is zero, the mandatory sign is positive; the exponent of zero is zero.

Syntax:



G18058

Examples of e-formats:

```
###^^^
.####^^^^^
#.^^^
#.#####^^^^^
```

The second step in displaying a formatted number is generating the sign. A leading sign or space is always generated with each number to be displayed according to the following rules.

1. If the rounded value of a number is negative, a minus sign (-) is generated regardless of the sign in the format item.
2. If the rounded value is nonnegative and the format item contains a plus sign (+), a plus sign is generated.
3. If the rounded value is nonnegative and the format item contains a minus sign, a space is generated.
4. If the rounded value is nonnegative and the format item contains no sign, no leading space or sign is generated.

The third step taken by IBASIC before displaying a numeric value is to justify the value (extend it with spaces), if necessary, so that its length equals that of the format item. Spaces are added on the left, unless a format item begins with a less than sign (<), in which case the spaces are added on the right.

*Formatted String Output*

A string value may be written using any type of format item. The string is extended by spaces so that its length equals that of the format item. These spaces are added on the left for right justification if the format item begins with a greater than sign (>). They are added on the right for left justification if the format item

begins with a less than sign. Otherwise, they are added equally on either side for centering. If the number of spaces required in the last case is odd, the extra space is added on the right.

If the string value is longer than its corresponding format item, the current print line is terminated by an end-of-line character, the string value is displayed unformatted, and displaying continues according to the format.

Examples of formatted string output:

```
PRINT USING "<##### LITERAL STRING";"THIS IS A" :
PRINT USING "#####.##### LITERAL STRING";"THIS IS A" :
PRINT USING ">##### LITERAL STRING";"THIS IS A" :
```

Execution of these examples gives the following output:

```
THIS IS A          LITERAL STRING
      THIS IS A    LITERAL STRING
            THIS IS A LITERAL STRING
```

*End-of-Line Conditions*

The characters generated by each <literal-string> and each value under the control of a format item are transmitted in the same manner as described under Terminal Output in this section. In particular, if the generation of characters for any <literal-string> or value would cause the columnar position of a nonempty line to exceed the margin by more than one, an end-of-line character is generated before the characters of the <literal-string> or value. Furthermore, an end-of-line character is generated each time the columnar position of the current line exceeds a nonzero margin.

Example:

```
MARGIN 50
PRINT 1,2,3,"OVERLAP"
PRINT "-----1-----2-----3-----4-----5"
PRINT 1,2,3,4,5,6,7,8,9,10
PRINT "-----1-----2-----3-----4-----5"
```

Execution of this example gives the following output:

```
1          2          3
OVERLAP
-----1-----2-----3-----4-----5
1          2          3          4
5          6          7          8
9          10
-----1-----2-----3-----4-----5
```

If the number of values to be written exceeds the number of format items in the format string, an end-of-line character is generated and the format string is reused for the remaining expressions. If format items remain in the format string after all values have been written, any succeeding <literal-string> is written, and generation of characters is terminated beginning at the first unused format item.



Example:

```
A$ = "### ### END OF FORMAT ITEMS"  
PRINT USING A$:1,-1,2,-2,3,-3,4,-4,5
```

Execution of this example gives the following output:

```
1 -1 END OF FORMAT ITEMS  
2 -2 END OF FORMAT ITEMS  
3 -3 END OF FORMAT ITEMS  
4 -4 END OF FORMAT ITEMS  
5
```

Finally, an end-of-line character is generated after all other character generation is completed, unless the output list ends with a semicolon, in which case no end-of-line character is generated.

## MARGIN Statement

The MARGIN statement provides programmatic control over the length of lines produced by the PRINT or PRINT USING statement.

Syntax:

```
----- MARGIN <margin-value> -----|  
G18059
```

<margin-value> is a numeric expression.

Semantics:

The MARGIN statement resets the maximum number of bytes that the PRINT and PRINT USING statements can generate in a print line. When <margin-value> is evaluated, it is rounded to the nearest integer and then assigned as the new margin. The new margin takes effect immediately; thus, if a partial line is awaiting completion, the new margin is used when a subsequent PRINT or PRINT USING statement is executed.

A margin setting of 0 restores the margin to the default value for the terminal to which the user is attached.

Examples of MARGIN statements:

```
MARGIN 20  
PRINT "MARGIN LENGTH - 20"  
PRINT "THIS SENTENCE GOES BEYOND THE MARGIN."  
PRINT "THIS STAYS WITHIN."  
MARGIN 50  
PRINT "NOW THE MARGIN IS 50."  
PRINT "-----*-----1-----*-----2-----*-----3-----*-----4-----*-----5"
```

Execution of these examples gives the following output:

```
MARGIN LENGTH - 20
THIS SENTENCE GOES B
EYOND THE MARGIN.
THIS STAYS WITHIN.
NOW THE MARGIN IS 50.
-----1-----2-----3-----4-----5
```

## ARRAY I/O

Array I/O statements enable entire arrays to be read or written.

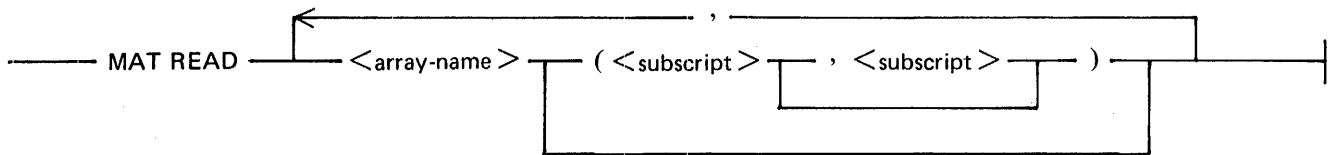
### ARRAY INPUT

One statement is provided to enable an entire array to be initialized from internal DATA. This statement is the MAT READ statement.

### MAT READ Statement

Execution of a MAT READ statement causes arrays to be assigned values from the data sequence created by DATA statements.

Syntax:



G18060

<array-name> follows the same naming conventions as simple variables. <subscript> is a numeric expression. This numeric expression must evaluate to a number which is greater than or equal to the lower-dimension bound for arrays in the program.

Semantics:

If one or both of the <subscript>s are present, the array is redimensioned before values are assigned to it. Arrays are redimensioned in the manner described for the MAT Assignment Statement in Section 6. <subscript>s are evaluated after values are assigned to the arrays preceding (to the left of) them in the array list.

Elements in an array are assigned values from the DATA statements in a row-by-row fashion. Refer to DATA Statement in this section for more information on DATA statements. The example in this subsection shows row-by-row assignment.

The type of each datum in the data sequence must correspond to the type of the array element to which it is to be assigned. Numeric variables require numeric constants as data and string variables require quoted strings or unquoted strings as data. An unquoted string which is a valid numeric representation may be assigned to a string variable or to a numeric variable by a MAT READ statement. If data types do not match, a fatal error occurs.

If the array list requires more data than are present in the remainder of the data sequence, a fatal error occurs.

Example of the use of a MAT READ statement:

```
OPTION BASE 1
DIM A(10,10)
DATA 1,2,3,4,5,6,7,8,9,10,11,12
MAT READ A(3,4)
MAT PRINT A;
```

Execution of this example gives the following output:

```
1 2 3 4
5 6 7 8
9 10 11 12
```

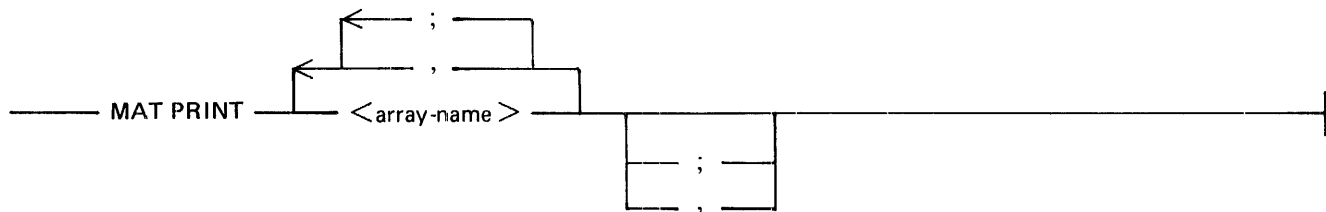
## ARRAY OUTPUT

One statement is provided to enable entire arrays to be written to the terminal. This statement is the MAT PRINT statement.

### MAT PRINT Statement

The MAT PRINT statement displays an entire array on the terminal in row order.

Syntax:



G18061

<array-name> follows the same naming conventions as simple variables.

Semantics:

Execution of a MAT PRINT statement causes the values of all elements in all arrays in the list of <array-name>s to be displayed on the terminal. The characters generated for transmission to the terminal by the displaying of one array in the list of <array-name>s are those that would be generated if the individual elements in an array had been listed, row by row, in the list of <expression>s of a PRINT statement. Each array element displayed with a MAT PRINT statement is separated from the following element by spaces according to the separator (comma or semicolon) that follows the <array-name> in the list of <array-name>s, or by a comma separator if the last separator is not specified.

An end-of-line character is generated prior to any characters generated by a MAT PRINT statement if the current line of output is nonempty. An end-of-line character is also generated between the output for successive arrays in the list of <array-name>s.

Example of the use of the MAT PRINT statement:

```
OPTION BASE 1
MAT READ A$(3,3)
MAT PRINT A$; A$,
DATA ONE, "2", THREE, "4", FIVE, "6", SEVEN, "8", NINE
PRINT "----*----1----*----2----*----3----*----4----*----5"
```

Execution of this example produces the following output:

```
ONE2THREE
4FIVE6
SEVEN8NINE

ONE          2          THREE
4           FIVE       6
SEVEN       8          NINE
----*----1----*----2----*----3----*----4----*----5
```

Example of MAT PRINT with different separators:

```
OPTION BASE 1
MAT READ A (4,4)
MAT PRINT A
PRINT "----*----1----*----2----*----3----*----4----*----5"
MAT PRINT A,
PRINT "----*----1----*----2----*----3----*----4----*----5"
MAT PRINT A;
DATA 11,12,13,14,21,22,23,24,31,32,33,34,41,42,43,44
```

Execution of this example causes the following to be displayed.

```
11          12          13          14
21          22          23          24
31          32          33          34
41          42          43          44
----*----1----*----2----*----3----*----4----*----5

11          12          13          14
21          22          23          24
31          32          33          34
41          42          43          44
----*----1----*----2----*----3----*----4----*----5

11 12 13 14
21 22 23 24
31 32 33 34
41 42 43 44
```

## FILE I/O STATEMENTS

An external file is a collection of data stored on disk. BASIC has the capability of manipulating external files. The statements and concepts necessary to use external files are described in this subsection.

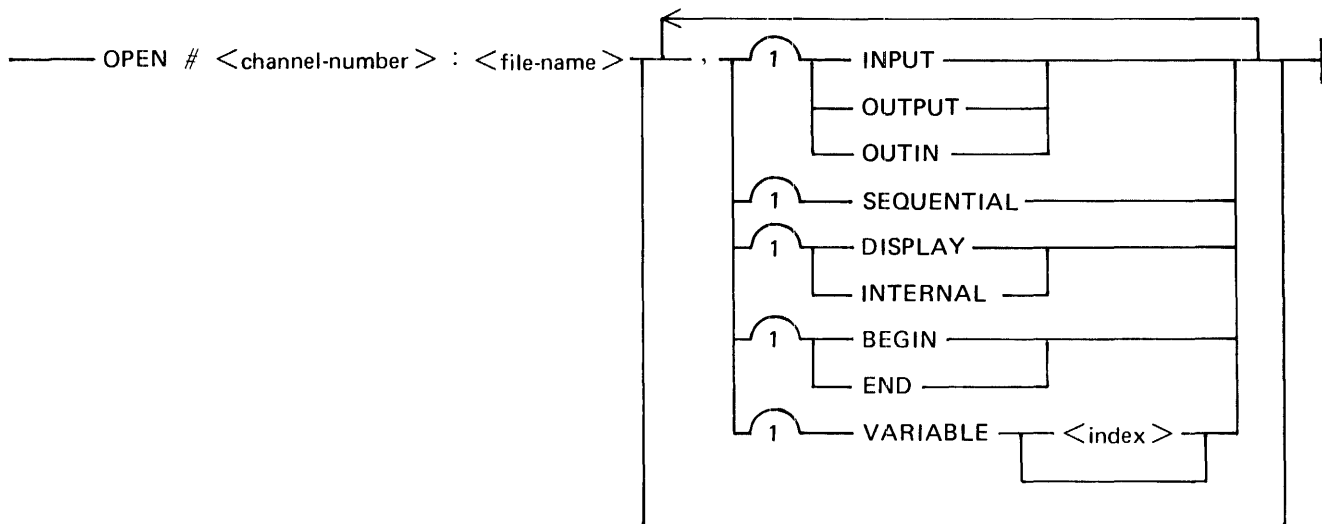
## FILE ACCESS

The OPEN and CLOSE statements are provided to enable access to external files. A particular BASIC environment may access, for input only, any external disk file maintained by MCPPII which may be accessed under the currently logged on usercode. A particular BASIC environment may create or change only files which have a family name of the currently logged on usercode. Thus, the rules for accessing a file for input only are more flexible than those for files which are to be created or changed. If usercodes are not used, the scope of access of the BASIC environment is limited to public files.

### OPEN Statement

The OPEN statement makes an external file accessible to a program by establishing the connection between the physical file (on disk) and the channel number within the program.

Syntax:



G18062

<channel-number> is a numeric expression which must evaluate to an integer in the range 0 to 255. <file-name> is a string expression which, when evaluated, is the name of a disk file. Refer to Syntax Definitions in Section 11 for the syntax of <file-name>. <index> is a numeric expression which gives the maximum allowable length for a record of a file.

Semantics:

Through use of the OPEN statement, disk files can be assigned to a channel, and can then be accessed in a program by referencing the assigned channel. If the file being accessed already exists, that file is assigned to the channel. If the file does not exist, a new file is created and assigned to the channel. A maximum of 16 files can be opened at one time in a BASIC program.

At the beginning of program execution, all channels except channel zero are inactive, that is, no file is assigned to them. Channel zero is always open during the execution of a program. The file associated with channel zero is the terminal from which IBASIC is executed. This file is the source of data for INPUT statements

and the destination of output from PRINT statements. The appearance of channel zero in an OPEN statement is ignored. The appearance of a nonzero channel in an OPEN statement that is already active causes a fatal error.

The keywords that can be listed after the <file-name> are called the file attributes. File attributes specify logical characteristics of a file and the manner in which a file is to be accessed by a program. If the file to be opened does not match the file attributes, the file is not opened and a fatal error occurs. The file attributes that can be specified are access mode, file organization, file type, file pointer position, and record type.

The access mode specifies the manner in which data in the file are accessed. The possible modes of access are INPUT, OUTPUT, and OUTIN, as can be seen from the syntax diagram. If INPUT is specified, it is only possible to read from the file. If OUTPUT is specified, it is only possible to write to the file. If OUTIN is specified, it is possible to read from and to write to the file. If no access mode is specified, the file is opened OUTIN.

The access mode of the terminal, channel zero, is OUTIN.

File organization is the logical organization of records within a file. Currently, there is only one organization possible: SEQUENTIAL. A sequential file is a linearly ordered sequence of records, accessible in sequential order. If no file organization is specified, the file organization is SEQUENTIAL.

The file organization of the terminal, channel zero, is SEQUENTIAL.

File type specifies the format of data in a record of a file. Two types are available: DISPLAY format and INTERNAL format. In a DISPLAY format file, each record is a string of characters. The only file organization provided for DISPLAY format files is SEQUENTIAL. In an INTERNAL format file, each record contains a sequence of numeric or string values. An end-of-record delimiter (NUL or physical end of the record) separates records in the INTERNAL format file, but is not part of the record. If no file type is specified, the type of the file is DISPLAY format.

The file type of the terminal, channel zero, is DISPLAY format.

A file pointer position specifies the initial position of the file pointer when the file is opened. This pointer indicates the position in the file that is affected by the next file input or output statement. The possible choices for the file pointer are BEGIN or END. If the pointer position is END, the pointer is positioned at the end of the file, the position immediately following the last record of the file. If the pointer position is BEGIN, the pointer is positioned at the beginning of the first record of the file, which is also the end of the file if it contains no records.

If the pointer position is not specified, the position is assumed to be the beginning of the file if the access mode is INPUT or the end of the file if the access mode is either OUTPUT or OUTIN.

A record type specifies the type and maximum length of records in a file. Currently, the only record type available is VARIABLE. A VARIABLE type record contains records whose lengths may be any value between 0 and <index>. The length of a record in a DISPLAY format file is the number of characters in that record. The length of a record in an INTERNAL format file is either (1) <index> \* 5 bytes if <index> is specified following the VARIABLE attribute, (2) the size of the records in an existing file, or (3) 180 bytes if the file does not already exist and no <index> is specified following the VARIABLE attribute. The length of each numeric item in the record is five bytes. The length of each string in the record is the number of characters in the string plus 1.

If no record type is specified, the type of records in the file is VARIABLE. The maximum length of the records in the file is either 180 bytes or the record size of the file if it already exists before execution of the corresponding OPEN statement.

The record type for the terminal, channel zero, is VARIABLE with a record length corresponding to a default value defined by the type of terminal attached. For example, for a TD830 the record length is 80.

#### NOTE

A record is variable only to IBASIC. A file actually appears as a fixed record length file on the B 1000 system. Also, the end-of-record delimiter generated by IBASIC is not recognized as such by the B 1000 system, so that old data in a record after the end-of-record delimiter are invisible to IBASIC but visible to the B 1000 system.

Examples of OPEN statements:

```
OPEN #1: "MYFILE"  
OPEN #1: "MYFILE", BEGIN  
OPEN #2: "RESULT", OUTPUT, VARIABLE 132  
OPEN #N: A$, SEQUENTIAL, DISPLAY, OUTIN, BEGIN
```

## CLOSE Statement

The CLOSE statement closes the file assigned to the specified channel.

Syntax:

```
_____ CLOSE # <channel-number> _____
```

G18063

<channel-number> has the same syntax as the <channel-number> in an OPEN statement: a numeric expression that must evaluate to an integer in the range 0 to 255.

Semantics:

Execution of a CLOSE statement closes the file assigned to the specified channel, causing the channel to become inactive. All files still assigned to channels when execution of a program terminates are closed. It is possible to close a file and then reopen it in the same program.

If an inactive nonzero channel appears in a CLOSE statement, a fatal error occurs.

Examples of CLOSE statements:

```
CLOSE #3  
CLOSE #N
```

## FILE I/O STATEMENTS

IBASIC provides for input from and output to disk files, and for end-of-file testing on these files through the use of file input and output statements. The statements necessary for the capabilities previously mentioned are described in this section under the headings File Input, File Output, and Exception Statement.

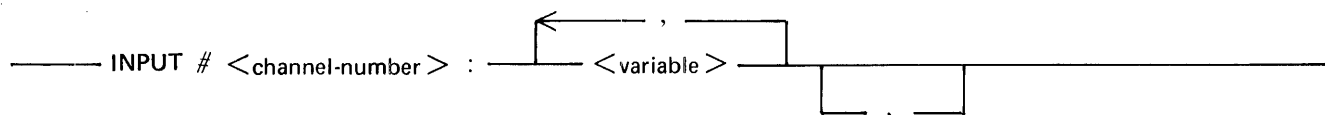
## File Input

File input statements enable the user to obtain input from files. Two statements provide this capability: the file INPUT statement and the file LINPUT statement.

### *FILE INPUT STATEMENT*

The file INPUT statement allows data to be transferred from a disk file to variables within a program.

Syntax:



G18064

<channel-number> is a numeric expression which must evaluate to an integer in the range 0 to 255, and specifies the channel through which data transfer takes place. <variable> is any numeric or string variable as described in Sections 4 and 5, respectively. The list of <variable>s specifies the variables within the program that are to receive data.

Semantics:

If channel zero is specified in a file INPUT statement, the statement is executed as if no <channel-number> were specified; it performs the same function as the INPUT statement for terminal I/O. If a nonzero <channel-number> is specified, execution is similar to the INPUT statement for terminal I/O, except that no prompt is transmitted and no error occurs if all values are not supplied in a single record of the file. If an inactive channel is specified, a fatal error occurs.

Each time a value is required from a file, the datum which begins at the current position of the file's pointer is used to supply that value. The type of this datum must correspond to the type of the variable to which it is to be assigned. Overflow and underflow are handled in the same manner as for assignment statements. After the value has been supplied, the file pointer is advanced to the beginning of the next datum in the record, if more data follow; otherwise, the pointer is advanced to the beginning of the next record. If there is insufficient data in a file to satisfy an INPUT request, a fatal error occurs.

If the file pointer is not at the beginning of a record following execution of a file INPUT statement which does not end with a final comma, the pointer is advanced to the beginning of the next record in the file. If the statement does end with a comma, the file pointer remains where it was until subsequent I/O operations take place. A pointer positioned in the middle of a record is advanced to the beginning of the next record if an output statement is executed on that file.

Examples of file INPUT statements:

```
INPUT #1: X
INPUT #N: X, A$, Y(2)
INPUT #N+1: X,Y,
```

### *FILE LINPUT STATEMENT*

The file LINPUT statement enables an entire record, including embedded spaces, commas, and quotation marks to be assigned as the value of a string variable. The syntax for the LINPUT statement follows.





If the <channel-number> is nonzero, the output media is disk instead of terminal.

The end-of-line character is the end-of-record for the file.

The margin is the record length and the columnar position is one more than the number of characters generated since the last end-of-record.

The OUTPUT statement may be used with a file whose format is either DISPLAY or INTERNAL.

Output to a file is appended to the file starting at the current position of the file's pointer. Any data previously in the file beyond the file pointer are lost. When an output operation is complete, the file pointer is positioned at the end of the file.

When an OUTPUT statement that ends with a comma or a semicolon is executed, the last record transmitted to the file has no end-of-record. However, if input is requested from a file left in this state, if the file is closed, or if its pointer is reset to the beginning of the file, an end-of-record is appended to the file before the requested operation is performed.

A fatal error occurs if the length of a string written to an INTERNAL format file exceeds the maximum record length of that file.

Examples of file OUTPUT statements:

```
OUTPUT #N  
OUTPUT #N: "X EQUALS"; X  
OUTPUT #3: TAB(10); A$; "IS DONE."
```

## Exception Statement

The exception statement allows programmatic action when the end of a file is encountered.

Syntax:

```
_____ AT EOF # <channel-number> THEN <line-number> _____
```

G18067

<channel-number> is a numeric expression which must evaluate to an integer in the range 0 to 255, and specifies the channel through which data transfer takes place. <line-number> is a line number which specifies the place where execution continues if an end-of-file condition occurs for the file specified by <channel-number>.

Semantics:

An end-of-file condition occurs when the amount of data remaining in the file is not enough to satisfy a request for input from that file, or when the physical end of a finite-capacity file is reached before output to that file is completed. Execution of an exception statement specifies the line number at which execution continues whenever an end-of-file occurs during a data transfer operation on the specified channel. The statement itself does *not* test for an end-of-file condition existing, nor does it branch, that is, transfer control to a line number other than the one next in sequence, it only specifies the action to be taken when an end-of-file condition is detected. If no exception statement is executed for a given channel prior to the occurrence of an end-of-file condition for that channel, a fatal error results. If more than one AT EOF statement is executed for a <channel-number>, the latest one executed takes precedence if an end-of-file condition occurs.

The effect of the exception statement is nullified if the file assigned to <channel-number> is closed.

Example of the use of an exception statement:

```
100 AT EOF #2 THEN 400 ! Go to line 400 when end-of-file
200 INPUT #2: A, B$ ! is detected.
300 GOTO 200
400 STOP
```

## FILE CONTROL STATEMENTS

Statements are provided to control the position of the pointer for an open file and to erase the contents of a file. There are two statements that accomplish these tasks: the file RESTORE statement and the SCRATCH statement.

### File RESTORE Statement

The file RESTORE statement resets the pointer for a file to the beginning of the file.

Syntax:

```
—— RESTORE # <channel-number> —————|
G18068
```

<channel-number> is a numeric expression which must evaluate to an integer in the range 0 to 255.

Semantics:

Execution of a file RESTORE statement resets the pointer for the file assigned to the specified channel to the beginning of the file.

Examples of file RESTORE statements:

```
RESTORE #1
RESTORE #15
```

## SCRATCH Statement

The SCRATCH statement erases the contents of a file and resets the pointer to the beginning of the file.

Syntax:

\_\_\_\_\_ SCRATCH # <channel-number> \_\_\_\_\_

G18069

<channel-number> is a numeric expression which must evaluate to an integer in the range 0 to 255.

Semantics:

Execution of a SCRATCH statement erases the contents of the file assigned to the specified channel and resets the pointer for that file to the beginning of the file. If the <channel-number> is zero, no action occurs.

Examples of SCRATCH statements:

```
SCRATCH #2  
SCRATCH #Z
```

## SECTION 10 DEBUGGING AIDS

Three statements are provided in BASIC for the purpose of debugging a program. They are the DEBUG statement, the BREAK statement, and the TRACE statement.

### DEBUG STATEMENT

The DEBUG statement either activates or deactivates the debugging facilities in BASIC. The statements available to the user when debugging is active are the BREAK and the TRACE statements. The syntax for the DEBUG statement follows.

Syntax:

```
_____ DEBUG _____ ON _____  
                    |_____|  
                    |_____|  
                    _____ OFF _____
```

G18070

Semantics:

DEBUG ON activates debugging. DEBUG OFF deactivates debugging. The default is DEBUG ON.

Examples of DEBUG statements:

```
DEBUG ON  
DEBUG OFF
```

### BREAK STATEMENT

The BREAK statement causes program execution to be temporarily stopped. The syntax for the BREAK statement follows.

Syntax:

```
_____ BREAK _____
```

G18071

Semantics:

When debugging is active and a BREAK statement is executed, program execution is stopped and a message is sent to the terminal. This message informs the user that a break has occurred and gives the line number where execution stopped. Execution may be continued by the execution of a CONTINUE or a STEP command. The STEP and CONTINUE commands are described in Section 11.

If debugging is not active, the BREAK statement has no effect.



## SECTION 11

### SYSTEM COMMANDS AND CAPABILITIES

System and editing commands are provided to allow the user to interact with IBASIC in Command mode.

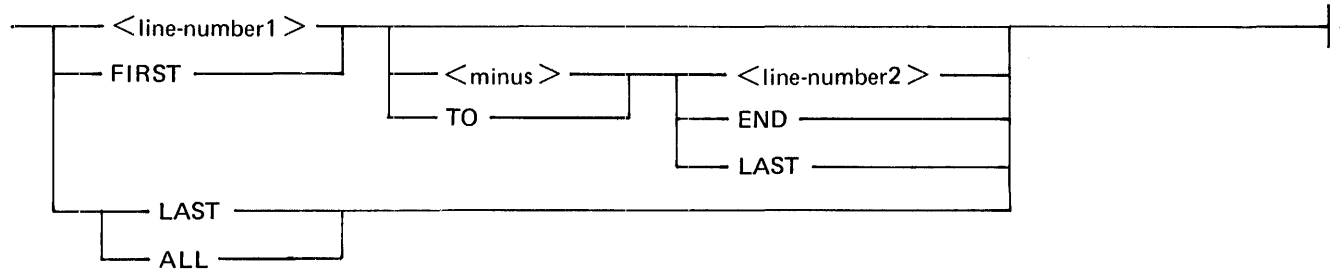
#### SYNTAX DEFINITIONS

Several of the system commands described in this section require the use of the constructs explained in this subsection. These constructs are line number range, BASIC file name, pack name, and MCP file name.

#### LINE NUMBER RANGE

A line number range allows a successive group of lines to be specified in a command.

Syntax:



G18073

The line number syntax is diagrammed under Statement Lines in Section 3. `<minus>` is a minus sign (\*).

Semantics:

`<line-number2>` must be greater than or equal to `<line-number1>`. Also, the pseudo line number `FIRST`, which refers to the first line in the program, must refer to a line number smaller than or equal to `<line-number2>`. The pseudo line number `LAST` (or `END`) must refer to a line number greater than or equal to `<line-number1>`. The special cases of `FIRST TO LAST` or `ALL` refer to the entire program.

Examples of valid line number ranges:

```

100-200
FIRST TO 3000
2000 - LAST
FIRST
ALL
FIRST TO 200           ! First lines <= 200.
```

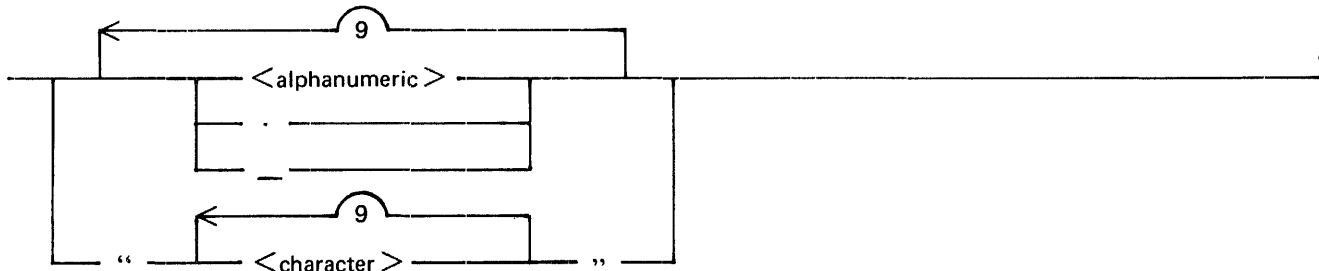
Examples of invalid line number ranges:

```

200-100
3000 TO FIRST
LAST TO 2000
END - 100
FIRST TO 200           ! Where the first line > 200.
```

## BASIC FILE NAME

Syntax:



G18074

<character> is any character valid to the MCP. <alphanumeric> is an alphabetic character or decimal digit.

A BASIC file name, that appears inside quotation marks, can contain a quotation mark by using two consecutive quotation marks instead of one (for example, "MY""FILE"). A BASIC file name, that does not use quotation marks, is translated to upper-case characters and must begin with an alphanumeric character.

A BASIC file name cannot begin with an asterisk (\*), space ( ), or equal sign (=). The file name can begin with a number sign (#) as long as the name is within quotation marks. The first and last characters of a BASIC file name cannot be a left parenthesis and a right parenthesis, respectively.

Examples of valid BASIC file names:

```
ABCD
1234
P.Q
"!""#$"
Q123ABC
abcd (equivalent ABCD)
"abcd"
c__ _d
```

Examples of invalid BASIC file names:

```
ABCDEFGHIJK
!"#$
.ABC
"qwe
*ABC
(ME)
"(ME)"
_ _ _ _
```



## PACK NAME

Syntax:



G18075

A pack name can contain up to 10 characters according to the same formation rules as described under BASIC File Name in this section. Spaces for the pack name indicate the system pack.

Examples of valid pack names:

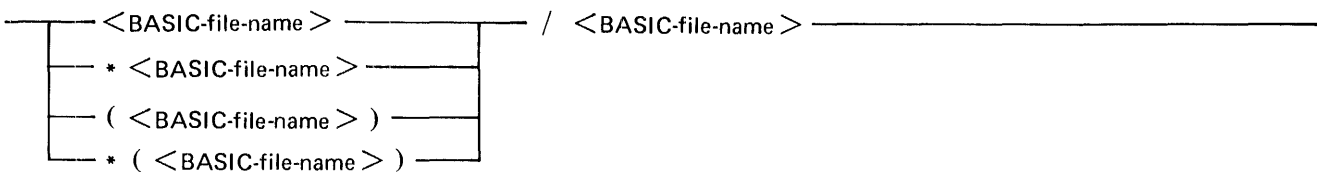
USER.243  
"1&2"  
""

Examples of invalid pack names:

(ME)  
= or "= "  
""

## MCP FILE NAME

Syntax:



G18076

The use of quotation marks in a <BASIC-file-name> needs further explanation in relation to an MCP file name. If the first BASIC file name uses quotation marks, they must enclose any asterisk, and/or parentheses used.

Examples of valid MCP file names:

(IBASIC)/PQR  
XYZ  
XYZ/P.Q.R  
\*QWER  
\*(QWER)/LKJ  
"\*ASSF"  
"\* (qwer)"/"zxcv"  
X\_Y/L.K

Examples of invalid MCP file names:

```
“(IBASIC)/PQR”
*“QWER”
X$/Y$
X/=
“ ASD”
“(qwe”
=
=/=
```

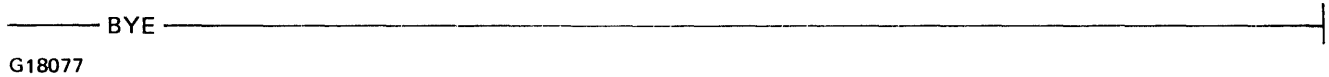
## SYSTEM COMMANDS

System commands can be entered at any time, although their effect may depend upon the state of the BASIC environment. Unless stated to the contrary, the effect of the command is immediate. These commands cannot be preceded by a line number nor can they be imbedded within a BASIC statement or BASIC command. The system commands are listed in alphabetical order.

### BYE COMMAND

The BYE command causes the BASIC environment to be cleared and the IBASIC program to go to EOJ.

Syntax:



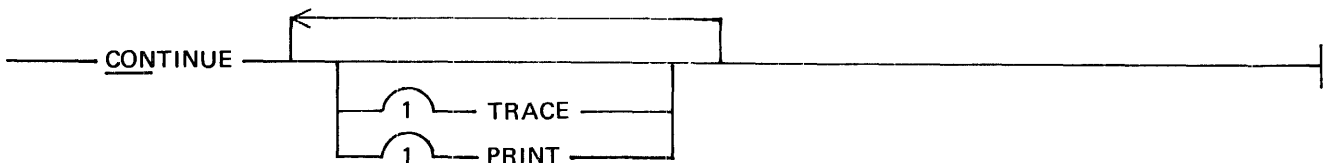
Semantics:

The action of the BYE will not occur if either of the following conditions applies: the source file is not saved or the BASIC environment is running.

### CONTINUE COMMAND

The CONTINUE command causes the BASIC environment to continue execution from wherever it last stopped.

Syntax:



Semantics:

When a CONTINUE command is entered, the BASIC data environment is not cleared, that is, data variables retain the values they had when the BASIC environment last stopped. A RUN or WALK command must precede the use of the CONTINUE command.

Certain editing functions, for example, deletion of the next statement to be executed, changing the dimensions of an array, or changing a FOR NEXT statement, cause the CONTINUE command to be disallowed until after a RUN or WALK command is executed.



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Examples of DELETE commands:

```
DELETE 123                ! Delete line 123 only.
DELETE 2000-3000
123                        ! Delete line 123 only.
DELETE 4000 TO LAST
DEL FIRST
DEL FIRST TO 100
DEL FIRST TO LAST        ! Delete all program statements.
```

## FILE COMMAND

The FILE command provides the capability to obtain information about a disk file.

Syntax:

FILE <MCP-file-name> ON <pack-name>

G18080

<MCP-file-name> and <pack-name> are described under Syntax Definitions in this section.

Semantics:

The FILE command scans the disk directories available to the current usercode (refer to Scope of File Access in the Glossary) to determine whether the file exists. If the file exists, information about it is returned. If no <pack-name> is specified, the default pack associated with the current usercode is queried.

Examples of FILE statements:

```
FILE IBASIC
FILE *XY
FILE X/Y ON P
FILE (PQR)/ZXY ON USER
FILE BLACKJACK ON ""      ! Look for BLACKJACK on system
                           ! pack.
```

## FIX COMMAND

The FIX command enables the user to change portions of one or more lines without re-entering the entire line.

Syntax:

FIX <line-number-range> <delim> <text> <delim> <new-text>

G18081

<line-number-range> is described under Syntax Definitions in this section. <delim> can be any character other than A through Z, 0 through 9, or space. <text> may be any string of characters excluding <delim> and may contain zero characters, in which case <new-text> is inserted after the line number of the line scanned, and the rest of the line is shifted right accordingly. <new-text> may be any string of characters excluding <delim>. If the trailing <delim> is omitted, any trailing blanks are not included in <new-text>. <new-text> may contain zero characters, implying that occurrences of <text> are deleted from the scanned line, and that the rest of the line is shifted to the left accordingly.

Semantics:

The FIX command searches the specified <line-number-range> for the occurrence of the required <text>, replaces each occurrence of <text> within each line scanned with the <new-text>, and displays the new line. If <text> and <new-text> are not the same length, the rest of the line is shifted appropriately.

If the <line-number-range> is omitted, the whole program is scanned.

If a statement is changed, the modified statement is checked for syntax and included in the current file. As a result, the previous line having the line number of the modified statement is overwritten. Any syntax errors that result must be resolved before the program can be run.

If the resulting statement exceeds 256 characters, the excess is truncated. No warning message is given.

Examples of FIX commands:

```

FIX /3.14159/PI

FIX 100 .X/Y.Y/X

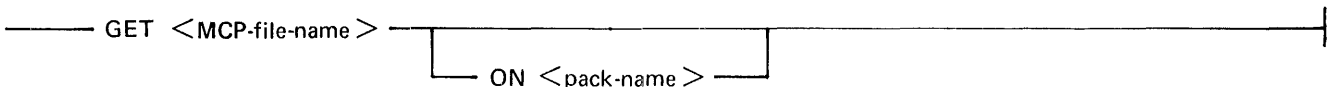
FIX LAST /END/  END      ! Move the END statement three
                        ! characters to the right.

FIX 2230 TO 2500 ::!     ! Make lines 2230 through 2500
                        ! comment lines.
    
```

## GET COMMAND

The GET command allows BASIC source files to be loaded into the BASIC environment.

Syntax:



G18082

<MCP-file-name> and <pack-name> are described under the heading Syntax Definitions in this section.

Semantics:

The GET command searches the directory for <MCP-file-name> and proceeds to load the file into the BASIC environment. If any syntax errors are found in the file, suitable error messages are emitted and the file cannot be run until these errors are fixed. If syntactically incorrect statements are listed with the LIST command, they are highlighted: reverse video on TD820 and TD830 terminal types, preceded by an asterisk (\*) otherwise.

Only those files within the current usercode scope of access are available. The default pack for the current usercode can be overridden by using the ON option.

Various parameters of the file are checked to make sure that it is a BASIC source file; for example, file type is data, record size is less than or equal to 256 bytes, and number of records is less than the maximum allowed (1979 records). Any record in this file which does not start with a valid line number is not included in the loaded file. The records in the file do not have to be in strict line number sequence. The lines are entered in the workfile just as if they were being entered from the terminal.

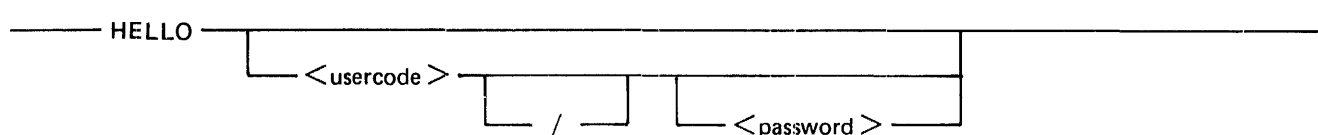
Examples of GET commands:

GET BLACKJACK	! Load BLACKJACK from default ! pack.
GET PQR ON ""	! Load PQR from system pack.
GET *MYPROG	! Load MYPROG from system pack, ! bypassing usercode defaults.
GET (HIS)/FILE	! Access another user's file.
GET (MY)/FILE ON OTHER	! Load a file from a specific ! pack.

## HELLO COMMAND

The HELLO command allows a user to log on or off.

Syntax:



G18083

Formation of a <usercode> follows the same rules as for a <BASIC-file-name> except that the maximum length of a <usercode> is seven characters. Formation of a <password> follows the same rules as for a <BASIC-file-name>. The syntax for a <BASIC-file-name> is described in this section under Syntax Definitions.

Semantics:

If only "HELLO" is entered, a log off function is requested. Log off occurs only if the current BASIC environment permits. Refer to conditions for the BYE command in this section. If the HELLO command is allowed, the current BASIC environment is cleared, and only the HELLO, BYE, and TEACH commands are allowed thereafter.

If <usercode> and, optionally, <password> follow HELLO, an implicit log off of the current usercode is performed, if necessary, followed by a log on of the requested usercode/password pair.

The <usercode> and <password> pair must be in the SYSTEM/USERCODE file if IBASIC was executed under a privileged usercode. (Refer to the B 1700/B 1800 Systems System Software Operation Guide, Volume 2, form number 1108966 for more information on privileged usercodes.) If IBASIC is not running under an MCP usercode, <password> has no meaning and is not allowed (refer to Usercode Considerations in Appendix C).

HELLO is ignored if the IBASIC system is not privileged (refer to Usercode Considerations in Appendix C for more information on a privileged IBASIC system).

Examples of HELLO commands:

HELLO ME/SECRET	! Log ME on.
HELLO	! Log off, if allowed.
HELLO MYOWN	! Log on, not running under the ! MCP usercode system.

## LIST COMMAND

The LIST command causes the requested lines or all of the current program to be listed at the remote terminal.

Syntax:

LIST \_\_\_\_\_  
          └───┬──────────┬──────────┘  
          └───┬──────────┘  
          <line-number-range>    PRINT

G18084

<line-number-range> is described under Syntax Definitions in this section.

Semantics:

With the LIST command, any syntactically incorrect lines are highlighted by means of reverse video (for TD820 and TD830 terminals) or a preceding asterisk (\*). If the line which is displayed would be the next line executed as a result of a CONTINUE or STEP command, it is highlighted by means of bright video (for TD830 terminals) or by a preceding greater than sign (>) (for all other terminal types).

If the PRINT option is requested, the list is written to the file LINE and not to the remote device. The file LINE is defined as a printer file.

Examples of LIST commands:

LIST	! List the whole program.
LIST FIRST TO 100	! List up to line 100.
LIST 1234	! List line 1234 only.
LIST PRINT	! List the current file on the ! printer.





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If a syntax error is found in a merged line, a suitable error message is displayed on the terminal, and runs of the file are inhibited until these errors are fixed. If those syntactically incorrect statements are listed with the LIST command, they are highlighted by reverse video on TD820 and TD830 terminal types, or preceded by an asterisk (\*), otherwise.

Only those files within the current usercode scope of file access are available. The default pack for the current usercode can be overridden by using the ON option.

Various parameters of the file are checked to make sure that it is a BASIC source file; for example, file type is data, record size is less than or equal to 256 bytes, and number of records is less than the maximum allowed (approximately 2000 records).

Any record in the merged file which does not start with a valid line number is ignored.

Examples of MERGE commands:

```
MERGE OTHER/FILE                ! Merge the whole of OTHER/FILE
                                   ! into the current environment.

MERGE 1000 TO 2000 FROM OTHER/FILE

MERGE LAST OTHER/FILE ON OTHERPACK
```

### PASSWORD COMMAND

The PASSWORD command changes the password for the current usercode in the MCP usercode file.

Syntax:

```
_____ PASSWORD <old-password> <new-password> <new-password> _____
G18087
```

Formation of <old-password> and <new-password> follow the same rules as for a <BASIC-file-name>.

Semantics:

The PASSWORD command is only valid if the IBASIC system runs under an MCP usercode. The new password must be entered twice identically to ensure correct and intentional entry.

Example of a PASSWORD command:

```
PASSWORD SECRET TOPSECRET TOPSECRET
```

### PSEUDO BREAK FEATURE

The pseudo BREAK feature can be used to prematurely terminate a function.

Syntax:

```
_____ .BRK _____
G18088
```

To terminate a function, a special message of the precise form .BRK with no leading or trailing spaces can be entered, the SPCFY key can be depressed for CRT terminals, that is, display screen terminals, or the BREAK key can be depressed. (The BREAK key is supported for TTY-type devices and has the same effect as .BRK; however, the BREAK key is only effective on these devices during the printing of an output message.)

Semantics:

This pseudo BREAK feature may be used from any supported terminal type to terminate the following commands: LIST, RUN, WALK, CONTINUE, STEP, GET, SAVE, FIX, and a CHAIN statement or command.

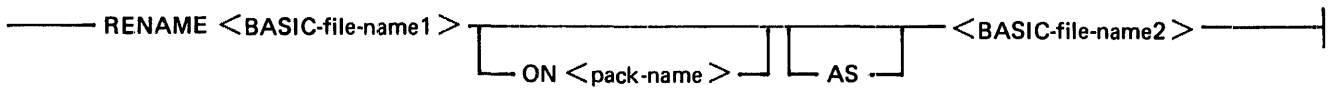
In addition, a pseudo BREAK may be used to terminate the automatic recovery of a prior user session, the period of time during which a user is logged on. If a pseudo BREAK is used in this context, that session is thereafter irrecoverable. Refer to Recovery in this section for more information on automatic recovery.

.BRK may also be used to interrupt the execution of an INPUT or LINPUT statement which is currently soliciting a response from the remote terminal. In the case of CRT terminals, .BRK must be typed over the input prompt character in the top left portion of the screen. Interruption of an INPUT or LINPUT statement also implies changing the state of the BASIC environment from running to stopped.

## RENAME COMMAND

The RENAME command provides the capability of changing the name of a file.

Syntax:



G18089

<BASIC-file-name1>, <BASIC-file-name2>, and <pack-name> are described under Syntax Definitions in this section.

Semantics:

The RENAME command checks for the presence and availability of <BASIC-file-name1> on the requested pack, ensures the absence of <BASIC-file-name2>, and causes the MCP to change the name of <BASIC-file-name1> to <BASIC-file-name2>. Only files within the current user's scope of access for files may be changed.

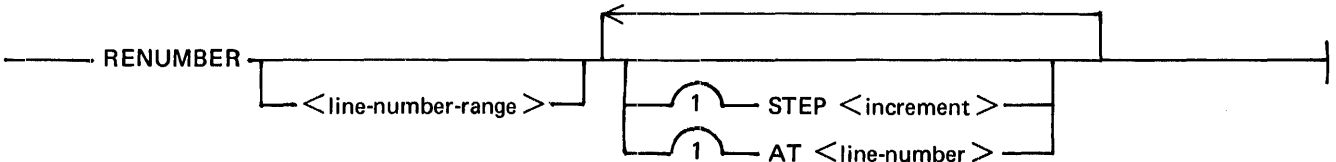
Examples of RENAME commands:

- RENAME ORANGES AS LEMONS ! On default pack.
- RENAME PROG1 ON "" AS PROG ! Force change on system pack.
- RENAME X Y

## RENUMBER COMMAND

The RENUMBER command is used to resequence the line numbers in a BASIC source program.

Syntax:



G18090.

<line-number-range> is described under Syntax Definitions in this section. <line-number> is described under Statement Lines in Section 3. <increment> is an integer constant.

Semantics:

The RENUMBER command is used to resequence the line numbers of, and the references to, all or part of the currently loaded source program. The STEP parameter defines the amount to increment each new line number. The AT parameter defines the starting value for the new numbers. If the STEP parameter is omitted, a value of 10 is assumed. If the AT parameter is omitted, a value of 100 is assumed.

Before the actual renumbering is done, checks are performed to make sure that (1) no overlap of existing statements would occur, (2) the order of execution of statements is not changed, (3) a previously unresolved line number reference would not become implicitly resolved by the renumber process, and (4) the last line number in the program would not exceed 99999.

The RENUMBER command cannot be interrupted by the pseudo BREAK feature. If the system fails during a RENUMBER command, the workfile may be partially renumbered.

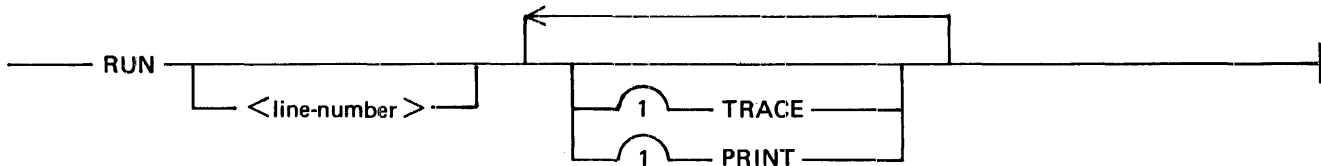
Examples of RENUMBER commands:

RENUMBER	! Renumber the whole program ! with implicit step 10 and ! starting with a value of 100.
RENUMBER 100 TO 1000	! Renumber the specified part ! of the program and all ! references to that part ! with the default parameters.
RENUMBER 5000 TO LAST AT 5000 STEP 100	! Renumber the ! last part of the program, ! incrementing the line ! numbers by 100.

## RUN COMMAND

The RUN command causes a program to be executed.

Syntax:



G18091

<line-number> is described under Statement Lines in Section 3.

Semantics:

The RUN command initiates the continuous execution of the statements in the current workfile, starting either from the first statement in the workfile, or from <line-number>, if specified. The BASIC data environment is cleared so that all numeric data items are zero and all string items have the value of the null string (""). The line number, if specified, must be a valid line number within the program. RUN <line-number> causes the program to be executed as if GOTO <line-number> were the first statement of the program.

The TRACE option causes the statements to be displayed on the remote device as they are executed.

The PRINT option causes the output from BASIC PRINT statements and the input from BASIC INPUT and LINPUT statements to be written to the file LINE as well as to the remote device. The file LINE is closed on execution of an END statement in the BASIC program.

If both the PRINT and TRACE options are specified, the trace of statements executed is directed to the file LINE interspersed with the BASIC PRINT, INPUT, and LINPUT output. In this instance, the traced statements are not displayed on the remote device.

The PRINT and TRACE options have effect until the program is stopped by a STOP or END statement or by a fatal error.

Examples of RUN commands:

RUN	! Run the program from its first ! executable statement.
RUN TRACE	! Run the program from its first ! executable statement and trace execution.
RUN 1234	! Run from line 1234 and clear the ! program's data variables.
RUN PRINT	! Print output to be written to file LINE.

## SAVE COMMAND

The SAVE command causes the current workfile to be saved on disk.

Syntax:

```
SAVE [ AS <BASIC-file-name> ] [ ON <pack-name> ] [ FOR CANDE ]
```

G18092

<BASIC-file-name> and <pack-name> are described under Syntax Definitions in this section.

Semantics:

The SAVE command writes the current source program to a file on the current usercode default pack with the name of the current file. The pack can be overridden by the ON option and the name can be overridden by the AS option.

If the FOR CANDE option is used, an attempt is made to make the saved file compatible with CANDE BASIC files: leading zeros are appended to the line numbers, if necessary, to make them five characters long. The resulting line is checked for a maximum of 80 characters. If a line exceeds 80 characters, the save is not done, and a message is emitted to identify the line (or lines) which cannot be made compatible.

If the current workfile does not have a name associated with it, either the AS option or the TITLE command must be used to associate a name with the workfile.

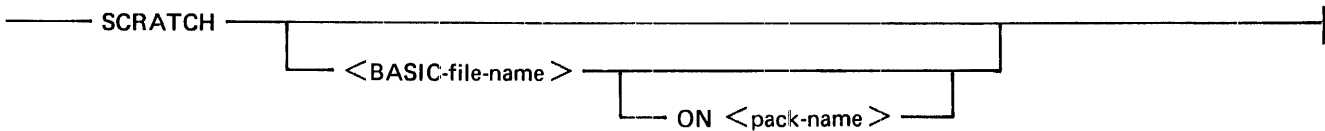
Examples:

SAVE	! Save the current workfile.
SAVE AS PQR ON P	! Save the current workfile on ! pack P with name PQR.
SAVE FOR CANDE	! Save the current workfile and ! attempt to make the file ! compatible with CANDE.

## SCRATCH COMMAND

The SCRATCH command causes a file to be removed or the current environment to be cleared, or causes both.

Syntax:



G18093

Semantics:

<BASIC-file-name> and <pack-name> are described under Syntax Definitions in this section.

The SCRATCH command is used to clear the current BASIC code and data environment or to remove a file in the current usercode scope of access from the disk directory. If no file name follows SCRATCH, the clearing of the current file in the BASIC environment is assumed. If the file name is specified, files can be removed from disk, from the default pack, or from an explicit pack if the ON option is used. The scratched file is irrecoverably removed.

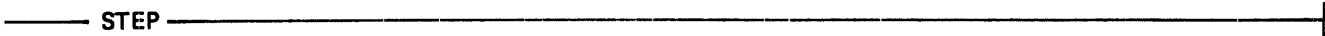
Examples of SCRATCH commands:

SCR	! Clear the current workfile.
SCRATCH OLDFILE	! Remove OLDFILE from the user's ! directory.
SCR BADFILE ON P	! Remove BADFILE from the user's ! directory on pack P.

## STEP COMMAND

The STEP command causes single stepping of a program. Single stepping is stopping after the execution of a statement.

Syntax:



G18094

Semantics:

The STEP command can be used during the execution of a program when the BASIC environment is stopped. It causes the next statement to be displayed and then executed. After this statement, an implicit BREAK statement is executed. Thus, the STEP command enables the statement-by-statement execution of a BASIC program at the user's discretion.

When a STEP command is entered, the BASIC data environment is not cleared, that is, data variables retain the values they had when the BASIC environment last stopped.



## USER COMMAND

The USER command allows a user to log on.

Syntax:

```
USER <usercode> / <password>
```

G18097

Formation of <password> follows the same naming conventions as a <BASIC-file-name>.

Semantics:

The USER command is identical in function to the HELLO command, except that USER cannot be used for log off only. The intent of this command is to enable the SMCS auto log on feature, but its use is general.

Example of a USER command:

```
USER ME/SECRET      ! Logs off the current usercode, if  
                    ! one exists, and logs on ME/SECRET.
```

## WALK COMMAND

The WALK command causes program execution to be initiated in a single-stepping fashion.

Syntax:

```
WALK <line-number>
```

G18098

<line-number> is described under Statement Lines in Section 3.

Semantics:

The WALK command initiates the execution of the BASIC environment, clearing the BASIC data environment, and causes execution to be halted after the first statement is executed. The statement executed is displayed on the remote terminal. The STEP or CONTINUE command may be used to continue program execution after this command.

The presence of the optional <line-number> implies a GOTO <line-number> before execution begins. If <line-number> is invalid, a suitable message is returned.

Examples of WALK commands:

```
WALK                ! Run the first executable statement of  
                    ! the current workfile.  
  
WALK 1234           ! Run line 1234 as the first executable  
                    ! statement of the current workfile.
```



## WHAT COMMAND

The WHAT command returns a statement that indicates the status of the current BASIC environment.

Syntax:

----- WHAT -----

G18099

Example of WHAT command output:

```
YOU ARE (SOONER) AT S8, LSN=12 (TD832)
THE TIME IS 14:55:33.2 AND THE DATE IS 80 AUG 30
YOUR FILE IS CALLED "IBTEST" AND IS SAVED
AND BEGINS AT LINE 10 AND ENDS AT LINE 230
```

## WHERE COMMAND

The WHERE command returns information about the execution of a program.

Syntax:

----- WHERE -----

FROM
CALLED

G18100

Semantics:

The WHERE command, with no options, returns a message that contains the next statement to be executed.

If the FROM option is used, the last few (not more than 20) statements and commands executed are displayed.

If the CALLED option is used, the last few (not more than 20) GOSUB and user-defined FN<x> calls are displayed.

Examples of WHERE commands:

```
WHERE
WHERE FROM
WHERE CALLED
```



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System Commands and Capabilities

A request for a <line-number> returns only the statements which reference that <line-number>.

A request for a <line-number-range> returns references to items within that range inclusively.

A request for a user FN name (FNA-FNZ9,FNA\$-FNZ9\$) returns the statements which call, define, or assign that name.

A request for a delimited string initiates a search through the source statement(s) for occurrences of that string as a strictly literal string.

Examples of XREF statements:

XREF A\$	! Lists those statement lines ! which reference A\$.
XREF 100	! Lists those statement lines ! which reference line 100.
XREF 100-200 2000-3000	! Lists those statement lines, ! between lines 2000 and 3000, ! which reference lines 100-200.
XREF FNX 123-654	! Lists those statement lines ! between 123 and 654 which ! reference FNX.
XREF "X"	! Lists those statement lines in ! which the character X occurs.

## BASIC COMMANDS

A BASIC command is similar to a BASIC statement in function, except that a BASIC command is executed immediately, is required to be re-entered completely if the user desires to have it executed again, and is entered without a preceding line number.

Many of the BASIC statements described in Sections 3 through 10 of this manual can be used as BASIC commands but, by definition, some BASIC statements have no meaning unless properly accompanied by another statement or statements. A list of BASIC statements that are not allowed as commands follows.

DATA  
DEF  
DIM  
END  
FNEND  
FOR  
GOSUB  
IMAGE or :  
INPUT (disallowed only if the remote terminal is accessed)  
LINPUT (same as for INPUT)  
NEXT  
ON GOSUB  
OPTION  
User-defined function references

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BASIC commands which reference line numbers, for instance, GOTO and ON GOTO, simply change the next statement pointer (a memory location that contains the address of the next statement to be executed). Hence, if the BASIC environment is in a stopped state and a GOTO command is entered, a CONTINUE command causes execution to resume where the next statement pointer points, not necessarily where the environment was stopped. If the BASIC environment is running and a GOTO command is entered, execution continues as if the BASIC GOTO command were the next statement. Hence, the flow of execution of the running program may be changed dynamically.

If the statement following a THEN or ELSE in an IF statement is disallowed in Command mode, then the whole IF statement is disallowed.

Examples of BASIC commands:

```
PRINT A;B;C
BREAK
LET A = 1
PRINT A+B
MAT A = B - C
GOTO 500
```

### **BASIC STATEMENT ENTRY**

BASIC statements may be entered in any line number order. If a statement with a particular line number is entered more than once, the last entered line is retained, and all previously entered lines with that line number are lost.

The syntax of the statement is checked at the time of entry, and the line is retained even if there is a syntax error. Some BASIC statements rely on corresponding BASIC statements for complete correctness of syntax and function (for example, the FOR statement and the corresponding NEXT statement; the GOTO statement and the object of the GOTO). Any errors relating to this type of statement are detected and suitable error messages are emitted when any attempt is made to execute the program.

Thus, there are two kinds of syntax error message. One is emitted at statement entry time and the other is emitted when an attempt is made to run the program. These kinds of error messages are not mutually exclusive, hence, they may appear interspersed as a result of an attempt to run a program.

A BASIC statement may not exceed 256 characters in length.

Examples of BASIC statements:

```
10 PRINT A,B,C,D
5000 LET A$ = "IN THE " & A$
```

### **RECOVERY**

The IBASIC system is able to recover the current user's BASIC source program if the central system or the IBASIC system fails. At user log on time, HELLO time or at BOJ of IBASIC if auto log on is requested, IBASIC checks the system for the presence of a workfile left over from a previous session. If this file is present, IBASIC automatically reloads itself with the contents of this workfile. Only BASIC source code is maintained in this file, so the values of data variables from the previous session are lost.

If the recovery is not wanted, the workfile must be removed before log on, the recovered file must be scratched after log on, or a BREAK command must be entered during recovery. In order to remove the workfile before log on, it is necessary to determine the name of the workfile.

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System Commands and Capabilities

If IBASIC was using the MCP usercode system, the workfile name is <default-pack-name>/(<usercode>)/WORKFILE<xx>. The expression <xx> is a unique pair of characters generated from the usercode index in the MCP usercode file. Refer to the Recovery feature in the B 1000 Systems CANDE Reference Manual, form number 1090586.

If IBASIC was not using the MCP usercode system, the workfile name is called <usercode>/(WORKFILE).

### **SPCFY KEY USE (TD820 and TD830 terminals only)**

Depending on the state of the BASIC environment, the SPCFY key can be used as a shorthand way of typing a particular function.

The SPCFY key can be used in all cases where the pseudo BREAK feature can be used. Refer to Pseudo BREAK Feature in this section.

The SPCFY key can also be used as a shorthand notation for the STEP command or for the BASIC BREAK command, according to the state of the BASIC environment. If the BASIC environment is in a stopped state, ready to continue execution from wherever it was halted, a depression of the SPCFY key will have the same effect as entering the STEP command. If the BASIC environment is running, the effect is the same as when the BASIC BREAK command is entered: the program is halted and can be continued from that point.

To make sure that the SPCFY key does what is expected, it is suggested that the terminal be put in local mode by depressing the LOCAL key before depressing the SPCFY key.

## SECTION 12

### SPECIAL COMMANDS ('DOT' COMMANDS)

Dot commands are special commands which are primarily intended for debugging the IBASIC system. These commands do not go through the normal process of compilation and execution. Their syntax is simple.

General syntax:



G18102

#### **BACKSPACE** <new backspace char>

BACKSPACE changes the character to be used as a backspace character for TTY type terminals only. By default, this character is a reverse solidus (↵).

#### **CASE**

CASE enables or disables the use of lower-case letters in system responses. By default, lower-case is enabled for TD820 and TD830 terminal types and disabled for TTY and TD800 terminal types.

#### **CONTINUOUS**

CONTINUOUS changes the setting of continuous or wait mode for consecutive output messages. CANDE does not recognize the change and assumes that the mode is unchanged. Continuous mode means that the terminal is not switched to local mode after receiving a message. Wait mode means that the terminal is switched.

#### **DEBUG**

DEBUG sets or resets a debug toggle which enables various compiler trace and dump functions.

#### **DUMP**

DUMP causes a dumpfile of IBASIC and IBASIC/RUNNER to be created.

#### **FREEZE**

FREEZE inhibits the MCP rollout process; thus, IBASIC is frozen in memory.

#### **HELLO**

HELLO returns the opening message.

#### **HINTS** <string>

HINTS prints the contents of a memory area called HINTS, which is useful in the analysis of the IBASIC system. This memory area contains the values of several variables pertinent to the system. If <string> is present, it is included in the heading of the printout.

This command should be used if a problem is believed to exist. To initiate a dump to be sent to Burroughs for analysis, enter `.DUMP HINTS`.

## LOCAL

LOCAL sets or resets a toggle which forces the remote terminal to be put in local mode after every command response.

## LOG

LOG opens or closes a print file of all input and output messages. This command sets or resets a toggle accordingly.

## OL

OL returns the data communication status of the remote station.

## OVERLAY

OVERLAY returns the number of data and code overlays IBASIC has performed since BOJ.

## PROMPT

PROMPT switches the form of the prompt for user input from a single “#” to the word “ready” as a prompt message and vice versa.

## RY

RY, entered from the ODT, changes STATION(READY) to true.

## SS <string>

SS displays <string> on either the remote terminal or the system console, the opposite of where the message originated. The RMSG system option must be set for system console messages to be displayed.

## ST

ST changes STATION(READY) to false.

## STATUSLINE

STATUSLINE switches on or off the maintenance of the TD830 status line.

### NOTE

Firmware prior to the 2.0 release level in the TD830 does not implement the STATUSLINE feature, so STATUSLINE must be switched off by entering .STATUSLINE as the first message to IBASIC.

## TIME

TIME returns the elapsed time since the current user logged on and the total amount of cpu time accumulated this session.

## APPENDIX A

### GLOSSARY OF IBASIC TERMS

**active channel**

A channel that has a file assigned to it.

**alphanumeric**

An alphabetic or a numeric character.

**American Standard Code for Information Interchange (ASCII)**

The standard code, consisting of 7-bit code characters, used for information interchange among data processing systems.

**argument**

An expression used in a function reference to communicate data between the calling program unit and the function.

**arithmetic operator**

A symbol used in a numeric expression to indicate the arithmetic operation to be performed by IBASIC.

**array**

A group of string or numeric values stored under an array name and organized in columns, or in rows and columns.

**array element**

One element of an array.

**array name**

A symbolic name for an array.

**ASCII**

Refer to American Standard Code for Information Interchange.

**assign**

To give a variable a value through use of a READ, INPUT, LINPUT, or assignment statement.

**automatic log off**

The log off action that takes place when a remote terminal is prematurely disconnected from IBASIC.

**automatic log on**

The function of automatically logging a user on to IBASIC without a specific log on action for the specified usercode.

**BASIC**

Beginner's All-Purpose Symbolic Instruction Code.

**BASIC command**

A BASIC statement used in Command mode.

**BASIC environment**

The set of BASIC code and data that are maintained in the workfile by IBASIC.

**BASIC file name**

The name for an external file that can be specified within IBASIC.



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Glossary of IBASIC Terms

**BASIC statement (also BASIC language statement)**

A group of BASIC keywords and expressions associated with a single line number.

**BASIC program**

A sequence of BASIC statements terminated by an END statement.

**branch**

Transfer to another line in a program other than the next line in sequence.

**break**

Temporary interruption in the execution of a program caused by the execution of a BREAK command or statement.

**bridge**

A part of railroad syntax that specifies the number of times a path may or must be traversed.

**channel number**

A numeric expression which evaluates to an integer in the range 0 to 255. The channel number specifies the channel through which a file is accessed.

**character**

A letter, symbol, digit, or blank.

**clause**

Part of some BASIC statements. A clause starts with a key word such as STEP, ELSE, USING, or THEN.

**closed file**

A file that is not assigned a channel.

**column**

The dimension of an array which represents the vertical arrangement of elements of that array.

**columnar position**

The print position that is occupied by the next character transmitted to the current line; print positions are numbered consecutively from the left, starting with position one.

**command**

Operating instruction to the system that is executed immediately when entered.

**Command AND Edit (CANDE)**

An editor program on the B 1000 systems.

**command mode**

The mode of interaction that is in effect when a command (no preceding line number) is entered.

**constant**

A nonvariable numeric or string value.

**continuous mode**

A type of message transmission that does not leave the terminal in local mode.

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Glossary of IBASIC Terms

control statement

A statement that can alter the sequence of execution for statement lines by causing the program to branch.

control variable

A simple numeric variable used in a FOR NEXT loop to count and control the number of iterations of the loop.

conversational mode

The "talking" mode in which IBASIC and a user interact.

CRT terminal

Display screen terminal, most likely a cathode ray tube.

current line

The string of characters (possibly zero) generated by PRINT and OUTPUT statements since the last end-of-line character was generated.

current program

The program that is currently loaded into the BASIC environment.

data block

List of constant values to be assigned to variables in a program through DATA and READ statements.

datum

One item in a logical group of data.

debug

To find and correct errors in a program.

default

An attribute or value which is automatically selected by the system when not specified by the user.

default pack

The pack associated with a specified usercode.

delimit

To separate items of data with a delimiter.

delimiter

A character that separates items of data.

digit

A graphic character that represents an integer, for example, one of the characters 0 to 9.

dimension

The size of an array.

dot command

A special IBASIC command preceded by a dot.

dummy variable

A variable used in the definition for a function that is defined in a program. When the function is used, the values listed as arguments are substituted for the dummy variables in the definition.

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Glossary of IBASIC Terms

**EBCDIC**

Refer to Extended Binary-Coded Decimal Interchange Code.

**end of line**

The end of the record, or the first occurrence of a NUL, CR, LF, or ETX character.

**end of record**

A NUL character or the physical end of the record.

**enter**

To submit information to the IBASIC system for processing by pressing the transmit key (XMT key on a TD830).

**entry mode**

The mode of interaction that is in effect when a BASIC statement is entered.

**error**

A mistake in BASIC syntax, program logic, or system operation.

**error number**

A number used by the system to identify an error.

**execute**

To perform the operation or task indicated by a statement, program, or command. IBASIC executes a program by executing individual statements in a prescribed order.

**explicit-point notation**

A method of representing a decimal number with decimal digits and a decimal point.

**expression**

A constant, variable, function reference, or combination of these separated by operators and used to represent numbers or strings.

**Extended Binary-Coded Decimal Interchange Code (EBCDIC)**

A character set, consisting of 8-bit coded characters, used for information interchange in data processing systems.

**fatal error**

A run-time error which halts execution. An error message is displayed to inform the user of the error.

**file name**

The name assigned to an external file.

**file pointer**

An indicator of the position in a file that is affected by the next file input or output statement.

**floating-point notation**

A method of representing a real number. For example, 0.0001234 is 0.1234E-3, where 0.1234 is the fractional part and E-3 is the exponent.

**function**

An algorithm for making a calculation which yields a single value. Functions for some common calculations are provided by IBASIC. Other functions can be defined in programs with DEF statements.

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Glossary of IBASIC Terms

**function name**

A symbolic name used to identify a function.

**global variable**

A variable which can be referenced from anywhere within a program.

**IBASIC**

Refer to Interactive BASIC system.

**image**

The format according to which one or more data items are to be printed.

**implicit-point notation**

A method of representing a decimal number that contains only decimal digits. The decimal point is assumed to occur to the right of the rightmost digit of the number.

**inactive channel**

A channel with no file assigned to it.

**index**

A numeric expression which evaluates to an integer and identifies the position of an item of data with respect to some other item of data.

**input**

Data supplied for processing through external media.

**integer**

A whole number that can be represented exactly, using only decimal digits.

**interaction**

The conversational dialogue that takes place between the user and the computer.

**Interactive BASIC system**

The compiler, interpreter, message control system (MCS), editor, external intrinsics, and dummy program that comprise IBASIC.

**interactive command**

An instruction to IBASIC.

**intrinsic numeric function**

A predefined function supplied as part of IBASIC for the evaluation of commonly used numeric functions.

**intrinsic string function**

A predefined function supplied as part of IBASIC for the evaluation of commonly used string-valued functions and numeric-valued functions whose arguments are strings.

**jump**

Refer to branch.

**justifier**

A greater than (>) or less than (<) sign, occurring in an image, which specifies right or left justification, respectively.

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**Glossary of IBASIC Terms**

**keyword**

A character string which provides a distinctive identification of a statement or a component of a statement.

**letter**

An English alphabet character: A through Z or a through z.

**line number**

A number used to sequence a statement line. It may contain up to five decimal digits.

**line number range**

A syntactic construction that allows a sequential group of line numbers to be specified.

**local variable**

A variable that is only understood in a user-defined function. Parameters are the only variables that fall into this class.

**loop**

A sequence of statements in a program that are executed repeatedly; a repeating path in a railroad syntax diagram.

**margin**

The number of characters, excluding the end-of-line character, that can be written on one output line.

**matrix**

A 2-dimensional array.

**MCP file name**

A name for an external file that is valid to the MCP.

**MCS**

Refer to message control system.

**memory**

A place where the system can temporarily store programs and data during processing.

**message control system (MCS)**

A program which opens a remote file with the HEADERS option and thereby controls the stations in that remote file.

**NDL**

Refer to Network Definition Language.

**nest**

To imbed a language structure within itself.

**Network Controller**

The program generated through compilation of a Network Definition Language source program. The Network Controller handles the line discipline for the data communication devices of a system and the interface queue between an MCS and the operating system.

**Network Definition Language**

A descriptive free-form language for defining and implementing a data communications network. The NDL compiler analyzes the input statements and generates a network controller.

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Glossary of IBASIC Terms

**next statement pointer**

A memory location that contains the address of the next statement to be executed.

**nonfatal error**

A run-time error that does not halt execution of the BASIC program. An error message is displayed to inform the user of the error.

**null string**

A string value of zero characters, represented in BASIC by "".

**numeric constant**

A series of decimal digits, occurring with a BASIC program, that denote a numeric value.

**numeric expression**

A numeric constant, numeric variable, numeric function reference, or a combination of these separated by arithmetic operators.

**numeric function reference**

An intrinsic numeric function or a user-defined numeric function.

**numeric overflow**

A condition that occurs when a numeric value exceeds the maximum numeric value allowed.

**numeric variable**

A symbolic name used to represent a numeric value which may be changed during program execution.

**object of a loop**

An item within a loop of a railroad syntax diagram.

**open file**

A file that is assigned to a channel.

**operand**

A numeric or string expression used as part of a larger numeric or string expression.

**operator**

The symbol used in a numeric, string, or relational expression to indicate the operation to be performed by IBASIC in order to find the value of the expression.

**optional item**

An item in a railroad syntax diagram that may be omitted.

**order of operations**

The standard sequence in which IBASIC performs operations to find the values of expressions.

**ordinal position**

The position of a character in either of the character sets used in BASIC (ASCII or EBCDIC).

**output**

The results of a program, written to external media.

**overflow**

Refer to numeric overflow and/or string overflow.

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Glossary of IBASIC Terms

parameter

A simple variable used in a function to pass data between the calling routine and the function.

password

A word associated with a usercode that allows access to IBASIC.

path

The sequence of execution for statements in a program.

print item

An expression or a TAB call occurring in a PRINT or OUTPUT statement.

print line

A transmission of characters, from PRINT and/or OUTPUT statements, which terminates with an end-of-line character.

print zone

A contiguous set of 15 character positions in an output line which may contain an evaluated PRINT or OUTPUT statement expression.

privileged status

The status that the IBASIC system has if it is executed under a privileged MCP-type usercode or a non-MCP usercode. Privileged status affects the types of files that may be accessed.

program

A sequence of instructions for doing a task on a computer.

program designator

A string expression whose value specifies the name of a program to which chaining is to be performed.

prompt

A message displayed to signal the user to enter input.

quoted string character

Any character in Table E-1 in Appendix E, except those characters in ordinal positions 0 through 31, 34, 64, 91, 92, 96, and 123 through 127. Ordinal position 34, the quotation mark (''), may appear as a quoted string character if it is represented by two adjacent quotation marks.

real number

Decimal number containing a decimal point.

record length

The number of characters between the beginning of a record and the end of the record.

redimension

To change the bounds of an existing array.

relational expression

An expression containing a relational operator and having the value of true or false. Relational expressions are used only in IF statements to cause the program to take one path if the expression is true and another path if the expression is false.

relational operator

Symbol used in an expression to define a comparison to be made between two numbers or strings.

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remark string

A string of characters occurring in either a tail comment or a REM statement.

required item

An item in a railroad syntax diagram that may not be omitted.

reverse video

A method of highlighting a line on a display screen terminal.

row

The dimension of an array which represents the horizontal arrangement of elements of that array.

run-time

Occurring during program execution.

scalar

A quantity characterized by a single numeric or string value.

scaled notation

A method of representing a number by using a real number raised to a power of 10.

scope of file access

A particular BASIC environment may access, for input only, any disk file maintained by MCP II which may be accessed under the currently logged on usercode. The BASIC environment may only create or change a file which has the family name of the currently logged on usercode. Thus, the rules for forming a file name, which is for input only, are more flexible than those for files which are to be created.

sign

A plus (+) or minus (-) sign.

simple variable

A variable that is not subscripted.

single stepping

A method of executing a BASIC program in which each BASIC statement is performed in response to a single manual operation.

SMCS

Refer to Supervisory Message Control System.

source code

BASIC language statements.

source line

A line of source code.

statement

An instruction in a BASIC program occurring on one statement line.

statement line

A line number followed by a BASIC statement.



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**string**

A series of consecutive characters treated as a group.

**string constant**

A string of characters enclosed within quotation marks (").

**string expression**

A string constant, string variable, string function reference, or a concatenation of these.

**string function reference**

An intrinsic string function or a user-defined string function.

**string length**

The number of characters represented by a string.

**string overflow**

A condition occurring when a string variable is assigned more characters than its length allows.

**string variable**

A symbolic name used to represent a string value which may be changed during program execution.

**subscript**

An index into a row or a column of an array. A 1-dimensional array has one subscript and a 2-dimensional array has two subscripts.

**subscripted variable**

A variable with one or two subscripts.

**Supervisory Message Control System (SMCS)**

The standard message control system available on the B 1000 systems.

**symbolic name**

A symbol or symbols used to represent a numeric or string variable.

**syntax error**

An error in the syntax of a command or statement.

**system command**

See command.

**underflow**

A condition that occurs when an attempt is made to represent a numeric value smaller than the smallest value representable in BASIC.

**unscaled notation**

Notation for a number characterized by the absence of an exponent part as occurs in scaled notation.

**usercode**

A name assigned to a user and used for file security.

**user-defined function**

A function defined by a user with a DEF statement.

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**user session**

The period of time during which a user is logged on.

**value**

A number or a string represented by a constant, variable, or expression.

**variable**

A data name within a program whose value can be changed.

**wait mode**

A type of message transmission that leaves the terminal in local mode.

**workfile**

The temporary file that IBASIC uses to store user-entered BASIC statements.

**zoned format**

Design for output that allocates 15 character positions for each value.

## APPENDIX B

### IBASIC LOG ON, LOG OFF, AND EXECUTION

#### EXECUTION UNDER SMCS

IBASIC may be initiated by using the execute or the sign on syntax. If the execute syntax is chosen, no entry in the SMCS jobs file is required. If the sign on syntax is used, an entry in the SMCS jobs file is required. In either case, the signal character for IBASIC must not be either '#' or '.' or SUB (refer to Table E-1 in Appendix E).

Termination of the current IBASIC session may be caused, in either case, by using the sign off syntax (that is, "<signal> OFF").

#### EXECUTE SYNTAX

IBASIC can be initiated by entering "EX IBASIC". If the terminal is logged on under an MCP usercode, IBASIC is executed under that usercode. The normal usercode considerations apply. If automatic log on is required and the logged on usercode is privileged, modify IBASIC with 'SW = USER' or enter 'EX IBASIC SW = USER' (refer to Usercode Considerations and Switch Values in Appendix C).

#### ON SYNTAX

IBASIC can be initiated by entering 'ON IBASIC'. The SMCS jobs file must have an entry with the following format:

column 1	\$
column 2	IBASIC LOG-ON NO-SESSION ;
	US <any privileged usercode/password>
	EX IBASIC SW = AUTO
	ME <user site default>
	PR <user site default>

#### EXECUTION UNDER CANDE

Use the execute command to cause execution under the usercode which is logged on to CANDE. If automatic log on to this usercode is required, the switches must be set to "USER".

Example:

```
EX *IBASIC;<optional ME and/or SW parameters>
```

#### NOTE

If IBASIC does a display to the ODT (for instance, as a result of a .SS command), the display messages are repeated at the remote terminal and are displayed only at the ODT if the RMSG system option is set.

## EXECUTION WITH NO MCS

The IBASIC program must be executed from the ODT with the file given the name of the remote file declared in the network controller which contains only the remote station required. If automatic log on to the usercode, under which IBASIC is executed, is required, the switches must be set to "USER". If other than the default memory is required, a memory clause should be added to the control string.

Example:

```
US ME/MINE EX IBASIC SW = USER FI F0 NAM MYTERM;
```

## AUTOMATIC LOG OFF

If the remote terminal is prematurely disconnected from IBASIC before a proper log off (BYE or HELLO command) occurs, an automatic log off occurs regardless of the state of the BASIC environment. The remote user must re-establish connection and log on again to IBASIC in the normal manner. The source file that was loaded at the time of the log off can be recovered, but any data values are lost.

The TERMINATE ERROR mechanism in the network controller implements this feature. Thus, if IBASIC receives a TERMINATE ERROR message from the remote terminal with one or more of the relevant error conditions true, a log off procedure is initiated. The following data communication errors are relevant:

```
TIMEOUT  
LOSS OF DSR  
LOSS OF CARRIER  
ADDRESS ERROR  
TRANSLATE ERROR  
FORMAT ERROR  
READ NOT READY
```

The same procedure is invoked if the SMCS sign OFF command is used before proper log off procedures occur.

It is strongly recommended that the remote user log off IBASIC in the proper manner if conditions allow.

## APPENDIX C OPERATIONAL CONSIDERATIONS

### NETWORK CONTROLLER CONSIDERATIONS

There are some constraints on the generation of the Network Controller. The Interactive BASIC system assumes the validity of the TYPE field specified in the TERMINAL Section of the NDL source. Currently, only the following values for the TYPE field are valid:

Type	Terminal
0	B9350 (TTY)
26	TC4000
41	TD801
42	TD802
43	TD821
44	TD822
45	TD831
46	TD832

Scrolling of input and output lines is supported only for TD820 and TD830 type terminals. To enable scrolling, the standard CANDE request and control sets must be used.

For correct operation of TTY type terminals, the CANDE IOTTY request set must be used.

The following considerations are only relevant if nonstandard request and control sets are used. A knowledge of NDL coding and the use of station TOG and TALLY values is assumed. The special meanings for the following values are assumed.

When TOG[1] is set on an output message, it means that this message is not to be scrolled.

A true value in station TOG[2] in an input message means that the input message was scrolled or that the output message is to be scrolled.

Station TOG[3] is set for all output messages to a teletype, and associated TOG[7] can be set to indicate inhibition of transmission of trailing CR and LF characters for this message.

Station TOG[3] is also set for all messages that are to be scrolled. This method is used to enable multiple line output scrolling which is in the CANDE request sets.

A true value in station TOG[5] means that BREAK was detected in the last output attempt. This must only be true in a 'GOOD RESULTS REPLY' type message.

If station TALLY[0] = 2, a screen type terminal is forced to local after this output message (even in scroll mode).

### INTERACTIVE BASIC SYSTEM CONSIDERATIONS

IBASIC may or may not require modifications to suit the particular user. These modifications may be applied through MODIFY MCP syntax or as parameters with the execute control syntax.

There is one copy of the IBASIC program per user of the system. Thus, the following considerations may be applied differently to each user, or globally to all users as required.

## DYNAMIC MEMORY

IBASIC relies heavily on SDL paged array structures. Both s-code and data are maintained in paged arrays; therefore, if the average BASIC program has many statements or uses large amounts of data, IBASIC may require a larger dynamic memory size. Dynamic memory size can be changed only at BOJ time of IBASIC, so either an ME control parameter can be included in the execute command or a particular installation can modify a default value to suit its particular median requirements. Use of the .OVERLAY dot command may help in determining the need for more memory.

## HARDWARE REQUIREMENTS

The Interactive BASIC system requires the following minimum hardware:

- B 1700/B 1800/B 1900 processor (excluding B 1710 and B 1830)
- 128K bytes (dependent on number of users)
- 1MB disk per user
- TD820, TD830, TC4000, TTY type terminals

## ODT OPERATION

If no remote operation is required (that is, if no data communication system exists or is needed), IBASIC can be operated from the system console. To do this, IBASIC must be executed or modified as follows.

FILE F0 DSK (or nonremote) NAM <any nonexistent name>

By default, file F0 has an external name of F0, so if F0 does not exist in the system, the NAME parameter is unnecessary.

Further communication with IBASIC is achieved through the normal MCP accept (unsolicited) and display interface.

The ensuing log on process is identical to the normal remote log on process according to the usercode (if any) under which the IBASIC program is logged on. There is no implied limit to the number of users who may use the ODT.

## PRIORITY

For quick servicing of a request from a user station, IBASIC must be run at a priority (both memory and processor) higher than any batch jobs, as is the case for most remote applications.

## SOFTWARE REQUIREMENTS

The Interactive BASIC system requires the following software.

IBASIC	(compiler)
IBASIC/INTERP	(interpreter)
IBASIC/INTRINSICS	(intrinsic)
IBASIC/RUNNER	(dummy program called when programs are run)
MCPII	(Systems software release 9.0 or later)
NDL	(Systems software release 9.0 or later)

## SWITCH VALUES

There are three switch values of concern to the user:

SW = USER

Requests that IBASIC always log on automatically to the usercode under which it was executed (refer to Usercode Considerations in this appendix).

SW = AUTO

Requests that IBASIC wait for a log on message, in particular for one sent by the SMCS auto log on feature, and requests that IBASIC check whether it was executed under a privileged usercode.

SW = WW

Enables extensions to the ANSI language as explained in Appendix F, and forces auto log on.

## USERCODE CONSIDERATIONS

IBASIC may or may not be executed under the MCP usercode system.

If IBASIC is not executed under the MCP usercode system, the scope of access of the BASIC environment is limited to public files. In this mode, the concept of a password does not exist: a logged on usercode is simply a default family name of a file accessed for input only; and is also a mandatory family name for a file to be created or changed.

If IBASIC is executed under a nonprivileged MCP usercode, IBASIC automatically logs on that usercode. Log on of another usercode is disallowed. IBASIC must be logged off and re-executed under a different usercode to effect a change of user.

If IBASIC is executed under a privileged MCP usercode, automatic log on to the execution usercode may or may not occur, depending on the value of the switches. If automatic log on is not requested, IBASIC requests an explicit log on from the user before continuing. The usercode and password must be defined in the MCP's usercode file. Regardless of the switch settings, another user may log on after the current user has logged off without IBASIC going to EOJ.

## APPENDIX D SYNTAX SUMMARY

### ABS FUNCTION

—— ABS ( <numeric-expression > )

G18103

### ACOS FUNCTION

—— ACOS ( <numeric-expression > )

G18104

### ANGLE FUNCTION

—— ANGLE ( <numeric-expression > , <numeric-expression > )

G18105

### ASIN FUNCTION

—— ASIN ( <numeric-expression > )

G18106

### ATN FUNCTION

—— ATN ( <numeric-expression > )

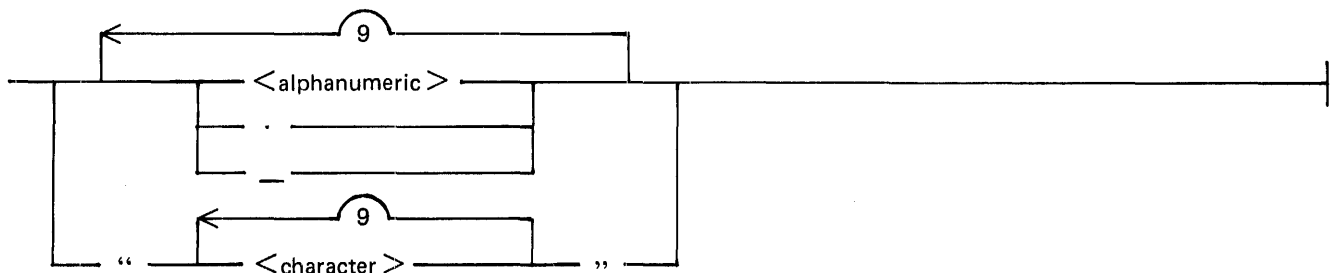
G18107

### .BACKSPACE COMMAND

—— .BACKSPACE <new backspace char >

G18108

### BASIC FILE NAME



G18074



## BREAK STATEMENT

—— BREAK ——  
G18071

## .BRK

—— .BRK ——  
G18088

## BYE STATEMENT

—— BYE ——  
G18077

## .CASE COMMAND

—— .CASE ——  
G18109

## CEIL FUNCTION

—— CEIL ( <numeric-expression> ) ——  
G18110

## CHAIN STATEMENT

—— CHAIN <program-designator> ——  
G18044

## CHR\$ FUNCTION

—— CHR\$ ( <numeric-expression> ) ——  
G18111

## CLOSE STATEMENT

—— CLOSE # <channel-number> ——  
G18063

## CONTINUE COMMAND

—— CONTINUE ——

1 TRACE  
1 PRINT

G18078  
1108990

## **.CONTINUOUS COMMAND**

\_\_\_\_\_ .CONTINUOUS \_\_\_\_\_  
G18112

## **COS FUNCTION**

\_\_\_\_\_ COS ( <numeric-expression > ) \_\_\_\_\_  
G18113

## **COSH FUNCTION**

\_\_\_\_\_ COSH ( <numeric-expression > ) \_\_\_\_\_  
G18114

## **COT FUNCTION**

\_\_\_\_\_ COT ( <numeric-expression > ) \_\_\_\_\_  
G18115

## **CSC FUNCTION**

\_\_\_\_\_ CSC ( <numeric-expression > ) \_\_\_\_\_  
G18116

## **DATA STATEMENT**

\_\_\_\_\_ DATA \_\_\_\_\_  
\_\_\_\_\_ <datum > \_\_\_\_\_  
G18046

## **DATE FUNCTION**

\_\_\_\_\_ DATE \_\_\_\_\_  
G18117

## **DATE\$ FUNCTION**

\_\_\_\_\_ DATE\$ \_\_\_\_\_  
G18118

## **DEBUG STATEMENT**

\_\_\_\_\_ DEBUG \_\_\_\_\_  
\_\_\_\_\_ ON \_\_\_\_\_  
\_\_\_\_\_ OFF \_\_\_\_\_  
G18070

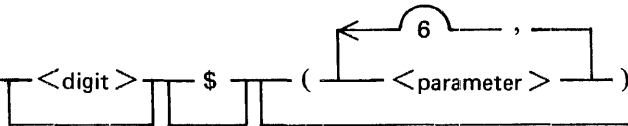
## .DEBUG COMMAND

\_\_\_\_\_ .DEBUG \_\_\_\_\_

G18119

## DEF STATEMENT

\_\_\_\_\_ DEF FN <letter> <digit> \$ ( <parameter> ) = <expression> \_\_\_\_\_



G18120

## DEG FUNCTION

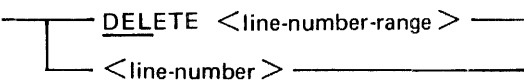
\_\_\_\_\_ DEG ( <numeric-expression> ) \_\_\_\_\_

G18121

## DELETE COMMAND

\_\_\_\_\_ DELETE <line-number-range> \_\_\_\_\_

<line-number>

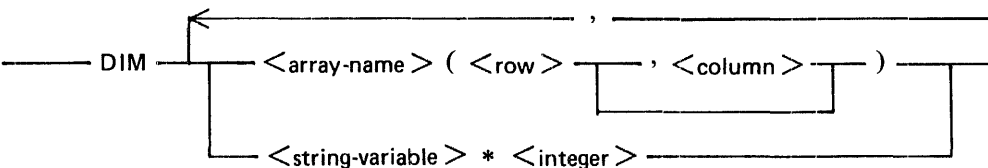


G18079

## DIM STATEMENT

\_\_\_\_\_ DIM <array-name> ( <row> , <column> ) \_\_\_\_\_

<string-variable> \* <integer>



G18122

## DOT FUNCTION

\_\_\_\_\_ DOT ( <array-name> , <array-name> ) \_\_\_\_\_

G18024

## .DUMP COMMAND

\_\_\_\_\_ .DUMP \_\_\_\_\_

G18123

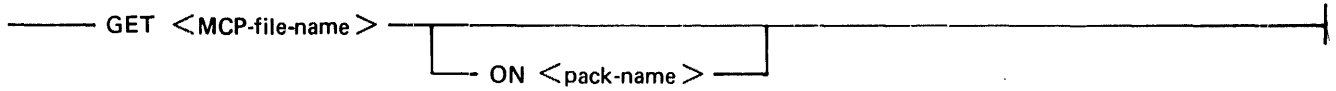
## END STATEMENT

\_\_\_\_\_ END \_\_\_\_\_

G18004

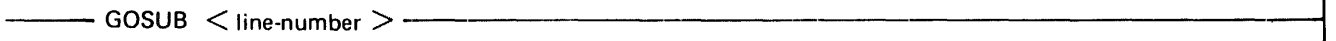


## GET COMMAND



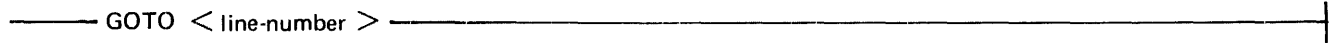
G18082

## GOSUB STATEMENT



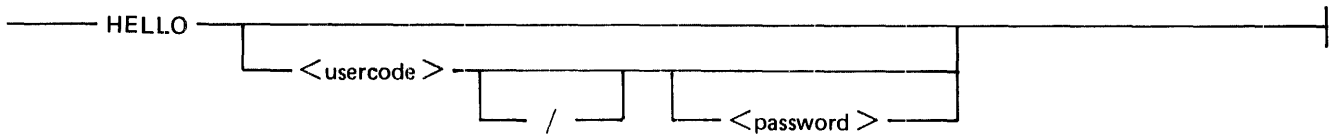
G18033

## GOTO STATEMENT



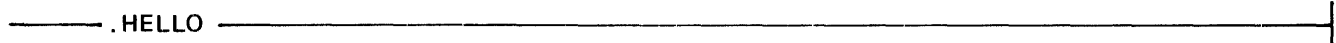
G18032

## HELLO COMMAND



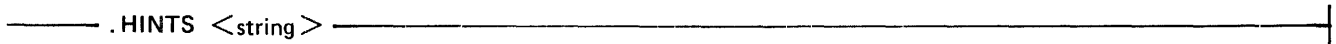
G18083

## .HELLO COMMAND



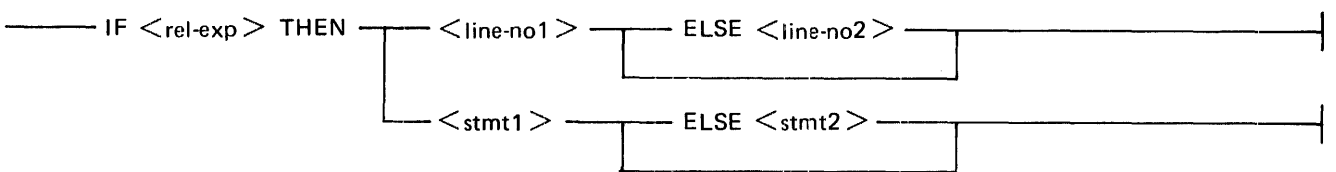
G18128

## .HINTS COMMAND



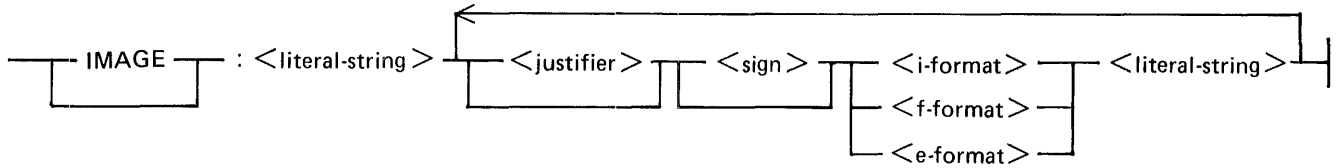
G18129

## IF STATEMENT



G18039

### IMAGE STATEMENT



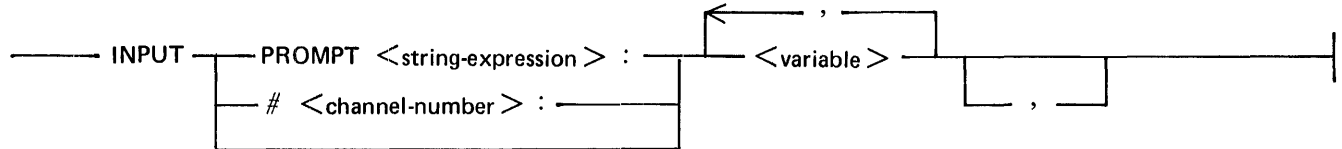
G18055

### INF FUNCTION



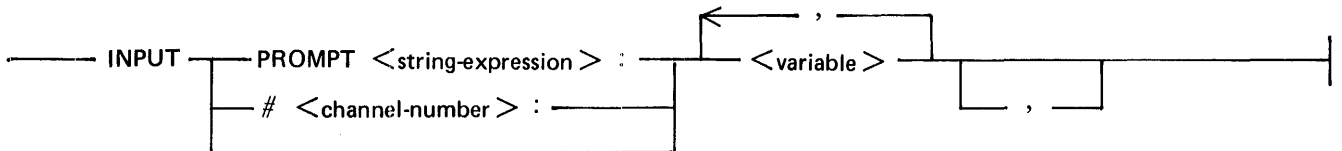
G18130

### INPUT REPLY



G18131

### INPUT STATEMENT



G18131

### INT FUNCTION



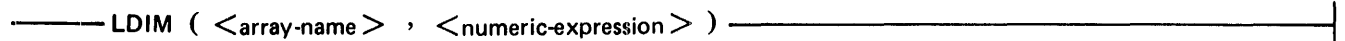
G18132

### IP FUNCTION



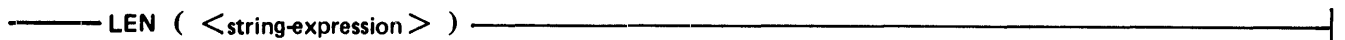
G18133

### LDIM FUNCTION



G18134

### LEN FUNCTION



G18135

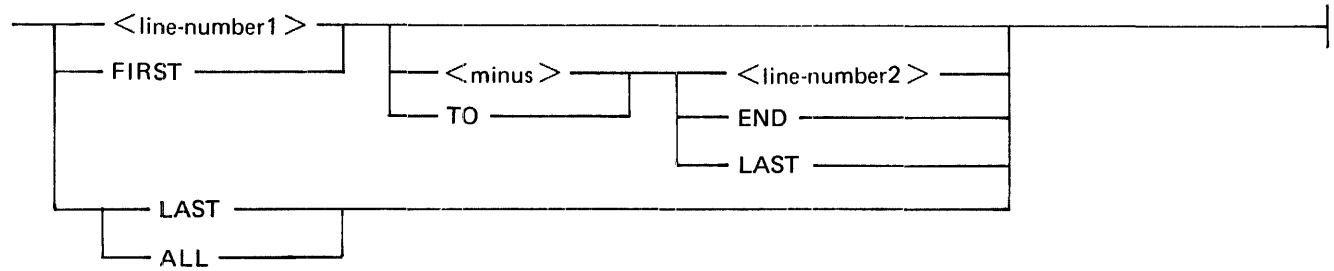
1108990

## LINE NUMBER



G18136

## LINE NUMBER RANGE



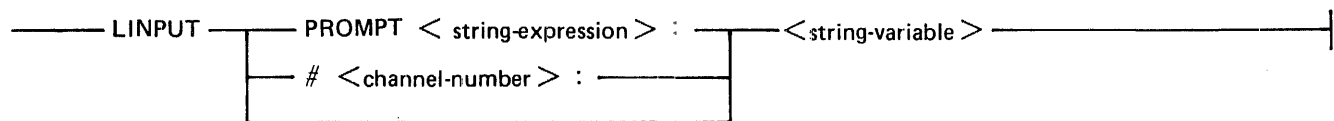
G18073

## LINPUT REPLY



G18052

## LINPUT STATEMENT



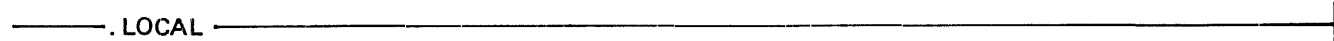
G18137

## LIST COMMAND



G18084

## .LOCAL COMMAND



G18138

## LOG FUNCTION



G18139

### .LOG COMMAND

\_\_\_\_\_ .LOG \_\_\_\_\_  
G18140

### LOG10 FUNCTION

\_\_\_\_\_ LOG10 ( <numeric-expression > ) \_\_\_\_\_  
G18141

### LOG2 FUNCTION

\_\_\_\_\_ LOG2 ( <numeric-expression > ) \_\_\_\_\_  
G18142

### MAKE COMMAND

\_\_\_\_\_ MAKE <BASIC-file-name > \_\_\_\_\_  
G18085

### MARGIN STATEMENT

\_\_\_\_\_ MARGIN <margin-value > \_\_\_\_\_  
G18059

### MAT ADDITION STATEMENT

\_\_\_\_\_ MAT <array-name1 > = <array-name2 > + <array-name3 > \_\_\_\_\_  
G18021

### MAT ASSIGNMENT STATEMENT

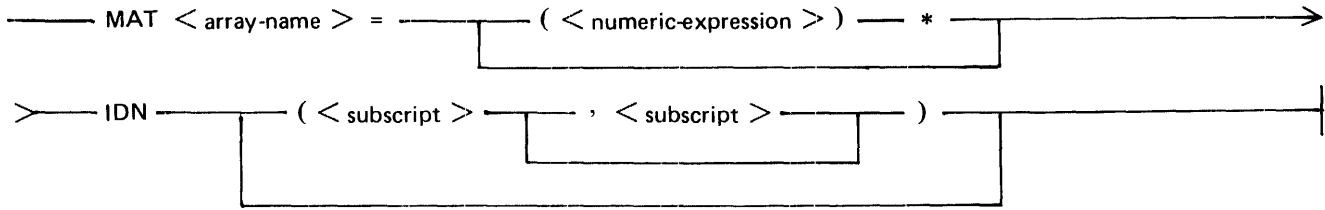
\_\_\_\_\_ MAT <array-name1 > = <array-name2 > \_\_\_\_\_  
G18022

### MAT CON STATEMENT

\_\_\_\_\_ MAT <array-name > = \_\_\_\_\_ ( <numeric-expression > ) \* \_\_\_\_\_  
\_\_\_\_\_ CON \_\_\_\_\_ ( <subscript > \_\_\_\_\_ , <subscript > \_\_\_\_\_ ) \_\_\_\_\_  
G18023

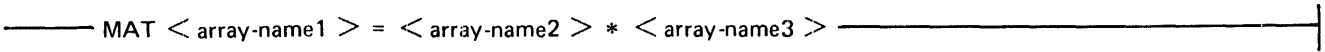


### MAT IDN STATEMENT



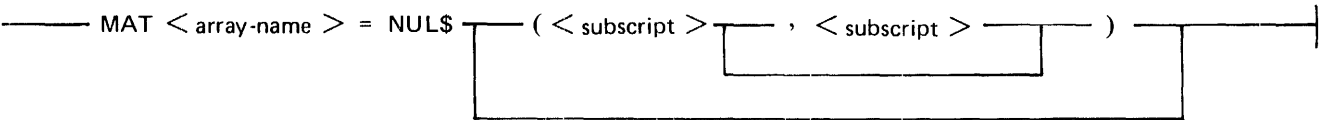
G18025

### MAT MULTIPLICATION STATEMENT



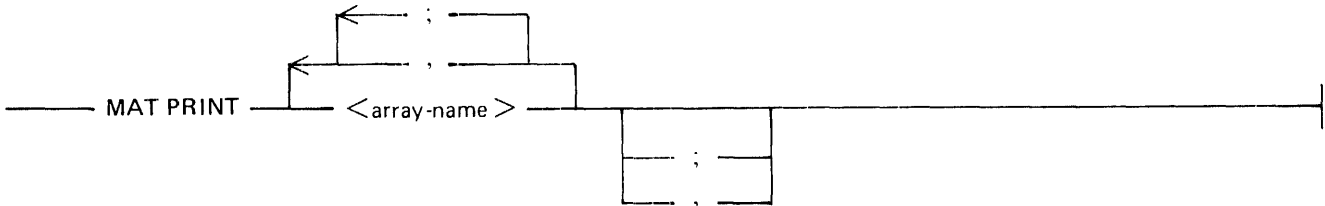
G18026

### MAT NUL\$ STATEMENT



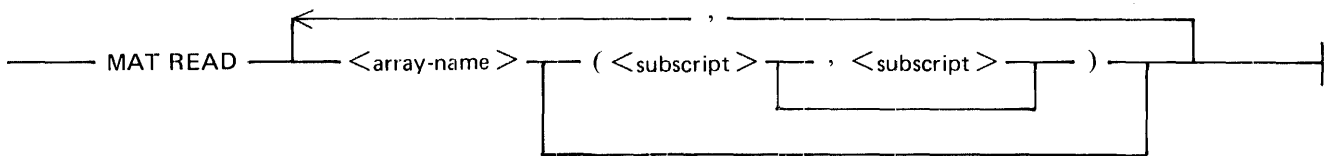
G18030

### MAT PRINT STATEMENT



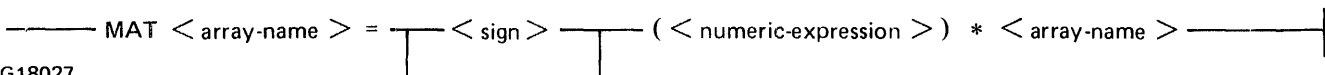
G18061

### MAT READ STATEMENT



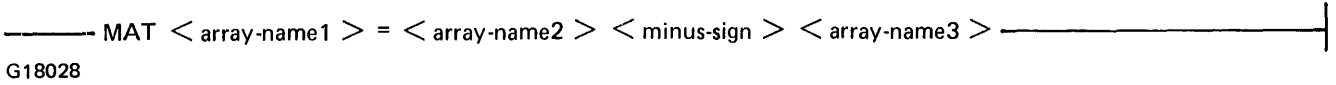
G18060

### MAT SCALAR MULTIPLICATION STATEMENT

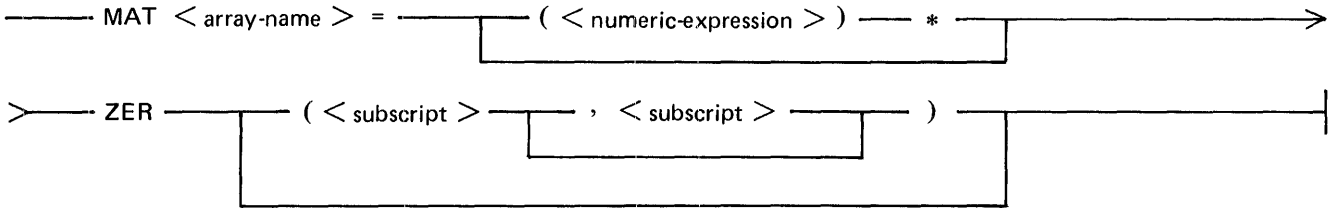


G18027

### MAT SUBTRACTION STATEMENT

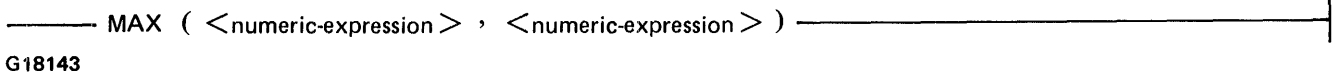


### MAT ZER STATEMENT

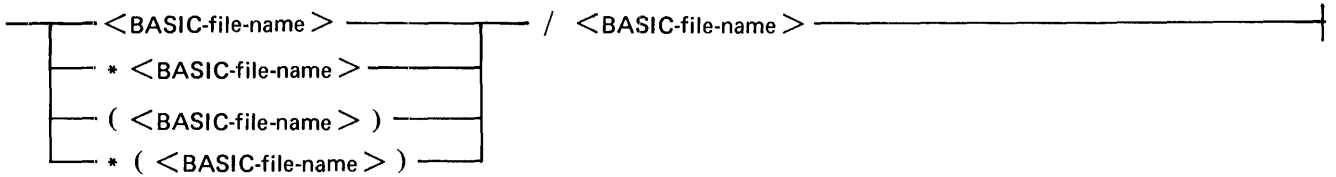


G18029

### MAX FUNCTION

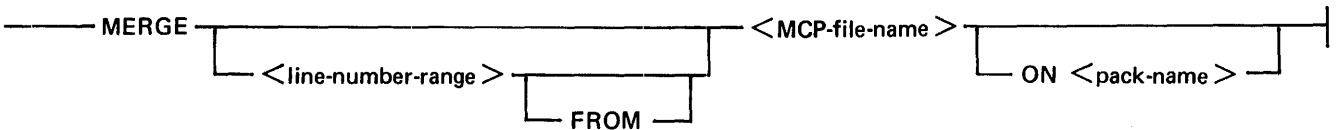


### MCP FILE NAME



G18076

### MERGE COMMAND



G18086

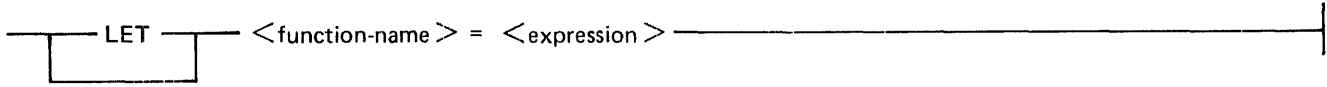
### MIN FUNCTION



### MOD FUNCTION

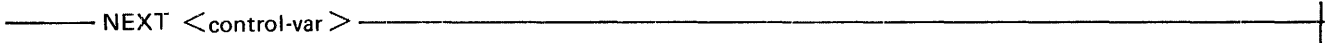


### MULTIPLE-STATEMENT FUNCTION ASSIGNMENT STATEMENT



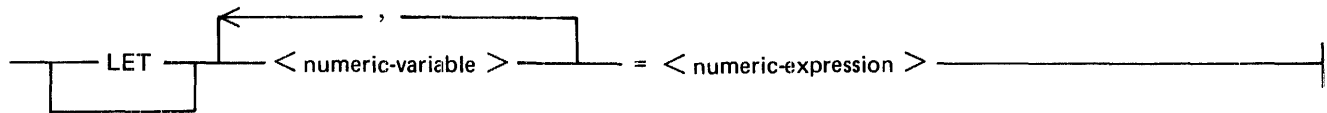
G18043

### NEXT STATEMENT



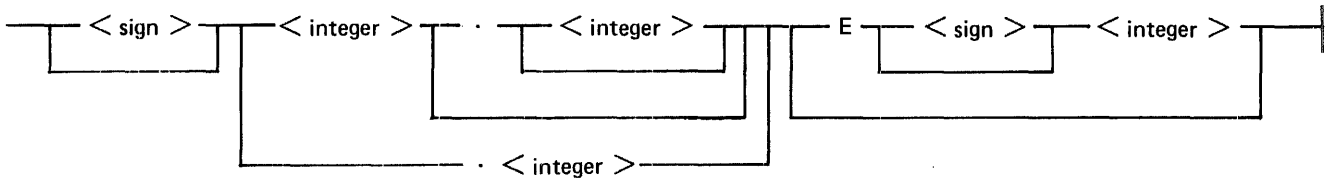
G18038

### NUMERIC ASSIGNMENT STATEMENT



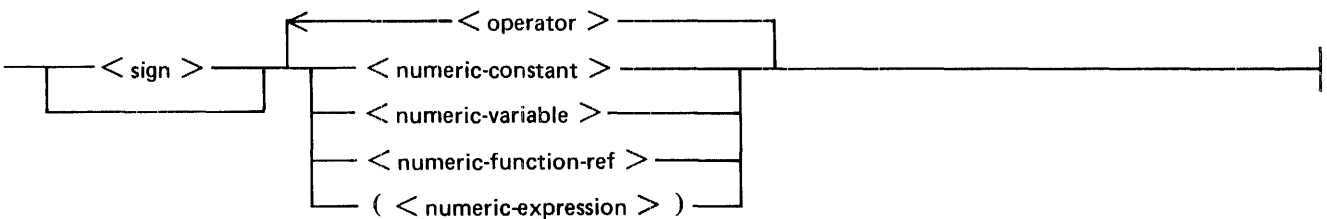
G18007

### NUMERIC CONSTANT



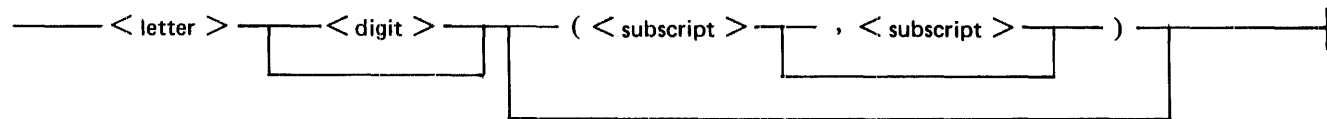
G18005

### NUMERIC EXPRESSION



G18008

### NUMERIC VARIABLE

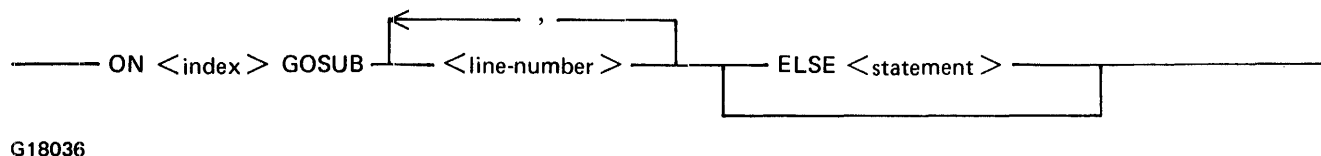


G18006

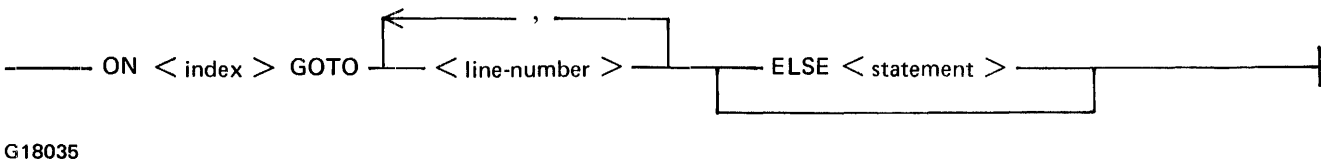
### .OL COMMAND



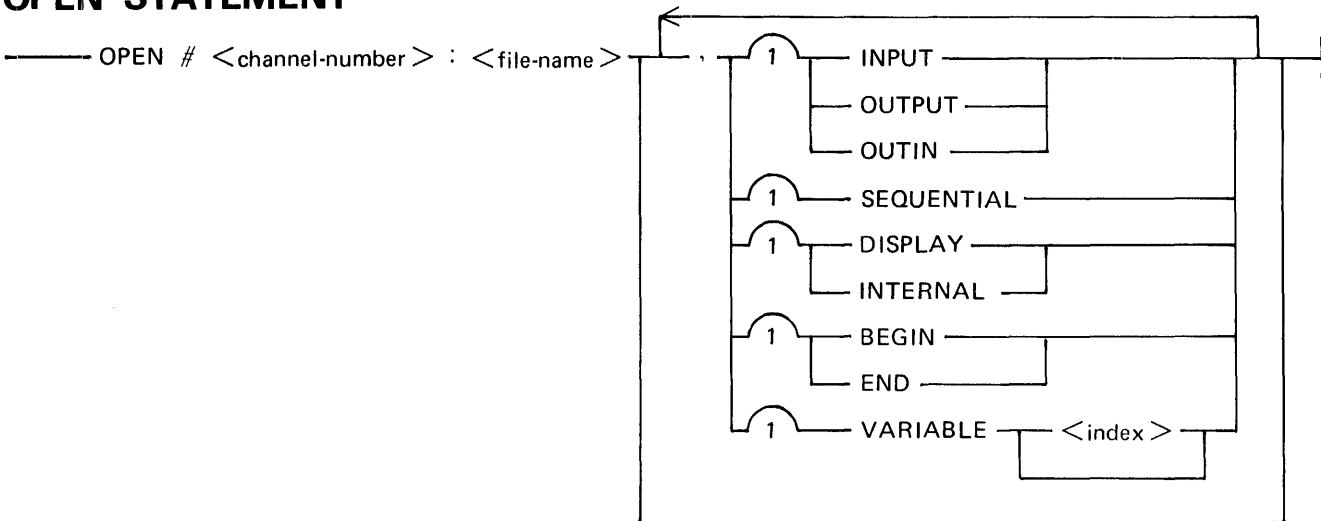
### ON GOSUB STATEMENT



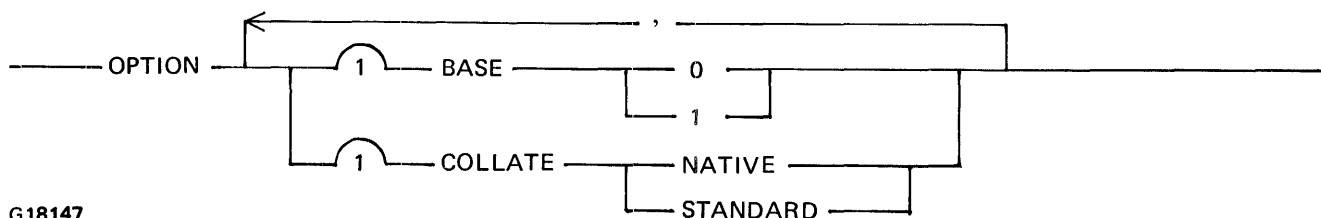
### ON GOTO STATEMENT



### OPEN STATEMENT

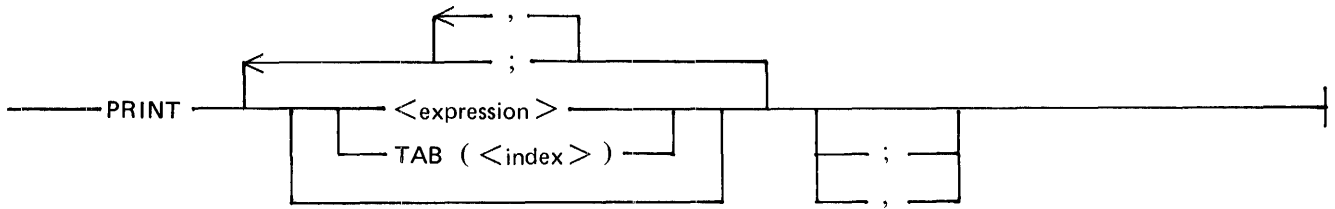


### OPTION STATEMENT



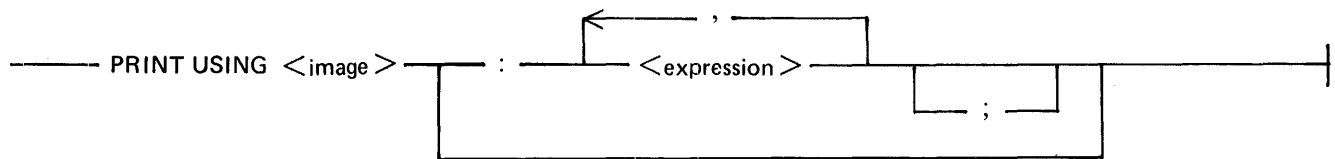


### PRINT STATEMENT



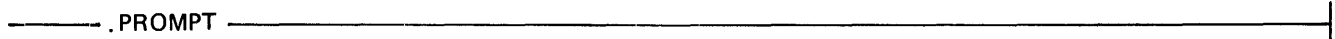
G18053

### PRINT USING STATEMENT



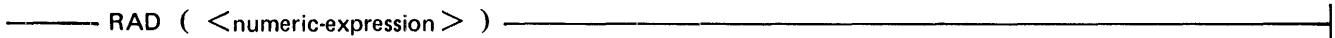
G18054

### .PROMPT COMMAND



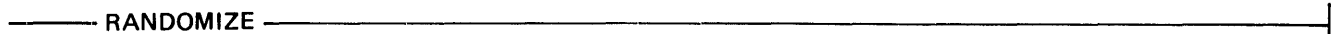
G18152

### RAD FUNCTION



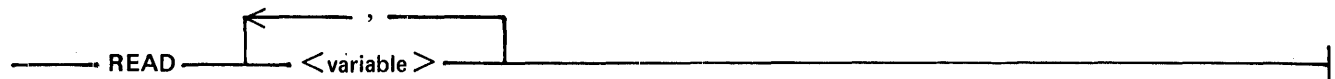
G18153

### RANDOMIZE STATEMENT



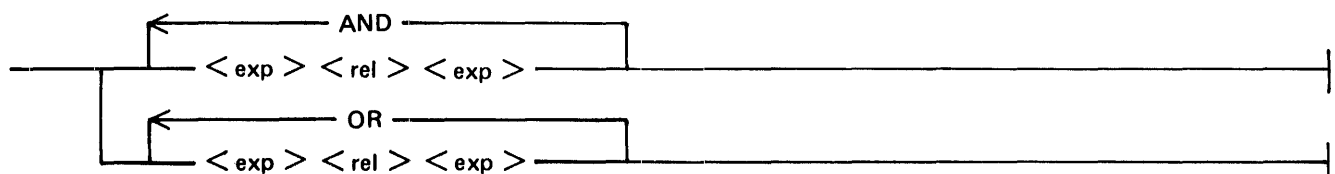
G18010

### READ STATEMENT



G18047

### RELATIONAL EXPRESSION



G18031

1108990

## REM FUNCTION

\_\_\_\_\_ REM ( <numeric-expression> , <numeric-expression> ) \_\_\_\_\_  
G18154

## REM STATEMENT

\_\_\_\_\_ REM <remark-string> \_\_\_\_\_  
G18002

## RENAME COMMAND

\_\_\_\_\_ RENAME <BASIC-file-name1> \_\_\_\_\_ <BASIC-file-name2> \_\_\_\_\_  
                                  ON <pack-name> AS  
G18089

## RENUMBER COMMAND

\_\_\_\_\_ RENUMBER \_\_\_\_\_  
                  <line-number-range>   STEP <increment>  
  1  
  AT <line-number>  
  1  
G18090

## RESTORE STATEMENT

\_\_\_\_\_ RESTORE # <channel-number> \_\_\_\_\_  
G18155

## RETURN STATEMENT

\_\_\_\_\_ RETURN \_\_\_\_\_  
G18034

## RND FUNCTION

\_\_\_\_\_ RND \_\_\_\_\_  
G18156

## RUN COMMAND

\_\_\_\_\_ RUN \_\_\_\_\_  
                  <line-number>   TRACE  
  1  
  PRINT  
  1  
G18091

## .RY COMMAND

\_\_\_\_\_ .RY \_\_\_\_\_  
G18157

## SAVE COMMAND

\_\_\_\_\_ SAVE \_\_\_\_\_  
          ┌ AS <BASIC-file-name > ─┐ ┌ ON <pack-name > ─┐ ┌ FOR CANDE ─┐  
G18092

## SCRATCH COMMAND

\_\_\_\_\_ SCRATCH \_\_\_\_\_  
          ┌ <BASIC-file-name > ─┐ ┌ ON <pack-name > ─┐  
G18093

## SCRATCH STATEMENT

\_\_\_\_\_ SCRATCH # <channel-number > \_\_\_\_\_  
G18069

## SEC FUNCTION

\_\_\_\_\_ SEC ( <numeric-expression > ) \_\_\_\_\_  
G18158

## SGN FUNCTION

\_\_\_\_\_ SGN ( <numeric-expression > ) \_\_\_\_\_  
G18159

## SIN FUNCTION

\_\_\_\_\_ SIN ( <numeric-expression > ) \_\_\_\_\_  
G18160

## SINH FUNCTION

\_\_\_\_\_ SINH ( <numeric-expression > ) \_\_\_\_\_  
G18161



## SQR FUNCTION

\_\_\_\_\_ SQR ( <numeric-expression> ) \_\_\_\_\_  
G18162

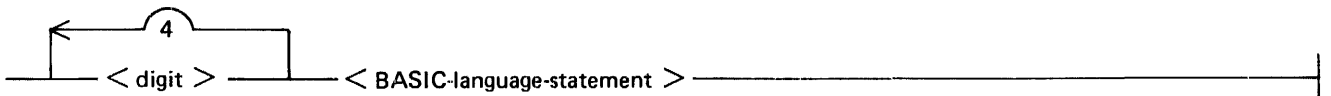
## .SS COMMAND

\_\_\_\_\_ .SS <string> \_\_\_\_\_  
G18163

## .ST COMMAND

\_\_\_\_\_ .ST \_\_\_\_\_  
G18164

## STATEMENT LINE

  
\_\_\_\_\_ < digit > \_\_\_\_\_ < BASIC-language-statement > \_\_\_\_\_  
G18000

## .STATUSLINE COMMAND

\_\_\_\_\_ .STATUSLINE \_\_\_\_\_  
G18165

## STEP COMMAND

\_\_\_\_\_ STEP \_\_\_\_\_  
G18094

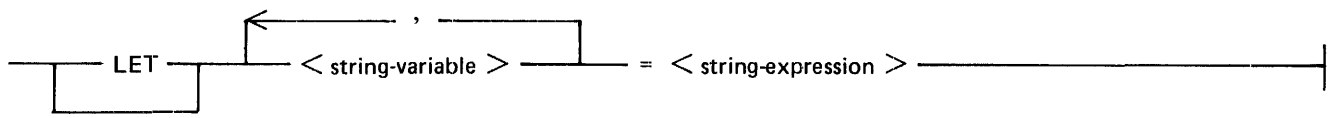
## STOP STATEMENT

\_\_\_\_\_ STOP \_\_\_\_\_  
G18003

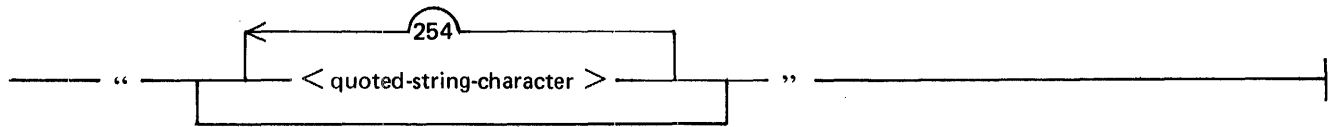
## STR\$ FUNCTION

\_\_\_\_\_ STR\$ ( <numeric-expression> ) \_\_\_\_\_  
G18166

## STRING ASSIGNMENT STATEMENT

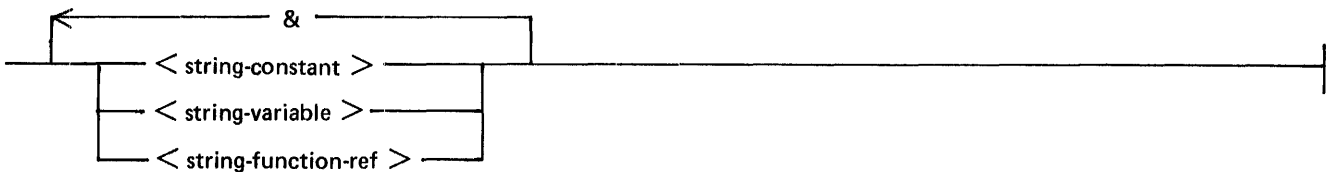
  
\_\_\_\_\_ LET \_\_\_\_\_ < string-variable > \_\_\_\_\_ = \_\_\_\_\_ < string-expression > \_\_\_\_\_  
G18013

### STRING CONSTANT



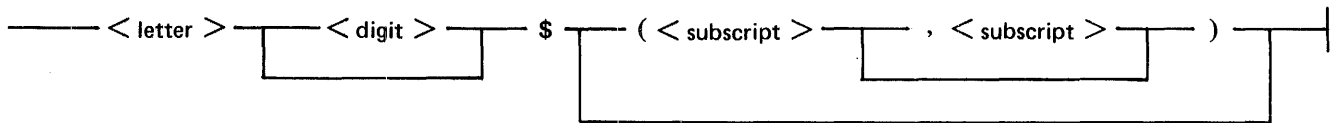
G18011

### STRING EXPRESSION



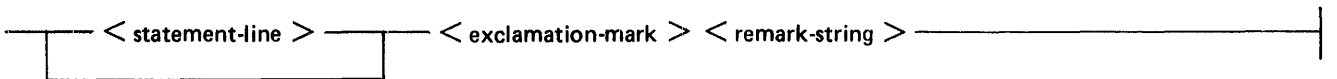
G18014

### STRING VARIABLE



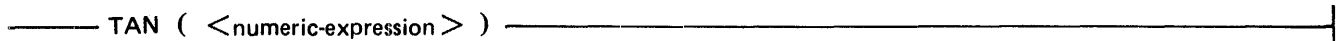
G18012

### TAIL COMMENT



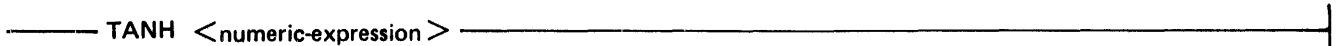
G18001

### TAN FUNCTION



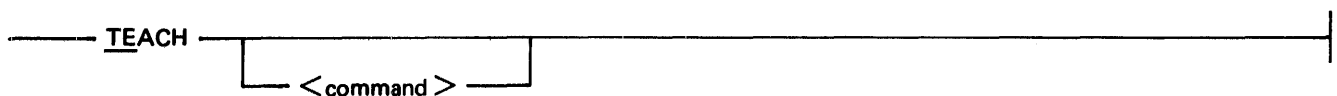
G18167

### TANH FUNCTION



G18168

### TEACH COMMAND



G18095

## TIME FUNCTION

\_\_\_\_\_ TIME \_\_\_\_\_  
G18169

## .TIME COMMAND

\_\_\_\_\_ .TIME \_\_\_\_\_  
G18170

## TIME\$ FUNCTION

\_\_\_\_\_ TIME\$ \_\_\_\_\_  
G18171

## TITLE COMMAND

\_\_\_\_\_ TITLE <BASIC-file-name> \_\_\_\_\_  
G18096

## TRACE STATEMENT

\_\_\_\_\_ TRACE \_\_\_\_\_  
          ON \_\_\_\_\_  
          OFF \_\_\_\_\_  
G18072

## UDIM

\_\_\_\_\_ UDIM ( <array-name> , <numeric-expression> ) \_\_\_\_\_  
G18172

## USER COMMAND

\_\_\_\_\_ USER <usercode> \_\_\_\_\_  
                  / \_\_\_\_\_  
                  <password> \_\_\_\_\_  
G18097

## VAL FUNCTION

\_\_\_\_\_ VAL ( <string-expression> ) \_\_\_\_\_  
G18173

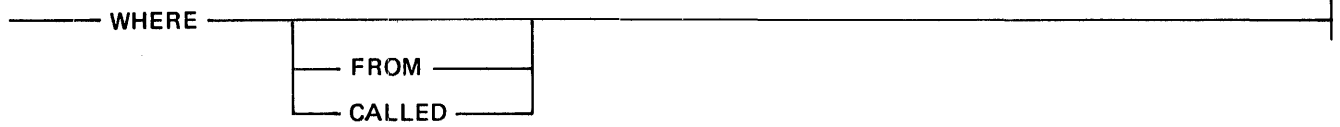
## WALK COMMAND

\_\_\_\_\_ WALK \_\_\_\_\_  
          \_\_\_\_\_ <line-number> \_\_\_\_\_  
G18098

## WHAT COMMAND

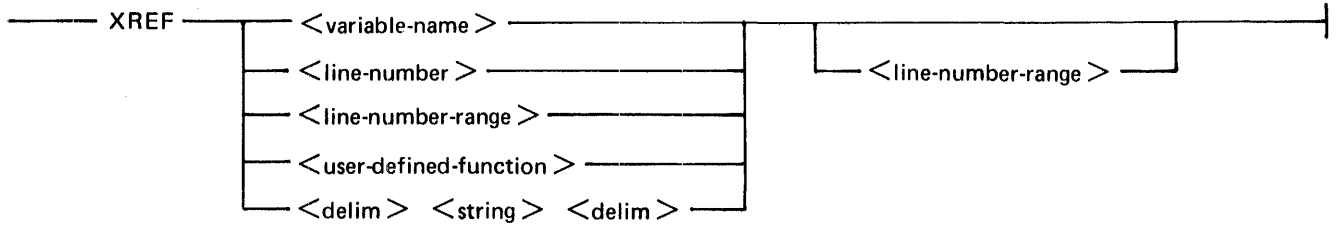


## WHERE COMMAND



G18100

## XREF COMMAND



G18101

## APPENDIX E CHARACTER SETS

Tables E-1 and E-2 list the character sets available to IBASIC for comparing strings and for computing values with the CHR\$ and ORD functions. Table E-1 contains the STANDARD character set (ASCII). Table E-2 contains the NATIVE character set (EBCDIC).

Hexadecimal representation is the standard convention for the 8-bit internal codes. Examples of the translation of these codes to the equivalent binary values follows.

Examples:

Hex Number Pair		8-Bit Internal Code			
		8	4	2	1
@39@	=	0	0	1	1
@BE@	=	1	0	1	1
@0F@	=	0	0	0	0

**Table E-1. Standard BASIC Character Set (ASCII)**

Ordinal Position	Hex Code	Graphic	ORD Mnemonic	Name
0	00		NUL	Null
1	01		SOH	Start of heading
2	02		STX	Start of text
3	03		ETX	End of text
4	04		EOT	End of transmission
5	05		ENQ	Enquiry
6	06		ACK	Acknowledge
7	07		BEL	Bell
8	08		BS	Backspace
9	09		HT	Horizontal tab
10	0A		LF	Line feed
11	0B		VT	Vertical tab
12	0C		FF	Form Feed
13	0D		CR	Carriage Return
14	0E		SO	Shift Out
15	0F		SI	Shift In
16	10		DLE	Data link escape
17	11		DC1	Device control 1
18	12		DC2	Device control 2
19	13		DC3	Device control 3
20	14		DC4	Device control 4
21	15		NAK	Negative Acknowledge
22	16		SYN	Synchronous idle
23	17		ETB	End of transmission block
24	18		CAN	Cancel
25	19		EM	End of medium

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Table E-1. Standard BASIC Character Set (Cont) (ASCII)

Ordinal Position	Hex Code	Graphic	ORD Mnemonic	Name
26	1A		SUB	Substitute
27	1B		ESC	Escape
28	1C		FS	File separator
29	1D		GS	Group separator
30	1E		RS	Record separator
31	1F		US	Unit separator
32	20		SP	Space
33	21	!		Exclamation mark
34	22	"		Quotation mark
35	23	#		Number sign
36	24	\$		Dollar sign
37	25	%		Percent sign
38	26	&		Ampersand
39	27	'		Apostrophe
40	28	(		Left parenthesis
41	29	)		Right parenthesis
42	2A	*		Asterisk
43	2B	+		Plus sign
44	2C	,		Comma
45	2D	-		Minus sign, hyphen
46	2E	.		Full stop, period, or decimal point
47	2F	/		Solidus
48	30	0		Zero
49	31	1		One
50	32	2		Two
51	33	3		Three
52	34	4		Four
53	35	5		Five
54	36	6		Six
55	37	7		Seven
56	38	8		Eight
57	39	9		Nine
58	3A	:		Colon
59	3B	;		Semicolon
60	3C	<		Less than sign
61	3D	=		Equals sign
62	3E	>		Greater than sign
63	3F	?		Question mark
64	40	@		At sign
65	41	A		Upper-case A
66	42	B		Upper-case B
67	43	C		Upper-case C
68	44	D		Upper-case D
69	45	E		Upper-case E
70	46	F		Upper-case F
71	47	G		Upper-case G
72	48	H		Upper-case H
73	49	I		Upper-case I
74	4A	J		Upper-case J

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**Table E-1. Standard BASIC Character Set (Cont) (ASCII)**

Ordinal Position	Hex Code	Graphic	ORD Mnemonic	Name
75	4B	K		Upper-case K
76	4C	L		Upper-case L
77	4D	M		Upper-case M
78	4E	N		Upper-case N
79	4F	O		Upper-case O
80	50	P		Upper-case P
81	51	Q		Upper-case Q
82	52	R		Upper-case R
83	53	S		Upper-case S
84	54	T		Upper-case T
85	55	U		Upper-case U
86	56	V		Upper-case V
87	57	W		Upper-case W
88	58	X		Upper-case X
89	59	Y		Upper-case Y
90	5A	Z		Upper-case Z
91	5B	[		Left bracket
92	5C	\		Reverse solidus
93	5D	]		Right bracket
94	5E	^		Circumflex accent
95	5F	_	UND	Underline
96	60	`	GRA	Grave accent
97	61	a	LCA	Lower-case a
98	62	b	LCB	Lower-case b
99	63	c	LCC	Lower-case c
100	64	d	LCD	Lower-case d
101	65	e	LCE	Lower-case e
102	66	f	LCF	Lower-case f
103	67	g	LCG	Lower-case g
104	68	h	LCH	Lower-case h
105	69	i	LCI	Lower-case i
106	6A	j	LCJ	Lower-case j
107	6B	k	LCK	Lower-case k
108	6C	l	LCL	Lower-case l
109	6D	m	LCM	Lower-case m
110	6E	n	LCN	Lower-case n
111	6F	o	LCO	Lower-case o
112	70	p	LCP	Lower-case p
113	71	q	LCQ	Lower-case q
114	72	r	LCR	Lower-case r
115	73	s	LCS	Lower-case s
116	74	t	LCT	Lower-case t
117	75	u	LCU	Lower-case u
118	76	v	LCV	Lower-case v
119	77	w	LCW	Lower-case w
120	78	x	LCX	Lower-case x
121	79	y	LCY	Lower-case y
122	7A	z	LCZ	Lower-case z
123	7B	{	LBR	Left brace

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**Table E-1. Standard BASIC Character Set (Cont) (ASCII)**

Ordinal Position	Hex Code	Graphic	ORD Mnemonic	Name
124	7C		VLN	Vertical line
125	7D	}	RBR	Right brace
126	7E	~	TIL	Tilde
127	7F		DEL	Delete

**Table E-2. Native BASIC Character Set (EBCDIC)**

Ordinal Position	Hex Code	Graphic	ORD Mnemonic	Name
0	00		NUL	Null
1	01		SOH	Start of heading
2	02		STX	Start of text
3	03		ETX	End of text
4	04			
5	05		HT	Horizontal tab
6	06			
7	07		DEL	Delete
8	08			
9	09			
10	0A			
11	0B		VT	Vertical tab
12	0C		FF	Form feed
13	0D		CR	Carriage return
14	0E		SO	Shift out
15	0F		SI	Shift in
16	10		DLE	Data link escape
17	11		DC1	Device control 1
18	12		DC2	Device control 2
19	13		DC3	Device control 3
20	14			
21	15		NL	New line
22	16		BS	Backspace
23	17			
24	18		CAN	Cancel
25	19		EM	End of medium
26	1A			
27	1B			
28	1C		FS	File separator
29	1D		GS	Group separator
30	1E		RS	Record separator
31	1F		US	Unit separator
32	20			
33	21			



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**Table E-2. Native BASIC Character Set (Cont) (EBCDIC)**

Ordinal Position	Hex Code	Graphic	ORD Mnemonic	Name
34	22			
35	23			
36	24			
37	25		LF	Line feed
38	26		ETB	End of transmission block
39	27		ESC	Escape
40	28			
41	29			
42	2A			
43	2B			
44	2C			
45	2D		ENQ	Enquiry
46	2E		ACK	Acknowledge
47	2F		BEL	Bell
48	30			
49	31			
50	32		SYN	Synchronous idle
51	33			
52	34			
53	35			
54	36			
55	37		EOT	End of transmission
56	38			
57	39			
58	3A			
59	3B			
60	3C		DC4	Device control 4
61	3D		NAK	Negative acknowledge
62	3E			
63	3F			
64	40		SP	Space
65	41			
66	42			
67	43			
68	44			
69	45			
70	46			
71	47			
72	48			
73	49			
74	4A	[		Left bracket
75	4B	.		Full stop, period, decimal point
76	4C	<		Less than sign
77	4D	(		Left parenthesis
78	4E	+		Plus sign
79	4F		VLN	Vertical line
80	50	&		Ampersand
81	51			

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Table E-2. Native BASIC Character Set (Cont) (EBCDIC)

Ordinal Position	Hex Code	Graphic	ORD Mnemonic	Name
82	52			
83	53			
84	54			
85	55			
86	56			
87	57			
88	58			
89	59			
90	5A	]		Right bracket
91	5B	\$		Dollar sign
92	5C	*		Asterisk
93	5D	)		Right parenthesis
94	5E	;		Semicolon
95	5F	^		Circumflex accent
96	60	-		Minus sign, hyphen
97	61	/		Solidus
98	62			
99	63			
100	64			
101	65			
102	66			
103	67			
104	68			
105	69			
106	6A			
107	6B	,		Comma
108	6C	%		Percent sign
109	6D	—	UND	Underline
110	6E	>		Greater than sign
111	6F	?		Question mark
112	70	!		Exclamation mark
113	71			
114	72			
115	73			
116	74			
117	75			
118	76			
119	77			
120	78			
121	79			
122	7A	:		Colon
123	7B	#		Number sign
124	7C	@		At sign
125	7D	'		Apostrophe
126	7E	=		Equals sign
127	7F	“		Quotation mark
128	80			
129	81	a	LCA	Lower-case a

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Table E-2. Native BASIC Character Set (Cont) (EBCDIC)

Ordinal Position	Hex Code	Graphic	ORD Mnemonic	Name
130	82	b	LCB	Lower-case b
131	83	c	LCC	Lower-case c
132	84	d	LCD	Lower-case d
133	85	e	LCE	Lower-case e
134	86	f	LCF	Lower-case f
135	87	g	LCG	Lower-case g
136	88	h	LCH	Lower-case h
137	89	i	LCI	Lower-case i
138	8A			
139	8B			
140	8C			
141	8D			
142	8E			
143	8F			
144	90			
145	91	j	LCJ	Lower-case j
146	92	k	LCK	Lower-case k
147	93	l	LCL	Lower-case l
148	94	m	LCM	Lower-case m
149	95	n	LCN	Lower-case n
150	96	o	LCO	Lower-case o
151	97	p	LCP	Lower-case p
152	98	q	LCQ	Lower-case q
153	99	r	LCR	Lower-case r
154	9A			
155	9B			
156	9C			
157	9D			
158	9E			
159	9F			
160	A0			
161	A1	~	TIL	Tilde
162	A2	s	LCS	Lower-case s
163	A3	t	LCT	Lower-case t
164	A4	u	LCU	Lower-case u
165	A5	v	LCV	Lower-case v
166	A6	w	LCW	Lower-case w
167	A7	x	LCX	Lower-case x
168	A8	y	LCY	Lower-case y
169	A9	z	LCZ	Lower-case z
170	AA			
171	AB			
172	AC			
173	AD			
174	AE			
175	AF			
176	B0			
177	B1			

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**Table E-2. Native BASIC Character Set (Cont) (EBCDIC)**

Ordinal Position	Hex Code	Graphic	ORD Mnemonic	Name
178	B2			
179	B3			
180	B4			
181	B5			
182	B6			
183	B7			
184	B8			
185	B9			
186	BA			
187	BB			
188	BC			
189	BD			
190	BE			
191	BF			
192	C0	{	LBR	Left brace
193	C1	A		Upper-case A
194	C2	B		Upper-case B
195	C3	C		Upper-case C
196	C4	D		Upper-case D
197	C5	E		Upper-case E
198	C6	F		Upper-case F
199	C7	G		Upper-case G
200	C8	H		Upper-case H
201	C9	I		Upper-case I
202	CA			
203	CB			
204	CC			
205	CD			
206	CE			
207	CF			
208	D0	}	RBR	Right brace
209	D1	J		Upper-case J
210	D2	K		Upper-case K
211	D3	L		Upper-case L
212	D4	M		Upper-case M
213	D5	N		Upper-case N
214	D6	O		Upper-case O
215	D7	P		Upper-case P
216	D8	Q		Upper-case Q
217	D9	R		Upper-case R
218	DA			
219	DB			
220	DC			
221	DD			
222	DE			
223	DF			
224	E0	↖		Reverse solidus
225	E1			

B 1000 Systems Interactive BASIC (IBASIC) Reference Manual  
Character Sets

**Table E-2. Native BASIC Character Set (Cont) (EBCDIC)**

Ordinal Position	Hex Code	Graphic	ORD Mnemonic	Name
226	E2	S		Upper-case S
227	E3	T		Upper-case T
228	E4	U		Upper-case U
229	E5	V		Upper-case V
230	E6	W		Upper-case W
231	E7	X		Upper-case X
232	E8	Y		Upper-case Y
233	E9	Z		Upper-case Z
234	EA			
235	EB			
236	EC			
237	ED			
238	EE			
239	EF			
240	F0	0		Zero
241	F1	1		One
242	F2	2		Two
243	F3	3		Three
244	F4	4		Four
245	F5	5		Five
246	F6	6		Six
247	F7	7		Seven
248	F8	8		Eight
249	F9	9		Nine
250	FA			
251	FB			
252	FC			
253	FD			
254	FE			
255	FF			

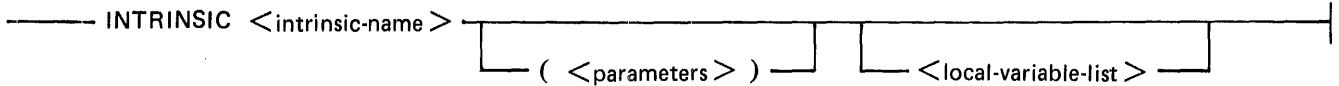
## APPENDIX F EXTENSIONS TO BASIC

The following extensions to the ANSI language are recognized only when IBASIC is executed with SW=WW. The intent of these extensions is to enable the writing of external intrinsic functions and subprograms in BASIC. A side effect of this extension is that while IBASIC is being executed with SW=WW, the intrinsic file it is using is inaccessible to any other copy of IBASIC. Therefore, it is desirable to have a separate copy of the intrinsic file (not the system's copy) when it is desired to run in this mode. This is done by executing with FI INTRINSICS NAM <your own name>. By default, IBASIC calls the runner program named \*IBASIC/RUNNER. If it is desired to call some other runner program, IBASIC must be invoked with SW=WW and FI WORKFILE NAM <your-own-runner-name>.

### INTRINSIC STATEMENT

The INTRINSIC statement is used to identify an intrinsic.

Syntax:



G18174

Semantics:

The INTRINSIC statement must be the first statement of an intrinsic function. The <intrinsic-name> must match an entry in the intrinsic function table in the compiler and the <parameters> must match, in type and number, the parameters of this entry. The <local-variable-list> may be any valid BASIC simple variable (up to seven variables). The statements that follow may only reference those names that are either in the <parameters> or in the <local-variable-list> (enforced at COMPILE or RUN time). If the intrinsic being defined is run, it supercedes the intrinsic in the intrinsic file. The external intrinsic file is only changed after a COMPILE INTRINSICS command is executed. While the local intrinsic is being executed, the <parameters> and the <local-variable-list> are global. The compilation process and ensuing intrinsic call process "localize" the references.

The parameters may be arrays which are passed by reference. Array parameters are only allowed if the intrinsic requires them and are denoted by appending a left parenthesis "(" to the array name which is passed. Within the intrinsic, the array may be referenced with one or two subscripts (with obviously bad results if a 2-dimensional array is accessed with one subscript, and vice versa). The special function NDIM should be used to ensure correct usage. Refer to Special Functions in this section.

Within the intrinsic definition the following statements are invalid:

Array references (unless they are passed as parameters)

CHAIN	END	MAT	STOP
CLOSE	FNEND	OPTION	SUB
DATA	INPUT	READ	SUBEND
DEF (and any FN references)	LINPUT	RESTORE	SUBEXIT
DIM	MARGIN	SCRATCH	

Example of an INTRINSIC statement:

```
INTRINSIC SIN (A) X,Y,Z
```



## MSV(X)

Returns the number of elements that were originally defined for array X, whether the array was explicitly or implicitly dimensioned. Dynamic redimensioning does not change this value.

## MXI

Returns the maximum integer that the current numeric representation may hold precisely.

## RDUC(X)

Returns the value of X, such that  $.5 \leq X < 1$ , as if X were divided or multiplied by 2 repetitively until X is in that range.

## XPND(X,Y)

Returns the value of X as if multiplied by  $2^{**Y}$ .

## XPON(X)

Returns the power to which the value 2 must be raised so that  $X/2^{**XPON(X)}$  results in  $.5 \leq X < 1$ .

## XTIM

Returns the current cpu time usage of IBASIC in tenths of a second.

## SPECIAL VARIABLE NAMES

The following special variables can be used when the extensions are enabled.

### DET

When used as a destination in an assignment statement, DET assigns a value to the function DET (no parameters).

### RAN1, RAN2, AND RAN3

May be used as sources or destinations. These variables are initialized to particular values at the beginning of any particular RUN of a program and are intended for use by the RND intrinsic function.

## COMPILE COMMAND

The COMPILE command compiles intrinsics.

Syntax:

————— COMPILE ————— INTRINSICS —————

G18178

Semantics:

The COMPILE command is used to convert the locally defined intrinsic function to a form which can be put into the external intrinsic file. This code is then written to the intrinsic file, overwriting whatever code may already have been compiled for the function or functions being defined locally. The local definition of the function is used until the local definition is deleted from the workfile. If a syntax error exists in the workfile, nothing is written to the external file, and Command mode invocations of the intrinsic function yield an "invalid op code" run-time error message.



## EXTERNAL INTRINSICS

The following intrinsic functions are defined as external intrinsics and are maintained in a 'compiled' form in the intrinsics file:

ACOS  
ASIN  
ATN  
ATN2  
COS  
COSH  
COT  
CSC  
EXP  
LOG  
LOG10  
LOG2  
RND  
SEC  
SIN  
SINH  
SQR  
TAN  
TANH

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