MATRIX OPERATIONS

Name	Examples	Description
DIM	10 DIM A[20,30],B[10,5]	Reserves space for a matrix of the specified physical dimensions. Initially, the working size is the same as the physical size for a matrix, as specified in the DIM statement.
REDIM	20 REDIM A[10,15]	Specifies a new working size for a matrix. The working size must not be greater than the physical size.
MAT READ	30 MAT READ A 31 MAT READ X,Y[5,5]	Reads an entire matrix from DATA statements. The matrix is filled in conventional row-column order. More than one matrix can be included in a MAT READ statement, and a new working size can be specified.
MAT PRINT	40 MAT PRINT A 41 MAT PRINT X,Y;Z;	Prints an entire matrix row by row, with spacing of the columns controlled by the use of the comma and the semicolon. More than one matrix can appear in a MAT PRINT statement.
MAT +	50 MAT C=A+B 51 MAT X=X+Y	Matrix addition. The same matrix can appear on both sides of the equals sign.
MAT -	60 MAT C=A-B 61 MAT X=X-Y	Matrix subtraction. The same matrix can appear on both sides of the equals sign.
MAT =	70 MAT A=B	Copies values of Matrix B into Matrix A.
SCALAR *	80 MAT A=(1/5)*B 81 MAT B=(2*PI)*B	Each element in Matrix B is multiplied by the scalar value (expression in parentheses). The same matrix can appear on both sides of the equals sign.
MAT *	90 MAT A=B*C	Matrix multiplication. If the dimensions of A = (P,N) and B = (N,Q), the resulting matrix has dimensions (P,Q). The same matrix cannot appear on both sides of the equals sign.
MAT TRN	100 MAT A=TRN(B)	Transposes a matrix. If the dimensions of B = (P,N), the resulting matrix has dimensions (N,P). The same matrix cannot appear on both sides of the equals sign.
MAT CON	110 MAT A=CON 111 MAT B=CON[10,15]	Sets all elements of the matrix equal to 1. A new working size can be specified.
MAT ZER	120 MAT B=ZER 121 MAT X=ZER[5,5]	Sets all elements of the matrix equal to 0. A new working size can be specified.
MAT IDN	130 MAT C=IDN 131 MAT X=IDN[4,4]	Establishes an identity matrix - a square matrix containing all zeros with a principal diagonal of ones.
MAT INV	140 MAT A=INV(B) 141 MAT X=INV(X)	Inverts a square matrix. A matrix can be inverted into itself.
DET	150 IF DET (A)=0 THEN 80 151 X=DET(A)+DET(B)	Returns the value of the determinant of a square matrix to an expression.

STRINGS

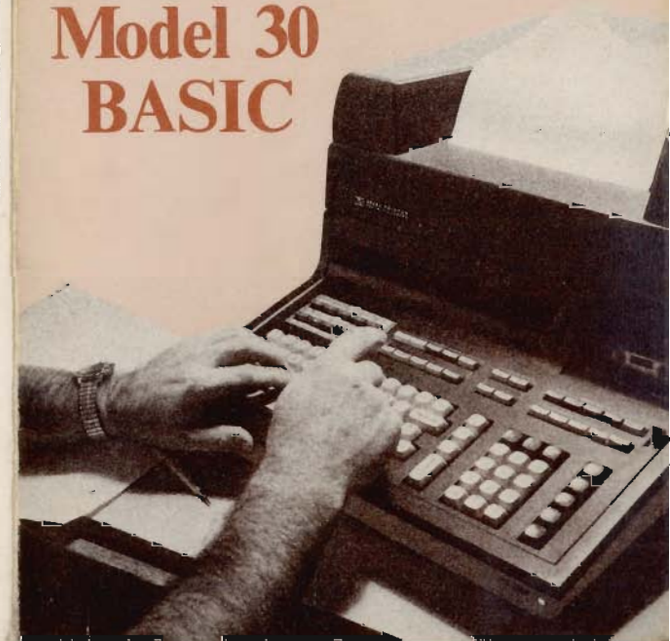
NOTES:

1. *A string is 1 to 255 characters enclosed in quotes; it may be assigned to a string variable (any letter A to Z followed by a $).*
2. *Each string variable used in a program must be dimensioned (with a DIM statement) if it has a length of more than one character.*
3. *Substrings are described by subscripted string variables. For example, if A$="ABCDEF," A$(2,2)=B, and A$(1,4)="ABCD."*

Name	Examples	Description
DIM	10 DIM A$(236),B$(27)	Declares maximum string length in characters.
LET	20 LET A$="***ANNUAL PERCENTAGE" 30 B$="PROPOSED CHANGE"	Assigns the character string in quotes to a string variable.
=	105 IF A$=C$ THEN 600	String operators. They allow comparison of strings, and substrings, and transfer to a specified statement. Comparison is made in ASCII codes, character by character, left to right until a difference is found. If the strings are of unequal length, the shorter string is considered smaller if it is identical to the initial substring of the longer.
#	110 IF B$#X$(5,9) THEN 650	
>	115 IF N$(2,2)>B$(3,3) THEN 10	
<	120 IF N$<B$ THEN 999	
>=	125 IF P$ >=Y$ THEN 10	
<=	130 IF X$<=Z$ THEN 999	
INPUT	205 INPUT N$	Accepts characters from the keyboard during program execution. The characters need not be in quotation marks if only one string is input.
INPUT	210 INPUT N$,X$,Y$	Inputs the specified strings; input must be in quotes and separated by commas.
READ	215 READ P$	Reads a string from a DATA statement; each string read must be enclosed in quotes.
LEN	250 PRINT LEN(B$)	Gives the current length of the specified string.
POS	260 PRINT POS(A$,"STOP")	Gives the position of the specified character group within a string.
	270 PRINT POS(A$,B$)	A string or substring within a string can also be located.
VAL	280 PRINT VAL(A$)	Converts the digits in the specified string to a number. The first character in the string must be numeric.

HEWLETT hp PACKARD

Quick Reference To H-P Model 30 BASIC



TAPE CASSETTE OPERATION

NOTE: If the cassette select code is not specified, the internal cassette is assumed; for external cassettes, the # symbol and the select code are included in the commands, for example,

REWIND #5
STORE #4, 5, 100, 200

Name	Examples	Description
FIND	FIND3	Searches for the specified cassette file.
LINK	LINK8	Loads the entire program from the specified cassette file into the memory without erasing the current values of variables.
	LINK8,40	Renumbers the program lines from the cassette file, beginning with the specified line number, and then links the lines into memory.
	LINK8,40,80	Renumbers and links the program lines and then runs the program, continuing with the specified line number.
LOAD	LOAD5	Loads the entire program from the specified cassette file into memory.
	LOAD5,100	Renumbers the program lines from the cassette file, beginning with the specified line number, and loads the lines into memory.
	LOAD5,100,200	Renumbers and loads the program lines and then runs the program, beginning with the specified line number.
LOAD BIN	LOADBIN3	Loads a special language program from the specified cassette file into memory.
LOAD DATA	LOADDATA2	Loads data from the specified cassette file into the variables defined by the COM statement.
	LOADDATA2,A	Loads data from the cassette file into the specified array.
LOAD KEY	LOADKEY5	Loads definitions of all 20 Special Function keys from the specified file into memory.
MARK	MARKX,Y	Marks the number of files specified by X, each having the length in words specified by Y.
MERGE	MERGE8	Combines the program lines from the specified cassette file with the lines currently in memory.
	MERGE8,100	Renumbers the program lines from the cassette file, beginning with the specified line number, and then merges the lines in memory.
	MERGE8,100,80	Renumbers and merges the program lines and then runs the program, beginning with the specified line number.
REWIND	REWIND	Rewinds the cassette tape.
SECURE	SEC	Secures the entire program contained in memory.
	SEC40	Secures all lines after and including specified line.
	SEC40,80	Secures lines between and including the specified lines.
STORE	STORE5	Stores the entire program on the specified cassette file.
	STORE5,100	Stores all lines after and including the specified line.
	STORE5,100,200	Stores lines between and including the specified lines.
STORE DATA	STOREDATA2	Stores data for variables defined by the COM statement on the specified cassette file.
	STOREDATA2,A	Stores data contained in the specified array on the cassette file.
STORE KEY	STOREKEY5	Stores definitions of Special Function keys on the specified cassette file.
TLIST	TLIST	Prints information about the size and content of files stored on the cassette tape.

The assumed headers of the columns in a TLIST:

File Number	*File Type Code*	*Absolute File Size (in words)*	*Current File Size (in words)*	*Program Line Numbers (First)*	*(Last)*	*Common Area (in words)*

FUNCTIONS

Name	Examples	Description
ABS(X)	310 PRINT ABS(X)	Gives the absolute value of the expression (X).
ATN(X)	320 PRINT ATN(X)	Gives the arctangent of the expression (X).
COS(X)	330 PRINT COS(X)	Gives the cosine of the expression (X).
EXP(X)	340 PRINT EXP(X)	Gives the constant e raised to the power of the expression value (X); in this example, e ↑ X.
INT(X)	350 PRINT INT(X)	Gives the largest integer ≤ the expression (X).
LGT(X)	360 PRINT LGT(X)	Gives the base ten logarithm of an expression; expression must have a positive value.
LOG(X)	370 PRINT LOG(X)	Gives the natural logarithm of an expression; expression must have a positive value.
RND(X)	380 PRINT RND(X)	Generates a random number between 0 and 1; if the expression (X) is negative, it is used as a "seed."
SGN(X)	390 PRINT SGN(X)	Gives: 1 if X > 0, 0 if X = 0, -1 if X < 0.
SIN(X)	400 PRINT SIN(X)	Gives the sine of the expression (X).
SQR(X)	410 PRINT SQR(X)	Gives the square root of the expression (X); expression must have a positive value.
TAB(X)	420 PRINT TAB(X);A	Tabs to the specified position (X), then prints specified value (A).
TAN(X)	430 PRINT TAN(X)	Gives the tangent of the expression (X).
PI	440 PRINT PI	Gives the value of PI, accurate to 12 significant digits.
RESULT	450 PRINT RES	Gives the result previously displayed.

OPERATORS

Name	Examples	Description
=	100 A=B=C=0	Assignment operator; assigns a value to a variable.
	110 LET A=0	May also be used with LET.
↑	120 PRINT X ↑2	Exponentiate (as in X^2).
*	130 C5=A*B	Multiply
/	140 PRINT T5/4	Divide
+	150 P=R1+10	Add
-	160 X3=R3-P	Subtract

NOTE: The numeric values used in logical evaluation are: "true" = any nonzero number; "false" = 0.

=	170 IF D=E THEN 600	Expression "equals" expression.
#	180 IF D6#D↑2 THEN 710	Expression "does not equal" expression.
< >	190 IF D6< >R8 THEN 700	Expression "does not equal" expression.
>	200 IF X>10 THEN 620	Expression "is greater than" expression.
<	210 IF R8<P7 THEN 640	Expression "is less than" expression.
> =	220 IF R8>= P7 THEN 710	Expression "is greater than or equal to" expression.
< =	230 IF X2 <= 10 THEN 650	Expression "is less than or equal to" expression.
AND	240 IF G2 and H5 THEN 900	Expression 1 AND expression 2 must both be "true" for the statement to be "true."
OR	250 IF G2 OR H5 THEN 910	If either expression 1 OR expression 2 is "true," the statement is "true."
NOT	260 IF NOT G5 THEN 950	Statement is "true" when the expression (G5) is "false."

MATRIX OPERATIONS

Name	Examples	Description
DIM	10 DIM A[20,30],B[10,5]	Reserves space for a matrix o specified physical dimensions. tially, the working size is the as the physical size for a matri specified in the DIM statement.
REDIM	20 REDIM A[10,15]	Specifies a new working size matrix. The working size mus be greater than the physical siz
MAT READ	30 MAT READ A 31 MAT READ X,Y[5,5]	Reads an entire matrix from D statements. The matrix is fill conventional row-column More than one matrix can b cluded in a MAT READ stater and a new working size ca specified.
MAT PRINT	40 MAT PRINT A 41 MAT PRINT X,Y;Z;	Prints an entire matrix row by with spacing of the columns trolled by the use of the co and the semicolon. More than matrix can appear in a MAT PI statement.
MAT +	50 MAT C=A+B 51 MAT X=X+Y	Matrix addition. The same m can appear on both sides o equals sign.
MAT -	60 MAT C=A-B 61 MAT X=X-Y	Matrix subtraction. The matrix can appear on both sid the equals sign.
MAT =	70 MAT A=B	Copies values of Matrix B Matrix A.
SCALAR *	80 MAT A=(1/5)*B 81 MAT B=(2*PI)*B	Each element in Matrix B is plied by the scalar value (expr in parentheses). The same m can appear on both sides o equals sign.
MAT *	90 MAT A=B*C	Matrix multiplication. If the d sions of A = (P,N) and B = (the resulting matrix has dimen (P,Q). The same matrix c appear on both sides of the e sign.
MAT TRN	100 MAT A=TRN(B)	Transposes a matrix. If the d sions of B = (P,N), the res matrix has dimensions (N,P). same matrix cannot appear on sides of the equals sign.
MAT CON	110 MAT A=CON 111 MAT B=CON[10,15]	Sets all elements of the m equal to 1. A new working siz be specified.
MAT ZER	120 MAT B=ZER 121 MAT X=ZER[5,5]	Sets all elements of the m equal to 0. A new working siz be specified.
MAT IDN	130 MAT C=IDN 131 MAT X=IDN[4,4]	Establishes an identity mat square matrix containing all with a principal diagonal of on
MAT INV	140 MAT A=INV(B) 141 MAT X=INV(X)	Inverts a square matrix. A m can be inverted into itself.
DET	150 IF DET (A)=0 THEN 80 151 X=DET(A)+DET(B)	Returns the value of the minant of a square matrix expression.

STATEMENTS

Name	Examples	Description
COM	1 COM A,B(50,2),XI(5)	Reserves common storage space for the specified variables and arrays. The COM statement must be the first statement entered in the memory, and cannot be changed after it is entered.
		Split or integer precision may be specified.
DATA	360 DATA 99,10.7,1.2	Provides values for variables named in a READ statement.
DEF	300 DEF FNA(X)=M*X+B	Allows the programmer to define functions; the function label (A) must be a letter from A to Z.
	305 DEF FNB(X) 306 Z=X12+2*X+1 307 Q=SQRZ 308 RETURN Q	Multiple-line functions use the DEF FN and the RETURN statements as boundaries; the RETURN statement must contain a variable or expression (e.g., 308 RETURN Q).
DEG	325 DEG	Causes angles to be expressed in degrees.
DIM	310 DIM A(72),B(2,5)	Reserves space for the specified arrays.
	311 DIM CS(5,5),DI(100)	Split or integer precision may be specified.
DISP	315 DISP 1, "X=";X	Displays the specified expressions.
END	500 END	Terminates the program.
FIXED	354 FIXED 5	Causes numeric values to be expressed with the specified number of decimal places.
FLOAT	415 FLOAT 8	Causes numeric values to be expressed in E-notation with the specified number of decimal places.
FOR ... NEXT	440 FOR J=X TO Y STEP Z . . . . . . 455 NEXT J	Executes statements between FOR and NEXT the specified number of times (a loop), incrementing the variable by a STEP number (or by 1 if STEP is not given).
FORMAT	420 FORMAT F10.2 421 FORMAT E12.8,B	Specifies the output format for the variables in a WRITE statement.
		E w.d indicates E-notation, and specifies the field width and decimal places to be output.
		F w.d indicates fixed-point format, and specifies the field width and decimal places to be output.
		B indicates binary format and is used to output symbols that are otherwise not obtainable.
		The X, the slash (/), and quote fields can also be used in FORMAT specifications.
GO TO	330 GOTO 900	Transfers program execution to the specified line number.
GO TO ... OF	412 GOTO N OF 90,40,60	Transfers program execution to the Nth line number listed after OF. In this example, if N is 2, the program continues at line 40.
GOSUB	420 GOSUB 800	Begins subroutine execution at the specified line number and continues until a RETURN statement is executed.
GOSUB	425 GOSUB N OF 800,900	Transfers to the subroutine located at the Nth of the line numbers listed after OF. In this example, if N is 2, the subroutine at line 900 is executed.
GRAD	505 GRAD	Causes angles to be expressed in grads.
IF ... THEN	340 IF A#10 THEN 370	Logical test of specified condition; transfers control if "true."
INPUT	390 INPUT X,Y2,A(5,1)	Permits the values of the specified variables to be entered through the keyboard while a program is running.
LET	300 LET X=50	Assigns a value to a variable.
LET (implied)	310 A=B1=0	LET is optional.
NEXT	455 NEXT J	Marks the boundary of the FOR loop.
NORMAL	75 NORMAL	Cancels trace mode.
PRINT	356 PRINT A; "DEGREES" 357 PRINT C(5,5),PI	Prints the specified expressions. Commas, semicolons, and the TAB function can be used to control spacing.
	358 PRINT	Causes the printer to advance one line.
RAD	550 RAD	Causes angles to be expressed in radians.
READ	360 READ A,B,C	Reads the values for the specified variables from the DATA statement.
REM	10 REM COMPUTE X/Y	Inserts non-executable text in a program.
RESTORE	380 RESTORE	Permits re-reading the data without re-running the program.
	385 RESTORE 100	Re-reads data beginning with the specified statement.
RETURN	850 RETURN	Returns program control to the statement following GOSUB after subroutine execution.
	308 RETURN Q	When used with the DEF FN statement in defining multiple-line functions, returns the value of the expression to the function. (In this example the value of Q is returned.)
STANDARD	860 STANDARD	Causes numeric values to be expressed in standard notation.
STOP	410 STOP	Terminates the program; may be used anywhere in a program.
TRACE	25 TRACE	Prints all program line numbers as they are executed.
WAIT	415 WAIT 1000	Causes the calculator to wait the specified number of milliseconds before executing the next statement. WAIT 1000 causes a one-second wait; the maximum WAIT is 32.767 seconds, or WAIT 32767.
WRITE	430 WRITE (15,*)A,"LBS"	Outputs the specified expressions to the device with the indicated select code. (In this example, the select code is 15.)
	440 WRITE (15,420)A,B,C	A FORMAT statement can be referenced, for control of output format. (In this example, the FORMAT statement is at line 420.)

SPECIAL KEYS

CLEAR — Clears the display.

DELETE LINE — Deletes the program line which is currently displayed.

END — Terminates key mode or program execution.

STOP — Stops execution of a program or a command.

INIT — Initializes or allocates storage space in memory for array variables.

PRT ALL — Causes all messages and commands which are normally displayed to be printed.

RECALL — Displays the last command executed.

STEP — Executes the next program line, and stops.

BACK FORWARD INSERT — These keys are used together to change the line currently in the display.

END OF LINE — Stores the program line in memory.

DISPLAY ↓ ↑ ← → — These keys are used together to view the program lines in memory.

TRACE NORMAL — These keys are used together during program execution. TRACE causes all program line numbers to be printed as they are executed; NORMAL cancels trace mode.

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Printed in U.S.A. 5-73

Part No. 09830-90012

Quick Reference To H-P Model 30 BASIC

The BASIC Programming Information on this card serves as a handy reference for users of the Hewlett-Packard 9830A Calculator. Use it as a pocket reference or keep it in a place near your calculator.

TURN-ON

The 9830 is ready to use when the power is turned ON. This means that all operations available can be executed with no further start-up procedure required.

MEMORY SIZE

The total available READ/WRITE memory in the basic calculator is 1760 (16-bit, 2-byte) words. If your calculator has additional memory, consult your 9830A Operating and Programming Manual for the actual READ/WRITE memory available.

To determine the number of words used by a program, subtract the remaining memory from the total memory. (The number of words remaining in memory is displayed when the LIST 9999 command is executed.)

RANGE

The calculating range of the Model 30 is $-9.99999999999 \times 10^{99}$ through -1×10^{-99}, 0, and 1×10^{-99} through $9.99999999999 \times 10^{99}$.

PRECISION

Generally, four words of memory are allocated per data element for full-precision (12-digit) accuracy. Although all calculations are performed with full-precision, split-precision or integer-precision accuracy can be used when it is necessary to conserve memory storage.

Precision	Words Used Per Data Element	Accuracy	Range	Indicator In DIM or COM Statement
FULL	4	12 digits	± 9.99999999999E ± 99	None
SPLIT	2	6 digits	± 9.99999E ± 63	S
INTEGER	1	integer	± 32767	I

LINE LENGTH

Even though only 32 characters can be displayed at any one time, up to 80 characters can be keyed in. After the 72nd character is keyed in, a soft beep informs the user that only eight more characters can be keyed in.

ERROR CODES

When an error occurs, the calculator makes a soft beeping sound and an error code appears on the display. The error codes are listed on a slide-out card underneath the Model 30.

MAINTENANCE

The tape head should be cleaned after every eight hours of cassette operations. Also, the tape cassette transport door should be kept closed whenever possible to prevent accumulation of excess dust.

The fan filter on the rear panel of the calculator should normally be cleaned about every three months.

For more information about cleaning the tape head or the fan filter, consult your 9830A Operating and Programming Manual.

ROMS

Each optional read-only-memory (ROM) is available either as an internal modification to the calculator or as a plug-in block. The plug-in ROM's are installed by the user behind the ROM door on the left side of the calculator. When the internal ROM's are installed, a decal showing the ROM option number is attached to the inside of the ROM door. Once they are installed, internal and plug-in ROM's operate identically.

COMMANDS

Name	Examples	Description
AUTO	AUTO	Automatically generates program line numbers beginning with line 10 and in increments of 10.
	AUTO5	Generates line numbers, beginning with the specified line number, and in increments of 10.
	AUTO5,15	Generates line numbers with the beginning line number and increment as specified.
CONT	CONT	Continues program execution without erasing the current values of variables.
	CONT40	Continues program execution from the specified line number.
DEL	DEL	Deletes the entire program.
	DEL40	Deletes all lines after and including the specified line number.
	DEL40,80	Deletes all lines between and including the specified lines.
FETCH	FETCH	Places the first line of memory in the display.
	FETCH40	Places the specified line of memory in the display.
LIST	LIST	Produces a listing of the entire program.
	LIST40	Lists program lines after and including the specified line number.
	LIST40,80	Lists program lines between and including the specified lines.
	LIST9999	Displays the remaining words of user read/write memory.
NORMAL	NORMAL	Cancels trace mode.
PTAPE	PTA7	Reads a program into memory from the paper tape reader with the specified select code.
RENUMBER	REN	Renumbers all program lines, beginning with line 10 and in increments of 10.
	REN5	Renumbers all program lines, beginning with the specified line number and in increments of 10.
	REN5,15	Renumbers all program lines with the beginning line number and increment as specified.
RUN	RUN	Runs the program currently in memory.
	RUN100	Runs the program, beginning at the specified line number.
SCRATCH	SCRATCH	Erases the program lines and the variables from memory.
	SCRATCHA	Identical to turning the calculator OFF, then ON again. Erases program lines, variables and Special Function key definitions from memory.
	SCRATCHK	Erases Special Function key definitions.
	SCRATCHV	Erases variables from memory.
TRACE	TRACE	Prints all program line numbers as they are executed.
	TRACE100	Traces all lines with the line numbers greater than or equal to the specified line number.
	TRACE100,200	Traces all lines with line numbers between and including the specified line numbers.
STOP	STOP100	Stops the program at the specified line number.
	STOP100,200	Stops the program when either of the specified lines is encountered.

STATEMENTS

Name	Examples	Description
COM	1 COM A,B(50,2),XI(5)	Reserves common storage space for the specified variables and arrays. The COM statement must be the first statement entered in the memory, and cannot be changed after it is entered.
		Split or integer precision may be specified.
DATA	360 DATA 99,10.7,1.2	Provides values for variables named in a READ statement.
DEF	300 DEF FNA(X)=M*X+B	Allows the programmer to define functions; the function label (A) must be a letter from A to Z.
	305 DEF FNB(X) 306 Z=X↑2+2*X+1 307 Q=SQR(Z 308 RETURN Q	Multiple-line functions use the DEF FN and the RETURN statements as boundaries; the RETURN statement must contain a variable or expression (e.g., 308 RETURN Q).
DEG	325 DEG	Causes angles to be expressed in degrees.
DIM	310 DIM A(72),B(2,5)	Reserves space for the specified arrays.
	311 DIM C$(5,5),D%(100)	Split or integer precision may be specified.
DISP	315 DISP 1, "X=";X	Displays the specified expressions.
END	500 END	Terminates the program.
FIXED	354 FIXED 5	Causes numeric values to be expressed with the specified number of decimal places.
FLOAT	415 FLOAT 8	Causes numeric values to be expressed in E-notation with the specified number of decimal places.
FOR ... NEXT	440 FOR J=X TO Y STEP Z ... ... 455 NEXT J	Executes statements between FOR and NEXT the specified number of times (a loop), incrementing the variable by a STEP number (or by 1 if STEP is not given).
FORMAT	420 FORMAT F10.2 421 FORMAT E12.8,B	Specifies the output format for the variables in a WRITE statement.
		E w.d indicates E-notation, and specifies the field width and decimal places to be output.
		F w.d indicates fixed-point format, and specifies the field width and decimal places to be output.
		B indicates binary format and is used to output symbols that are otherwise not obtainable.
		The X, the slash (/), and quote fields can also be used in FORMAT specifications.
GO TO	330 GOTO 900	Transfers program execution to the specified line number.
GO TO ... OF	412 GOTO N OF 90,40,60	Transfers program execution to the Nth line number listed after OF. In this example, if N is 2, the program continues at line 40.
GOSUB	420 GOSUB 800	Begins subroutine execution at the specified line number and continues until a RETURN statement is executed.