

Burroughs Corporation



COMPUTER SYSTEMS GROUP  
SANTA BARBARA PLANT

P.S. 2228 3410

B1000 IBASIC S-LANGUAGE

## PRODUCT SPECIFICATION

REV LTR	REVISION ISSUE DATE	APPROVED BY	REVISIONS
C	2/8/82	<i>R. Stroh</i>	Changes for Mark 11.0 Release. 1-1 Rewrote "INTERACTIVE BASIC is..." paragraph. Updated "The compiler is..." paragraph.

*164 pages*

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**PRODUCT SPECIFICATION**

REV LTR	REVISION ISSUE DATE	APPROVED BY	REVISIONS
A	1/30/80	<i>J. Hale</i>	Original Issue - MARK 9.0 Release.
B	9/17/80	<i>J. Hale</i>	Changes for MARK 10.0 Release.
			3-1 Updated "Alphabetical Listing". 3-2 Updated "Listing By S-OP". 4-1 Updated "Formats" section. 5-1 Added "Error Message" S-OPS. 5-6 Updated "String Array Check and Calculate Subscripts" format. 5-15 Updated "String Move" format. 5-22 Updated "Real Move" format. 5-25 Added "Array Base Address" S-OPS. 5-26 Updated all formats from page 5-26 through 5-36. 5-37 Deleted "Maximum Subscript Value". 5-44 Added "Array Size" S-OPS. 5-45 Updated all formats from page 5-45 through 5-53. 5-54 Added "Host Name" S-OPS. 5-55 Updated all formats from page 5-55 through 5-58. 5-59 Added "Real Case" S-OPS. 5-60 Added "String Case" S-OPS. 5-61 Updated all formats from page 5-61 through 5-64. 5-66 Updated all formats from page 5-66 through 5-69. 5-74 Updated "Set Exception Branch" format. 5-76 Added "Inquire File Attribute" File Function. 5-77 Updated all formats from page 5-77 through 5-80. 5-86 Added "Allocate Array" File Function. 5-88 Updated "Print" format. 5-90 Updated "Input" format. 5-100 Updated "Matrix Transpose" format. 5-102 Updated "Call External Intrinsic Function" function. 5-104 Updated "Call User Defined Function" format.

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REV LTR	REVISION ISSUE DATE	APPROVED BY	REVISIONS
B			Changes for MARK 10.0 Release con't. 5-110 Added "SPI Monitor Start" Debug Function. 5-111 Added "SPI Monitor Stop" Debug Function. 5-112 Added "SPI Monitor Count" Debug Function. 5-119 Added "Intiate Edit Mode" Command Function. 5-120 Updated all formats from page 5-120 through 5-135. 5-136 Added "Initiate Sequence Mode" Command Function. 5-138 Updated all formats from page 5-138 through 5-143.

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### INTERPRETER-COMPILER COMMUNICATION

INTERACTIVE BASIC is a system of one program with two environment structure nuclei (ESN) to effect its compiling and executing requirements. For a complete description of environments as provided by the operating system, refer to the MCP II Product Specification (P.S. 2212 5462).

The compiler is an SDL-written program which (with its own SDL interpreter) performs all compilation functions, communications with the user at the terminal, user and compiler required file handling, bookkeeping, etc.. Additionally, once a BASIC program is ready to run, those operations which require high-speed execution (arithmetics, branching and subroutine transfers, loop control, etc. ), can be turned over to a microcoded interpreter. This interpreter is attached to another, "secondary" environment and the compiler transfers control to it via the "switch environment" communicate.

The compiler has compiled the BASIC program into its own base-limit data space. That is, the compiler has generated code strings and data space which represent the BASIC program. When control is transferred to the interpreter, the interpreter has access to the compiler's base-limit area. The interpreter can "EXECUTE" the BASIC program's code, perform the necessary operations on the BASIC program's data, and return control to the compiler, leaving any messages in the compiler's data space.

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## MEMORY

The interpreter has sufficient space to build a communicate message to the MCP (for 'PROGRAM EXIT' or 'STOP RUN'). Other than this small memory area, the interpreter accesses the compiler's run structure.

The compiler has three fundamental types of data, some of which the interpreter must have access to:

1. A scratchpad area. This is the "STATE" of the BASIC program. In other compilers (such as RPG or COBOL), when an interpreter must give up control, it leaves its "STATE" in the run structure nucleus. The BASIC interpreter must report its state to the compiler because the compiler, in its interactive functions, must know the status of the BASIC program being run. This information is stored in the compiler's static memory.
2. The compiler has bookkeeping information which it uses to control the interactive process itself, that is, to control compiling, running, etc.. The interpreter has no access to this data, which is distributed over the compiler's static and dynamic memory.
3. The BASIC program's code and data strings reside in paged arrays in the compiler's dynamic memory. The scratchpad area contains pointers to all of the BASIC program's structural entities (code, data, stacks, etc.).

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## INSTRUCTION SET

## ALPHABETICAL LISTING

S-OP ----	S-OP NUMBER -----
** ALLOCATE.ARRAY	(55)
BOS	(01)
** CHAIN	(54)
** COMMAND	(63)
CONCATENATE	(15)
COPY.NAME	(11)
CUT.BACK.CS.STACK	(12)
DEBUG.OPS	(62)
DEF	(42)
** EOC	(03)
EOS	(02)
** ERROR.MESSAGE	(00)
EXT.INTRIN.CALL	(60)
** FILE	(49)
FNEND	(43)
FOR	(40)
GO.TO	(32)
GOSUB	(34)
** INPUT	(58)
** LINPUT	(50)
LOAD.NAME	(10)
LOAD.VALUE	(08)
** MATRIX	(59)
NEXT	(41)
ON.GOSUB	(35)
ON.GOTO	(33)
** PRINT	(57)
RACACS	(04)
** RANDOMIZE	(56)
** READ	(51)
REAL.ADD	(16)
REAL.CASE	(24)
REAL.DIVIDE	(19)
REAL.IF	(37)
REAL.INTRINSIC	(22)
REAL.MOVE	(21)
REAL.MULTIPLY	(18)
REAL.NEGATE	(20)
REAL.SUBTRACT	(17)
** RESTORE.DATA	(52)
RETURN.FROM.GOSUB	(36)
RETURN.FROM.LL1	(48)

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	SACACS	(05)
	SET.FILE.INDEX	(09)
**	STOP.RUN	(53)
	STRING.CASE	(25)
	STRING.IF	(38)
	STRING.INTRINSIC	(23)
	STRING.MOVE	(14)
	SUBSTRING	(13)
	TRIM	(06)
	USER.FUNCTION.CALL	(61)
	XCH	(07)

\*\* Indicates S-OPS which are not interpreted by the microcode.

#### LISTING BY S-OP

**	00	ERROR.MESSAGE
	01	BOS
	02	EOS
**	03	EOC
	04	RACACS
	05	SACACS
	06	TRIM
	07	XCH
	08	LOAD.VALUE
	09	SET.FILE.INDEX
	10	LOAD.NAME
	11	COPY.NAME
	12	CUT.BACK.CS.STACK
	13	SUBSTRING
	14	STRING MOVE
	15	CONCATENATE
	16	REAL.ADD
	17	REAL.SUBTRACT
	18	REAL.MULTIPLY
	19	REAL.DIVIDE
	20	REAL.NEGATE
	21	REAL.MOVE
	22	REAL.INTRINSIC
	23	STRING.INTRINSIC
	24	REAL.CASE
	25	STRING.CASE
	26	RESERVED
	27	RESERVED
	28	RESERVED
	29	RESERVED
	30	RESERVED
	31	RESERVED
	32	GO.TO
	33	ON.GOTO
	34	GOSUB
	35	ON.GOSUB

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	36	RETURN.FROM.GOSUB
	37	REAL.IF
	38	STRING.IF
	39	RESERVED
	40	FOR
	41	NEXT
	42	DEF
	43	FNEND
	44	RESERVED
	45	RESERVED
	46	RESERVED
	47	RESERVED
	48	RETURN.FROM.LL1
**	49	FILE
**	50	LINPUT
**	51	READ
**	52	RESTORE.DATA
**	53	STOP.RUN
**	54	CHAIN
**	55	ALLOCATE.ARRAY
**	56	RANDOMIZE
**	57	PRINT
**	58	INPUT
**	59	MATRIX
	60	EXT.INTRIN.CALL
	61	USER.FUNCTION.CALL
	62	DEBUG.OPS
**	63	COMMAND

\*\* Indicates S-OPS which are not interpreted by the microcode.

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### FORMATS

A floating point number is represented as:

1 BIT	7 BITS	24 BITS
-----		
1 SIGN	1 EXPONENT	1 FRACTION PART
-----		

where a positive number has the sign bit equal to 000, and a negative number has the sign bit equal to 010.

All floating point numbers are represented in excess 64 base 16 notation. For example,

The value 8 is represented as:

0 1000001 100000000000000000000000

and the value .5 is represented as:

0 1000000 100000000000000000000000

A header appears before each statement (followed by a beginning of statement OP, then appropriate S-OPS, then an end of statement OP). The header looks like:

PREVIOUS	16 BITS
NEXT	16 BITS
LL	1 BITS
ACTIVE	1 BITS
TYPE	6 BITS
NEST.LEVEL	4 BIT
FOR.LEVEL	4 BIT
LINE.NO	17 BIT
NEED.LN.FIXUP	1 BIT
NEED.NAME.FIXUP	1 BIT
REFERENCED	1 BIT
SOURCE.DISK.ADDRESS	12 BITS
SIZE	6 BITS
XREF.SIZE	6 BITS
SYNTAX.ERROR	8 BITS
SYNTAX.POSITION	8 BITS



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An array descriptor entry looks like:

TAG	4 BITS
REFERENCED BIT	1 BIT
DIMMED BIT	1 BIT
NO.OF.DIMS	2 BITS
UNALLOCATED BIT	1 BIT
FILLER	1 BIT
WHERE AREA	22 BITS
LENGTH FIXER	8 BITS
MSV	12 BITS
DIM(1)	12 BITS
DIM(2)	12 BITS
FILLER	20 BITS

An evaluation stack entry looks like:

REAL	32 BITS
FILLER	8 BITS

OR

STRING	40 BITS
--------	---------

OR

INDEX	24 BITS
FILLER	16 BITS

OR

NAME	9 BITS
FILLER	31 BITS

A control stack entry looks like:

LL	1 BIT
MARK	1 BIT
RETURN.LL	1 BIT
RETURN.MODE	1 BIT
LL1.ENTRIES	4 BITS
WHERE	16 BITS
DISP	16 BITS
EV.ENTRIES	8 BITS

An LL1 entry looks like:

TYPE	3 BITS	OR	TYPE	3 BITS
NAME	9 BITS		NAME	9 BITS
REAL	32 BITS		STRING	40 BITS
FILLER	20 BITS		FILLER	12 BITS

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A standard branch (used in OPS "GO TO", "IF", "FOR", AND "NEXT") may be one of the following types:

- |                              |                         |
|------------------------------|-------------------------|
| 1. DIRECT                    | (INTRA-STATEMENT)       |
| 2. CODEWORD ADDRESS          | (INTERACTIVE CODE ONLY) |
| 3. DIRECT AND SET NEST LEVEL | (COMPILED CODE ONLY)    |
| 4. NEXT CODEWORD             | (INTERACTIVE CODE ONLY) |

### STANDARD SOURCE

VARIANT	SOURCE
-----	-----
0	REAL SCALAR
1	STRING SCALAR
2	UNUSED
3	REAL ARRAY
4	STRING ARRAY
5	UNUSED
6	REAL STACK
7	STRING STACK
8	UNUSED
9	LITERAL 0
10	LITERAL 1
11	NULL STRING LITERAL
12	STRING LITERAL 1
13	REAL LITERAL
14	STRING LITERAL
15	UNUSED

Following are the formats of the standard sources:

\*\*\*\*\*  
 \* REAL SCALAR \*  
 \*\*\*\*\*

4 BITS	9 BITS
-----	-----
000002	SUBSCRIPT OF ELEMENT
	IN REAL SCALAR ARRAY
-----	-----

The source value is the value in the indicated real scalar array element.

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\*\*\*\*\*  
\* STRING SCALAR \*  
\*\*\*\*\*

4 BITS                      9 BITS  
-----  
| 000010 | SUBSCRIPT OF ELEMENT |  
|           | IN STRING SCALAR ARRAY |  
-----

The source string descriptor is in the indicated string scalar array element. The string descriptor points into string space at the actual string value.

\*\*\*\*\*  
\* REAL ARRAY \*  
\*\*\*\*\*

4 BITS  
-----  
000110

The top item on the evaluation stack is assumed to be an index (generated by the RACACS OP) in the real scalar array where the array element value is stored. This top item is popped.

\*\*\*\*\*  
\* STRING ARRAY \*  
\*\*\*\*\*

4 BITS  
-----  
001000

The top item on the evaluation stack is assumed to be an index (generated by the SACACS OP) in the string scalar array where the string descriptor of the array element is to be found.

\*\*\*\*\*  
\* REAL STACK \*  
\*\*\*\*\*

4 BITS  
-----  
001100

The top item on the evaluation stack is the real value. The stack is popped.

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\*\*\*\*\*  
 \* STRING STACK \*  
 \*\*\*\*\*

4 BITS  
 -----  
201112

The top item on the evaluation stack is the string descriptor pointing to the string value. The stack is popped.

\*\*\*\*\*  
 \* LITERAL 0 \*  
 \*\*\*\*\*

4 BITS  
 -----  
210012

The source value is the value 0 (Hex 200000002).

\*\*\*\*\*  
 \* LITERAL 1 \*  
 \*\*\*\*\*

4 BITS  
 -----  
210102

The source value is the value 1 (Hex 241100002).

\*\*\*\*\*  
 \* NULL STRING LITERAL \*  
 \*\*\*\*\*

4 BITS  
 -----  
210112

The source descriptor refers to a string of length zero.

\*\*\*\*\*  
 \* STRING LITERAL 1 \*  
 \*\*\*\*\*

4 BITS                      8 BITS  
 -----  
 | 211002 | ONE CHARACTER LITERAL |  
 -----

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The string value is that of the specific character.

\*\*\*\*\*  
 \* REAL LITERAL \*  
 \*\*\*\*\*

4 BITS	32 BITS
-----	
011010	ACTUAL VALUE OF
	THE LITERAL
-----	

The source value is the value of the specific real value.

\*\*\*\*\*  
 \* STRING LITERAL \*  
 \*\*\*\*\*

4 BITS	11 BITS	N BITS
-----		
011100	LENGTH OF LITERAL IN BITS	LITERAL CHARACTERS
-----		

The source value is the value of the in-line string characters.

#### STANDARD DESTINATION

VARIANT	DESTINATION
-----	-----
0	REAL SCALAR
1	STRING SCALAR
2	UNUSED
3	REAL ARRAY
4	STRING ARRAY
5	UNUSED
6	EVALUATION STACK
7	FN VALUE

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Following are the formats of the various standard destinations:

\*\*\*\*\*  
 \* REAL SCALAR \*  
 \*\*\*\*\*

3 BITS	9 BITS
-----	
0000	SUBSCRIPT INTO THE
	REAL SCALAR ARRAY
-----	

The destination is in the indicated real scalar array element.

\*\*\*\*\*  
 \* STRING SCALAR \*  
 \*\*\*\*\*

3 BITS	9 BITS
-----	
0001	SUBSCRIPT INTO THE STRING SCALAR ARRAY
-----	

The destination descriptor is in the indicated string scalar element. The string may require allocation of string space.

\*\*\*\*\*  
 \* REAL ARRAY \*  
 \*\*\*\*\*

3 BITS
-----
0011
-----

The top of the evaluation stack contains an index in the real scalar array (generated by the RACACS OP) for the destination real array element value. The stack is popped.

\*\*\*\*\*  
 \* STRING ARRAY \*  
 \*\*\*\*\*

3 BITS
-----
0100
-----

The top of the evaluation stack contains an index in the string scalar array (generated by the SACACS OP) for the destination string descriptor. The stack is popped.

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\*\*\*\*\*  
\* EVALUATION STACK \*  
\*\*\*\*\*

3 BITS  
-----  
21102

The destination value is pushed onto the top of the evaluation stack.

\*\*\*\*\*  
\* FN VALUE \*  
\*\*\*\*\*

3 BITS  
-----  
21112

The destination value (or string descriptor) is in the value part of the LL1 stack entry at index HINTS.LL1\_BASE.

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DESCRIPTION OF S-OPS

S-OPS

ERROR MESSAGE

\*\*\*\*\*  
\* ERROR MESSAGE \*  
\*\*\*\*\*

Format:

6 BITS	8 BITS	1 BIT
1 0002	1 WHICH	1 NON FATAL FLAG 1

Funtion:

This op will cause a nonfatal or fatal error number WHICH according to the NON FATAL FLAG (0 - fatal, 1 - non fatal).



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BEGINNING OF STATEMENT

\*\*\*\*\*  
\* BOS \*  
\*\*\*\*\*

Format:

6 BITS  
-----  
1 0012 1  
-----

Function:

Performs bookkeeping necessary to begin a statement (checks checking interval, monitors, traces, etc., updates current and next fields).

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END OF STATEMENT

\*\*\*\*\*  
\* EOS \*  
\*\*\*\*\*

Format:

6 BITS  
-----  
1 0023 1  
-----

Function:

Performs bookkeeping necessary to terminate a statement. (Halt  
if necessary, find the next executable statement).

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END OF COMMAND

\*\*\* NOT MICROCODED \*\*\*

\*\*\*\*\*  
\* EOC \*  
\*\*\*\*\*

Format:

6 BITS  
-----  
1 303a 1  
-----

Function:

Performs bookkeeping necessary to terminate a command.

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REAL ARRAY CHECK AND CALCULATE SUBSCRIPTS

\*\*\*\*\*  
 \* RACACS \*  
 \*\*\*\*\*

Format:

6 BITS	9 BITS	1 BIT	4+ BITS	4+ BITS (IF IT EXISTS)
1 0042	1 REAL ARRAY	1 # OF	1 STD. SOURCE	1 STD. SOURCE
1	1 SUBSCRIPT	1 SUBSC.	1	1

Note that if the element the user codes for an array is A(X,Y), the first standard source in the string is "Y" and the second standard source in the string is "X".

Function:

Fetches the value of the subscripts. After checking that they are within the limit of the defined bounds, an integer "INDEX" is loaded onto the evaluation stack. When the reference to the array is encountered, this "INDEX" is used as a subscript into the real scalar array.

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STRING ARRAY CHECK AND CALCULATE SUBSCRIPTS

\*\*\*\*\*  
 \* SACACS \*  
 \*\*\*\*\*

Format:

6 BITS	9 BITS	1 BIT	4+ BITS	4+ BITS (IF IT EXISTS)
1 2052	1 STRING ARRAY	1 # OF	1 STD. SOURCE	1 STD. SOURCE
1	1 SUBSCRIPT	1 SUBSC.	1	1

Note that if the element the user codes for an array is A\$(X,Y), the first standard source in the string is "Y" and the second standard source in the string is "X".

Function:

Fetches the value of the subscripts. After checking that they are within the limits of the defined bounds, an integer "INDEX" is loaded onto the evaluation stack. When the reference to the array is encountered, this "INDEX" is used as a subscript into the string scalar array.

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TRIM ARRAY DESCRIPTOR

\*\*\*\*\*  
 \* TRIM \*  
 \*\*\*\*\*

Format:

6 BITS	3 BITS	9 BITS	1 BIT	STD.SOURCE SIZE = 4+ BITS
2062	ARRAY	ARRAY	# OF	ROW.DIM   1 DIM
	TYPE	NAME	DIMS	-----
				COL.DIM   ROW.DIM   2 DIM

0=1 DIM  
 1=2 DIMS

Function:

Alters the size of an array. Only reduction from originally defined size is allowed. A fatal error will occur if either the number of dimensions does not match the actual array or if the the new number of elements exceeds the original array bounds.

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EXCHANGE

\*\*\*\*\*  
\* XCH \*  
\*\*\*\*\*

Format:

6 BITS  
-----  
I 3073 I  
-----

Function:

Exchanges the top two entries of the evaluation stack. Used for  
the "INPUT" statement.

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LOAD VALUE

\*\*\*\*\*  
\* LOAD.VALUE \*  
\*\*\*\*\*

Format:

6 BITS	4+ BITS
-----	
0082	STD. SOURCE
-----	

Function:

Loads the source value to the stack. Used to load the arguments of function calls to the stack (both user and external intrinsics).



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SET FILE INDEX

\*\*\*\*\*  
\* SET.FILE.INDEX \*  
\*\*\*\*\*

Format:

6 BITS      4+ BITS  
-----  
| 2092 | STD. SOURCE |  
-----

Function:

This OP is generated before each file operation. It sets up the current file index which is the physical index into the file table of the logical file number in standard source. The logical file number will be integerised.

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LOAD NAME

\*\*\*\*\*  
\* LOAD.NAME \*  
\*\*\*\*\*

Format:

6 BITS 3 BITS 9 BITS  
-----  
I 00A2 I TYPE I NAME I  
-----

Function:

Loads the specified name to the evaluation stack.

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COPY NAME

\*\*\*\*\*  
 \* COPY.NAME \*  
 \*\*\*\*\*

Format:

6 BITS		3 BITS	
0000	DESTINATION	DESTINATION NAME	
	TYPE		

Function:

Assumes the top entry on the evaluation stack is a "NAME" (which was loaded by a LOAD.NAME operator). The relevant descriptor is copied from the stack name (INDEX) to the destination name (INDEX).

DEST.TYPE

-----  
 0= REAL.SCALAR  
 1= STRING SCALAR  
 2= RESERVED  
 3= REAL ARRAY  
 4= STRING ARRAY  
 5= RESERVED  
 6= UNDEFINED  
 7= UNDEFINED

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CUT BACK CONTROL STACK

\*\*\*\*\*  
\* CUT.BACK.CS.STACK \*  
\*\*\*\*\*

Format:

6 BITS  
-----  
1 00C2 1  
-----

Function:

Performs bookkeeping necessary to cut back the control stack.

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SUBSTRING

\*\*\*\*\*  
 \* SUBSTRING \*  
 \*\*\*\*\*

Format:

6 BITS	4+ BITS	4+ BITS	4+ BITS	3+ BITS
20D2	STD.SOURCE	STD.SOURCE	STD.SOURCE	STD.DEST.

Note that the first standard source in the string is the ending position, the second standard source in the string is the beginning position, and the last standard source in the string is string of which the substring is required.

Function:

The specified substring of the string source (the third source) is extracted and assigned to the destination.

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STRING MOVE

\*\*\*\*\*  
\* STRING MOVE \*  
\*\*\*\*\*

Format:

6 BITS	4 BITS	4+ BITS	3+ BITS (EACH)
-----			
20E2   # OF DESTINATIONS   STD. SOURCE   STD. DEST(S).			
-----			

Function:

The character string defined by standard source is moved to the specified destination(s).

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CONCATENATE

\*\*\*\*\*  
\* CONCATENATE \*  
\*\*\*\*\*

Format:

6 BITS	4+ BITS	4+ BITS	3+ BITS
20F2	STD. SOURCE	STD. SOURCE	STD. DEST.

Note that the first standard source in the OP is actually the second character string the user gives, and the second standard source in the OP is actually the first character string the user gives.

Function:

The characters defined by the two standard sources are moved to the specified destination.

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REAL ADD

\*\*\*\*\*  
\* REAL.ADD \*  
\*\*\*\*\*

Format:

6 BITS	4+ BITS	4+ BITS	3+ BITS
2102	STD. SOURCE	STD. SOURCE	STD. DEST.

Function:

Adds the two sources, writing the real value result to the specified destination.



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REAL SUBTRACT

\*\*\*\*\*  
\* REAL.SUBTRACT \*  
\*\*\*\*\*

Format:

6 BITS	4+ BITS	4+ BITS	3+ BITS
0112	STD. SOURCE	STD. SOURCE	STD. DEST.

Function:

Subtracts the second standard source in the OP from the first standard source in the OP, writing the real value result to the specified destination.

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REAL MULTIPLY

\*\*\*\*\*  
 \* REAL MULTIPLY \*  
 \*\*\*\*\*

Format:

6 BITS	4+ BITS	4+ BITS	3+ BITS
0120	STD. SOURCE	STD. SOURCE	STD. DEST.

Note that the first standard source in the OP is actually the second operand the user gives, and the second standard source in the OP is actually the first operand the user gives.

Function:

Multiplies the two standard sources, writing the real value result to the specified destination.

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REAL DIVIDE

\*\*\*\*\*  
\* REAL.DIVIDE \*  
\*\*\*\*\*

Format:

6 BITS	4+ BITS	4+ BITS	3+ BITS
Q13Q	STD. SOURCE	STD. SOURCE	STD. DEST.

Function:

Divides the second standard source in the OP by the first standard source in the OP, writing the real value result to the specified destination.

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REAL NEGATE

\*\*\*\*\*  
\* REAL.NEGATE \*  
\*\*\*\*\*

Format:

6 BITS	4+ BITS	3+ BITS
-----		
0143	STD. SOURCE	STD. DESTINATION
-----		

Function:

Changes the sign of the non-zero standard source, writing the real value result to the specified destination. For a standard source value of zero, the sign is unchanged.

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REAL MOVE

\*\*\*\*\*  
\* REAL.MOVE \*  
\*\*\*\*\*

Format:

6 BITS	4 BITS	4+ BITS	3+ BITS (EACH)
0150	# OF DESTINATIONS	STD. SOURCE	STD. DEST(S).

Function:

Moves the real value standard source to the specified destination(s).

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REAL INTRINSIC

\*\*\*\*\*  
 \* REAL INTRINSIC \*  
 \*\*\*\*\*

Format:

6 BITS	5 BITS	4+ BITS (IF IT EXISTS)	3+ BITS
1 2162 1	WHICH	1 STD.SOURCE(S) 1	STD.DESTINATION 1
1	1 FUNCTION 1	(MAY BE 0-3) 1	1

Note that in the case of functions which use array references, such as LDIM and UDIM, the 5 bit area telling which function is desired will be followed by:

3 BITS	9 BITS
1 TYPE 1	ARRAY SUBSCRIPT 1

Which may then be followed by standard source and standard destination information.

The real intrinsic formats, with their 5 bit variants, are described below. All real intrinsics return a real value result.

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ABSOLUTE VALUE

\*\*\*\*\*  
\* ABS \*  
\*\*\*\*\*

Format:

6 BITS	5 BITS	4+ BITS	3+ BITS
2162	2000002	STD.SOURCE	STD. DESTINATION

Operation:

Writes to the specified destination the real value which is the absolute value of the specified source value.

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ARRAY BASE ADDRESS

\*\*\*\*\*  
 \* ADDR \*  
 \*\*\*\*\*

Format:

6 BITS	5 BITS	3 BITS	9 BITS	3+ BITS
2162	2000012	ARRAY TYPE	ARRAY INDEX	STD.DEST

Operation:

This op returns the base address of the indicated array into the destination numeric destination.



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CEILING

\*\*\*\*\*  
 \* CEIL \*  
 \*\*\*\*\*

Format:

6 BITS	5 BITS	4+ BITS	3+ BITS
0160	000100	STD. SOURCE	STD. DEST.

Operation:

Writes to the specified destination the real value which is the lowest integer greater than the specified source. For example:

CEIL(3.6) = 4; CEIL (-3.6) = -3.

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DATE

\*\*\*\*\*  
\* DATE \*  
\*\*\*\*\*

Format:

6 BITS	5 BITS	3+ BITS
1 2162	1 2000112	1 STD. DEST. 1

Operation:

Writes to the specified destination the real value which is the system date.

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DETERMINANT VALUE

\*\*\*\*\*  
\* DET \*  
\*\*\*\*\*

Format:

```
  6 BITS   5 BITS   3+ BITS  
-----  
| 2162 | 2001002 | STD. DEST. |  
-----
```

Operation:

Writes to the specified destination the real value which is the determinant. This value is at the predefined location 102 in the real scalar array and its value has been previously determined.

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FRACTION PART

\*\*\*\*\*  
\* FP \*  
\*\*\*\*\*

Format:

6 BITS	5 BITS	4+ BITS	3+ BITS
0160	0001010	STD. SOURCE	STD. DEST.

Operation:

Writes to the specified destination the real value which is the fraction portion of the specified source.

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FLOOR

\*\*\*\*\*  
 \* INT \*  
 \*\*\*\*\*

Format:

6 BITS	5 BITS	4+ BITS	3+ BITS
0160	001100	STD.SOURCE	STD. DEST.

Operation:

Writes to the specified destination the real value which is the highest integer value < the specified source. For example:

$INT(+3.6) = 3$ ;  $INT(-3.6) = -4$ .

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INTEGER PART

\*\*\*\*\*  
\* IP \*  
\*\*\*\*\*

Format:

6 BITS	5 BITS	4+ BITS	3+ BITS
0160	0001110	STD. SOURCE	STD. DEST.

Operation:

Writes to the specified destination the real value which is the integer portion of the specified source.

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### LOWER DIMENSION

\*\*\*\*\*  
 \* LDIM \*  
 \*\*\*\*\*

### Format:

6 BITS	5 BITS	3 BITS	9 BITS	4+ BITS	3+ BITS					
			TYPE		SUBSCRIPT		STD.		STD.	
	0160		0010000		(RL OR		INTO ARRAY		SOURCE	
			ST)						DEST.	

### Operation:

Writes to the specified destination the real value which is the lower value of the dimension specified in the STD.SOURCE for the array specified. Currently, the dimension value can only be 1 or 2 and the lower value will be either 0 or 1.

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LENGTH OF STRING

\*\*\*\*\*  
\* STRING.LEN \*  
\*\*\*\*\*

Format:

6 BITS	5 BITS	4+ BITS	3+ BITS
3162	3010012	STD. SOURCE	STD.DEST.

Operation:

Writes to the specified destination the real value which is the length of the specified standard source string.



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MAXIMUM OF TWO VALUES

\*\*\*\*\*  
 \* MAX \*  
 \*\*\*\*\*

Format:

6 BITS	5 BITS	4+ BITS	4+ BITS	3+ BITS
0160   0010100	STD.	STD.	STD.	
		SOURCE	SOURCE	DEST.

Operation:

Writes to the specified destination the real value which is the larger of the two specified sources.

Note that the first source in the OP is actually the second argument the user gives, and the second source is actually the first argument the user gives.

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MINIMUM OF TWO VALUES

\*\*\*\*\*  
 \* MIN \*  
 \*\*\*\*\*

Format:

6 BITS	5 BITS	4+ BITS	4+ BITS	3+ BITS
0160	0010110	STD.	STD.	STD.
		SOURCE	SOURCE	DEST.

Operation:

Writes to the specified destination the real value which is the smaller of the two specified sources.

Note that the first source in the OP is actually the first argument the user gives, and the second source in the OP is actually the first argument the user gives.

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MODULUS

\*\*\*\*\*  
 \* MOD \*  
 \*\*\*\*\*

Format:

6 BITS	5 BITS	4+ BITS	4+ BITS	3+ BITS
0160   0011000	STD.	STD.	STD.	
	SOURCE	SOURCE	DEST.	

Operation:

Writes to the specified destination the real value which is the result of:

$SOURCE\ 1 - SOURCE\ 2 * INT(SOURCE\ 1 / SOURCE\ 2).$

Note that the first source in the OP is actually the second argument the user gives, and the second source in the OP is actually the first argument the user gives.

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NUMBER OF DIMENSIONS

\*\*\*\*\*  
 \* NDIM \*  
 \*\*\*\*\*

Format:

6 BITS	5 BITS	3 BITS	9 BITS	3+ BITS
0162	0011012	TYPE (RL	SUBSC. INTO	STD.
		OR ST)	ARRAY	DEST.

Operation:

Writes to the specified destination the real value which is the number of dimensions allowed for the specified array. Currently, this will either be 1 or 2.

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ORDINAL VALUE

\*\*\*\*\*  
\* DRD \*  
\*\*\*\*\*

Format:

6 BITS	5 BITS	4+ BITS	3+ BITS
2162	2011102	STD. SOURCE	STD. DEST.

Operation:

Writes to the specified destination the real value which is the ordinal in the current collating sequence of the character string described by the standard source.

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POSITION IN STRING

\*\*\*\*\*  
 \* POS \*  
 \*\*\*\*\*

Format:

6 BITS	5 BITS	4+ BITS	4+ BITS	4+ BITS	3 BITS
0162	0011112	STD.	STD.	STD.	STD.
		SOURCE	SOURCE	SOURCE	DEST.

Operation:

Writes to the specified destination the real value which is the character position of the string specified by the second standard source in the string specified by the first standard source, beginning at the character specified by the third standard source. If no match is found, a value of 0 is written to the specified destination.

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REDUCE

\*\*\*\*\*  
\* RDUC \*  
\*\*\*\*\*

Format:

6 BITS	5 BITS	4+ BITS	3+ BITS
0160	0100000	STD. SOURCE	STD. DEST.

Operation:

Writes to the specified destination a real value which is a number between .5 and 1 if the specified source is positive or a number between -1 and -.5 if the specified source is negative. The value is determined by making the exponent = 64 and ensuring that the leading bit in the fraction portion is on.

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REMAINDER

\*\*\*\*\*  
 \* REM \*  
 \*\*\*\*\*

Format:

6 BITS	5 BITS	4+ BITS	4+ BITS	3+ BITS
2162	2100012	STD.	STD.	STD.
		SOURCE	SOURCE	DEST.

Operation:

Writes to the specified destination the real value which is the result of:

SOURCE 1 - SOURCE 2 \* IP(SOURCE 1/SOURCE 2).

Note that the first source in the OP is actually the second argument the user gives, and the second source in the OP is actually the first argument the user gives.



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SQUARE ROOT

\*\*\*\*\*  
\* ROOT \*  
\*\*\*\*\*

Format:

6 BITS	5 BITS	4+ BITS	3+ BITS
2162	2100102	STD. SOURCE	STD. DEST.

Operation:

Writes to the specified destination the real value which is the square root of the specified source.

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SIGN

\*\*\*\*\*  
\* SGN \*  
\*\*\*\*\*

Format:

6 BITS	5 BITS	4+ BITS	3+ BITS
0160	0100110	STD. SOURCE	STD. DEST.

Operation:

Writes to the specified destination the real value representation of the sign of the specified source. A -1 represents a negative source value, a +1 represents a positive source value, and a 0 represents a source value of zero.

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ARRAY SIZE

\*\*\* NOT YET IMPLEMENTED \*\*\*

\*\*\*\*\*  
\* SIZE \*  
\*\*\*\*\*

Format:

6 BITS 5 BITS  
-----  
| 3163 | 3101003 | to be defined  
-----

Operation:

This op is reserved to replace UDIM, LDIM and MSV.

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TIME

\*\*\*\*\*  
\* TIME \*  
\*\*\*\*\*

Format:

6 BITS	5 BITS	3+ BITS
2162	2101012	STD. DEST.

Operation:

Writes to the specified destination the real value which is the system time in seconds after midnight.

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## UPPER DIMENSION

\*\*\*\*\*  
 \* UDIM \*  
 \*\*\*\*\*

## Format:

6 BITS	5 BITS	3 BITS	9 BITS	4+ BITS	3+ BITS
		TYPE	SUBSC.	STD.	STD.
2162	2101102	(RL OR	INTO	SOURCE	DEST.
		ST)	ARRAY		

## Operation:

Writes to the specified destination the real value which is the maximum value of the dimension specified as the standard source for the specified array.

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NUMERIC VALUE

\*\*\* NOT MICROCODED \*\*\*

\*\*\*\*\*  
\* VAL \*  
\*\*\*\*\*

Format:

6 BITS	5 BITS	4+ BITS	3+ BITS
0162	0101112	STD. SOURCE	STD. DEST.

Operation:

Writes to the specified destination the real value representation of the character string specified by the standard source.

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EXPAND

\*\*\*\*\*  
 \* XPND \*  
 \*\*\*\*\*

Format:

6 BITS	5 BITS	4+ BITS	4+ BITS	3+ BITS
2162	2110002	STD.	STD.	STD.
		SOURCE	SOURCE	DEST.

Operation:

Writes to the specified destination a real value which is, essentially:

SOURCE 1 \* (2 \*\* SOURCE 2).

Note that the first source in the OP is actually the second argument the user gives, and the second source in the OP is actually the first argument the user gives.

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EXPONENT VALUE

\*\*\*\*\*  
 \* XPON \*  
 \*\*\*\*\*

Format:

6 BITS	5 BITS	4+ BITS	3+ BITS
1 2162	1 2110012	1 STD. SOURCE	1 STD. DEST. 1

Operation:

Writes to the specified destination a real value which is effectively the integer portion of the log to the base 2 of the specified source. Essentially, it is the reverse of the RDUC function.



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## PROCESSOR TIME

\*\*\*\*\*  
\* XTIM \*  
\*\*\*\*\*

\*\*\*\*\* THIS INTRINSIC IS FOR INTERNAL USE ONLY \*\*\*\*\*

## Format:

6 BITS

-----  
| 2162 | 2110012 | STD. DEST. |  
-----

## Operation:

Writes to the specified destination the real value which is the  
CPU time (RS time of interpreter + RS time of the compiler).

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STRING INTRINSIC

\*\*\*\*\*  
\* STRING.INTRINSIC \*  
\*\*\*\*\*

Format:

6 BITS	3 BITS	4+ BITS (IF IT EXISTS)	3+ BITS
2172	WHICH	STD.SOURCE(S)	STD. DESTINATION
	FUNCTION	(MAY BE 0-3)	

The string intrinsic formats, with their 3 bit variants, are described below. All string intrinsics return a character string result.

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CHARACTER FUNCTION

\*\*\*\*\*  
\* CHR\$ \*  
\*\*\*\*\*

Format:

6 BITS	3 BITS	4+ BITS	3+ BITS
0170	0000	STD. SOURCE.	STD. DEST.

Operation:

Writes to the specified destination the character in the current collating sequence which corresponds to the ordinal defined by the standard source.

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DATE IN STRING FORM

\*\*\* NOT MICROCODED \*\*\*

\*\*\*\*\*  
\* DATES \*  
\*\*\*\*\*

Format:

6 BITS	3 BITS	3+ BITS
1 2172	1 20012	1 STD. DEST. 1

Operation:

Writes to the specified destination the character string which is the date in the form YY/MM/DD.

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HOST NAME

\*\*\* FOR INTERNAL USE ONLY \*\*\*  
\*\*\* NOT MICROCODED \*\*\*

\*\*\*\*\*  
\* HOSTS \*  
\*\*\*\*\*

Format:

6 BITS 3 BITS 3+ BITS  
-----  
| 0173 | 00103 | STD.DEST. |  
-----

Operation:

The current value of the system HOST NAME is stored in the string destination specified.

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CONVERT TO LOWER CASE

\*\*\*\*\*  
\* LWRC\$ \*  
\*\*\*\*\*

Format:

6 BITS	3 BITS	4+ BITS	3+ BITS
0170	00110	STD. SOURCE	STD. DEST.

Operation:

Writes to the specified destination the lower case representation of the specified standard source.

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CHARACTER REPRESENTATION OF NUMERIC VALUE

\*\*\* NOT MICROCODED \*\*\*

\*\*\*\*\*  
\* STR\$ \*  
\*\*\*\*\*

Format:

6 BITS	3 BITS	4+ BITS	3+ BITS
2172	21002	STD. SOURCE	STD. DEST.

Operation:

Writes to the specified destination the character string representation of the real value standard source.

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TIME IN STRING FORM

\*\*\* NOT MICROCODED \*\*\*

\*\*\*\*\*  
\* TIMES \*  
\*\*\*\*\*

Format:

6 BITS	3 BITS	3+ BITS
0170	01010	STD. DEST.

Operation:

Writes to the specified destination a string which is the time in the form HH:MM:SS.



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CONVERT TO UPPERCASE

\*\*\*\*\*  
\* UPRCS \*  
\*\*\*\*\*

Format:

6 BITS	3 BITS	4+ BITS	3+ BITS
1	0172	1	01103
STD. SOURCE		STD. DEST. 1	

Operation:

Writes to the specified destination the uppercase character string representation of the specified standard source.

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### REAL CASE SELECTION

\*\*\*\*\*  
 \* REAL CASE \*  
 \*\*\*\*\*

#### Format:

6 BITS	16 BITS	4 BITS	variable	4 BITS	16 BITS
	END OF STATEMENT		VARIANT		NEXT
0180	ADDRESS	VARIANT	DATA	/.../	00000
					ADDRESS

#### Variant Format:

Variant	Variant data
00000	Next Case address
00XXX	Std.Source (XXX is the relational mask)
01000	Std. Source, Std.Source.
01XXX	Undefined.

#### Function:

This case operation selects variants and tests a standard location against the constant(s) as specified by the variant. If a true condition is found then the current code displacement is replaced by <end of statement address> and the op terminates. If the final variant (00000) is encountered, branching to the statement identified by <next case address> (with an implicit displacement to bypass preliminary code) is caused and the op terminates.

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### STRING CASE SELECTION

\*\*\*\*\*  
 \* STRING CASE \*  
 \*\*\*\*\*

#### Format:

6 BITS	16 BITS	4 BITS	variable	4 BITS	16 BITS
	END OF		VARIANT		NEXT
2192	STATEMENT	VARIANT	DATA	/.../	200002
	ADDRESS				ADDRESS

#### Variant Format:

Variant	Variant data
200002	Next Case address
20XXX2	Std.Source (XXX is the relational mask)
210002	Std. Source, Std.Source.
21XXX2	Undefined.

#### Function:

This case operation selects variants and tests a standard location against the constant(s) as specified by the variant. If a true condition is found then the current code displacement is replaced by <end of statement address> and the op terminates. If the final variant (200002) is encountered, branching to the statement identified by <next case address> (with an implicit displacement to bypass preliminary code) is caused and the op terminates.

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GOTO

\*\*\*\*\*  
\* -GO.TO \*  
\*\*\*\*\*

Format:

6 BITS	23 BITS
-----	
3202   STANDARD BRANCH	
-----	

Function:

Branches to the specified standard branch, which may be any of the standard branch types.

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### SELECTIVE GOTO

\*\*\*\*\*  
 \* GN.GOTO \*  
 \*\*\*\*\*

#### Format:

6 BITS	4+ BITS	6 BITS	23	23	23	23
	STANDARD		DEF	BCH	BCH	BCH
2210	SOURCE	# BRANCHES	BCH	1	2 /...../	N
					/ /	

#### Function:

- 1) Integerise the standard source
- 2) If the above is  $\geq 0$   
     or  
     is  $\leq$  than the # of branches,  
     then take the specified branch (i-N).
- 3) Otherwise, take the default branch.

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INTERNAL SUBROUTINE CALL

\*\*\*\*\*  
\* GDSUB \*  
\*\*\*\*\*

Format:

6 BITS	23 BITS
-----	
2223   CODE ADDRESS	
-----	

Function:

Perform a subroutine call to the specified code address, performing necessary bookkeeping on evaluation and control stacks. The branch defined by the code address will be either of the type codeword address or of the type direct and set nest level.

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SELECTIVE INTERNAL SUBROUTINE CALL

\*\*\*\*\*  
 \* DN.GOSUB \*  
 \*\*\*\*\*

Format:

6 BITS	4+ BITS	6 BITS	23 BITS	23 BITS (EACH)
2232	STANDARD	# BRANCHES	DEFAULT	BRANCH / ... BRANCH
	SOURCE		BRANCH	1 / N

Function:

- 1) Integerise the standard source
- 2) If the above is  $\leq$  to 0  
     or  
     is  $>$  than the # of branches,  
     then take the default branch.
- 3) Otherwise, do a subroutine call by  
     transferring control to the specified branch  
     (1-N), while performing necessary bookkeeping  
     on the evaluation and control stacks.

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RETURN FROM INTERNAL SUBROUTINE

\*\*\*\*\*  
\* RETURN FROM GOSUB \*  
\*\*\*\*\*

Format:

6 BITS  
-----  
I 2242 I  
-----

Function:

Using the information stored on the control stack, return control from the subroutine, while performing necessary bookkeeping on the evaluation and control stacks.



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REAL COMPARE AND BRANCH

\*\*\*\*\*  
 \* REAL-IF \*  
 \*\*\*\*\*

Format:

6 BITS	3 BITS	4+ BITS	4+ BITS	23 BITS
0252	MASK	STD. SOURCE	STD. SOURCE	STANDARD
				BRANCH

Function:

- 1) Develop a "RELATIONAL MASK" of source 2 to source 1, which is:

001 : SOURCE 2 < SOURCE 1  
 010 : SOURCE 2 = SOURCE 1  
 100 : SOURCE 2 > SOURCE 1

- 2) If the relational mask, "AND"ed with the 3-bit mask, equals zero, do not take the specified branch.
- 3) Otherwise, take the specified branch.

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STRING COMPARE AND BRANCH

\*\*\*\*\*  
 \* STRING-IF \*  
 \*\*\*\*\*

Format:

6 BITS	3 BITS	4+ BITS	4+ BITS	23 BITS
2262	MASK	STD. SOURCE	STD. SOURCE	STANDARD
				BRANCH

Function:

- 1) Develop a "RELATIONAL MASK" of source 2 to source 1, which is:

001 : SOURCE 2 < SOURCE 1  
 010 : SOURCE 2 = SOURCE 1  
 100 : SOURCE 2 > SOURCE 1

For equal length strings the comparison relation mask is created according to the prevailing "OPTION COLLATE" (STANDARD = ASCII, NATIVE = EBCDIC).

For unequal length strings the shorter string is compared to the equal length substring of the longer string as above. If the result is still equal then the shorter string is "LESS" than the longer string.

- 2) If the relational mask, "AND"ed with the 3-bit mask, equals zero, do not take the specified branch.
- 3) Otherwise, take the specified branch.

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FOR LOOP INITIATION

\*\*\*\*\*  
 \* FOR \*  
 \*\*\*\*\*

Format:

6 BITS	4+ BITS	23 BITS
2282	STD.SOURCE	STANDARD BRANCH

Function:

Compares ending value of loop (stack pointer - 2) with the control variable according to the sign of the step variable (stack pointer - 1). If still valid, skip the branch and continue; otherwise, branch to the statement after the corresponding "NEXT" statement by taking the standard branch.

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NEXT LOOP ITERATION

\*\*\*\*\*  
\* NEXT \*  
\*\*\*\*\*

Format:

6 BITS	4+ BITS	23 BITS
-----		
0292	STD. SOURCE	STANDARD BRANCH
-----		

Function:

Increment the control variable by step (stack pointer - 1) and branch to the statement after the corresponding "FOR" statement if end conditions are met.

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## DEFINE FUNCTION

\*\*\*\*\*  
 \* DEF \*  
 \*\*\*\*\*

### Format:

6 BITS	3 BITS	3 BITS	9 BITS	3 BITS	9 BITS (EACH)
22A2	# OF	FUNCTION	FUNCTION	1ST PAR	1ST PAR: / /
	PARAMS	TYPE	NAME	TYPE	NAME :/ /

### Function:

Performs bookkeeping necessary to transfer control to a user-defined function, that is, to pass the specified parameters to a function of the specified type. Maintenance is performed on the evaluation, control and LL1 stacks.

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END DEFINED FUNCTION

\*\*\*\*\*  
\* FEND \*  
\*\*\*\*\*

Format:

6 BITS  
-----  
1 22B2 1  
-----

Function:

Performs bookkeeping necessary to transfer control from a user-defined function. Maintenance is performed on the evaluation, control, and LLI stacks.

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RETURN FROM LEXIC LEVEL ONE PROCEDURE

\*\*\*\*\*  
\* RETURN.FROM.LL1 \*  
\*\*\*\*\*

**Format:**

6 BITS      4+ BITS  
-----  
| 2302 | STD. SOURCE |  
-----

**Function:**

Control is returned to a calling statement according to the top item on the control stack. This return is used in returning from user defined functions and external intrinsics.

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**FILE FUNCTIONS**

These functions and their respective variants are documented in the following pages.

**FILE**

\*\*\* NOT MICROCODED \*\*\*

\*\*\*\*\*  
\* FILE \*  
\*\*\*\*\*

**Format:**

6 BITS	3 BITS	N BITS
0312	VARIANT	VARIANT DEPENDENT DATA

Various file functions are encoded under this OP.



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SET EXCEPTION BRANCH

\*\*\*\*\*  
\* AT \*  
\*\*\*\*\*

Format:

3 BITS	4 BITS	23 BITS
-----		
0000	EXCEPTION TYPE	BRANCH ADDRESS
-----		

Function:

The AT OP sets the exception branch field in the relevant file table entry. HINTS.CURRENT\_FILE\_INDEX is assumed to be set correctly by the SET\_FILE\_INDEX OP. Exception type is currently defined only for the EOF exception (VALUE 00).

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CLOSE FILE

\*\*\*\*\*  
\* CLOSE \*  
\*\*\*\*\*

Format:

3 BITS  
-----  
I 20012 I  
-----

Function:

The CLOSE DP closes the file that HINTS.CURRENT\_FILE\_INDEX points to. Any partly filled buffer is written out if the file was last written to. Exceptions occur for a close of file zero and a close of an unopen file.

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INQUIRE FILE ATTRIBUTE

\*\*\*\*\*  
 \* INQUIRE \*  
 \*\*\*\*\*

Format:

3 BITS	3 BITS	3+ BITS
00100	WHICH	STD.DEST
	ATTRIBUTE	

Function:

The op puts a pre-defined character string relating to the value of a particular parameter of the file indicated by HINTS.CURRENT\_FILE\_INDEX into the destination. The following table correlates the WHICH values and the respective attributes:

WHICH	ATTRIBUTE
0	MODE
1	FORMAT
2	NAME
3	ORGANISATION
4	RECORD LENGTH
5	RECORD TYPE
6	STATUS

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SET MARGIN

\*\*\*\*\*  
\* MARGIN \*  
\*\*\*\*\*

Format:

```
  3 BITS    4+ BITS  
-----  
| 00110 | STD.SOURCE |  
-----
```

Function:

The standard source is the value to which the margin for file zero will be changed. The new margin must be in the range 0 to 255 inclusive. A new margin value of 0 indicates setting the margin to the current remote device width.

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OPEN FILE

\*\*\*\*\*  
 \* OPEN \*  
 \*\*\*\*\*

Format:

3 BITS	4 BITS	4+	4+	4	4	4	1
01000	RECORD	STD.	STD.	ORG	TYPE	MODE	INIT
	TYPE	SOURCE	SOURCE				

Function:

The OPEN OP encodes information necessary to open an external file. The first standard source (present if record type is variable) indicates the record size to create a new file or to match with an old file. This record size is in characters for a display format file and in words (of 5 characters each) for an internal format file. The second standard source is the string containing the file name. The organisation of the file may only be sequential, currently. The type of a file may be display (0) or internal (1). The mode of a file may be input (1), output (2) or output, input (3). The initial position of a file may be begin (0) or end (1).

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RESTORE FILE

\*\*\*\*\*  
\* RESTORE \*  
\*\*\*\*\*

Format:

3 BITS  
-----  
1 0101 1  
-----

Function:

The RESTORE OP resets the current file pointer to the beginning of the file. If HINTS.CURRENT\_FILE\_INDEX is zero then this OP is ignored.

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SCRATCH FILE

\*\*\*\*\*  
\* SCRATCH \*  
\*\*\*\*\*

Format:

3 BITS  
-----  
01102

Function:

The SCRATCH OP causes the current file to be removed from the disk and replaces it with a file containing zero records. Exceptions occur if the file is either not open or is open input only.

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LINE INPUT

\*\*\* NOT MICROCODED \*\*\*

\*\*\*\*\*  
 \* LINPUT \*  
 \*\*\*\*\*

Format:

6 BITS	3+ BITS	4+ BITS
3322	STD. DEST.	STD. SOURCE

Function:

The LINPUT OP causes the destination to be filled with the linput reply from the terminal, having sent a prompt string described by the standard source. The reply from the terminal is not edited at all unless the reply is from a screen and the first character is either a blank or a highlight character (the same character which was sent out to the screen by the prompt process).



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READ INTERNAL DATA

\*\*\* NOT MICROCODED \*\*\*

\*\*\*\*\*  
\* READ \*  
\*\*\*\*\*

Format:

6 BITS            3+ BITS  
-----  
| 2332 | STD. DESTINATION |  
-----

Function:

This OP reads the next item from the internal data statements in the program and assigns it to the destination. The data statements are encoded such that the data do not need to be converted at read time, only the datum and destination types need to be matched.

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RESTORE INTERNAL DATA

\*\*\* NOT MICROCODED \*\*\*

\*\*\*\*\*  
\* RESTORE DATA \*  
\*\*\*\*\*

Format:

6 BITS  
-----  
1 2342 1  
-----

Function:

The pointer to the first (if any) data statement is reset such that following read OPS will read internal data from the beginning of the internal data statements.

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STOP RUN

\*\*\* NOT MICROCODED \*\*\*

\*\*\*\*\*  
\* STOP.RUN \*  
\*\*\*\*\*

Format:

6 BITS      1 BIT  
-----  
| 2352 | END VARIANT |  
-----

Function:

Program execution stops when the next EOC OP or EOS OP is executed. The variant is used to differentiate between the stop and end statements. The only difference in effect is the message at the terminal.

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CHAIN (PROGRAM CALL)

\*\*\* NOT MICROCODED \*\*\*

\*\*\*\*\*  
\* CHAIN \*  
\*\*\*\*\*

Format:

6 BITS	4+ BITS
-----	
362   STD. SOURCE	
-----	

Function:

The standard source is a string value identifying the name of a BASIC source program which will be 'LOADED' and run. Various exceptions can occur e.g., the current file is not saved, the requested file is not a BASIC source file, the requested file is not available to the current user.

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ALLOCATE ARRAY

\*\*\* NOT MICROCODED \*\*\*

\*\*\*\*\*  
\* ALLOCATE \*  
\*\*\*\*\*

Format:

6 BITS	4 BITS	1 BIT	9 BITS	1 BIT	4+ BITS	4+ BITS
3372	NUMBER OF	TYPE	ARRAY	NO. OF	STD.	STD.
	ARRAYS		INDEX	SUBSCRIPTS	SOURCE	SOURCE
					/.../	

Function:

Each array indicated in allocated space at the top end of scalar space and cleared to zero or null string accordingly.

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INITIALISE RANDOM NUMBER GENERATOR

\*\*\* NOT MICROCODED \*\*\*

\*\*\*\*\*  
\* RANDOMIZE \*  
\*\*\*\*\*

Format:

6 BITS  
-----  
1 2382 1  
-----

Function:

The RANDOMIZE OP causes a seed number used by the random number generator to be created in an unpredictable manner according to the time of day clock.

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PRINT

\*\*\* NOT MICROCODED \*\*\*

\*\*\*\*\*  
 \* PRINT \*  
 \*\*\*\*\*

Format:

6 BITS	2 BITS	N BITS	2 BITS
-----			
1	0390	1 EXP. TYPE	1 VARIABLE DATA
-----			
1 DELIMITER TYPE 1			
-----			

Function:

The EXPRESSION\_TYPE variant has the following values:

- 0000 If the next bit is on then there follows a string value standard source which is a print format image. If the bit after the standard source is on then this string is already converted to an internal format otherwise this is a raw format image which requires conversion before it may be used. If the bit following the expression type is off then an address of an image statement follows. The effect is to set up an image string in the file table.
- 0010 A standard source of a print item follows. If the current file entry shows that formatting is required then formatted output results.
- 0100 The standard source that follows is a numeric 'TAB' item. The tab item is 'INTEGERISED' and checked for the range 1 through 16777215. An exception occurs if it is out of range. The effect of the 'TAB' function is to position the buffer pointer to the specified position. If the tab value is less than the current position then the current buffer is written to the file.
- 0110 Nothing follows this expression type to denote a null print item.

The delimiter type has the following meanings:

- 0000 This is the last item in the print list, hence the current print buffer should be written.

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- 2012 This print item was terminated with a comma. The buffer pointer must be positioned to the next zone (every 15 characters) in the buffer. If the skip to the next zone causes a buffer overflow then the buffer is written and a new one initialised.
- 2102 This print item was terminated with a semi-colon, do nothing to the buffer.
- 2112 The print list was null, print the current buffer regardless.



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## INPUT

\*\*\* NOT MICROCODED \*\*\*

\*\*\*\*\*  
 \* INPUT \*  
 \*\*\*\*\*

### Format:

6 BITS	4+ BITS	6 BITS	3+ BITS	9 BITS	...	1 BIT
23A2	STD.	# INPUT	STD.	INDEX /	... /	TRAILING
	SOURCE	ITEMS	DEST.		... /	COMMA BIT

### Function:

The standard source is a string value which is used as the prompt for requesting input from the remote terminal. If the current file is an external file then the prompt is ignored. The input process stacks the individual input values on the evaluation stack after checking the values for the correct range (numeric overflow, numeric underflow and string overflow). Code that follows will assign the values to the requested variables. The trailing comma bit requests that any excess input reply be saved for the next input or linput statement.

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**MATRIX FUNCTIONS**

The individual functions are documented below.

**MATRIX**

\*\*\* NOT MICROCODED \*\*\*

\*\*\*\*\*  
\* MATRIX \*  
\*\*\*\*\*

**Format:**

6 BITS 4 BITS  
-----  
| 33B3 | VARIANT | VARIANT DEPENDENT BITS |  
-----

**Function:**

This OP causes certain functions to be performed on matrices as whole entities.

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ASSIGN MATRICES

\*\*\*\*\*  
\* ASSIGN \*  
\*\*\*\*\*

Format:

4 BITS	3 BITS	9 BITS	3 BITS	9 BITS
000	SOURCE TYPE	SOURCE NAME	DEST TYPE	DEST NAME

Function:

The data values of the specified source array are moved to the destination array. The destination array is made to conform (in shape) to the source array. Both numeric and string arrays are handled.

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MATRIX CONSTANT

\*\*\*\*\*  
\* CON \*  
\*\*\*\*\*

Format:

4 BITS	3 BITS	9 BITS
-----		
010	DESTINATION TYPE	DESTINATION NAME
-----		

Function:

The CON OP causes each element of the numeric array to have the value 1.

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IDENTITY MATRIX

\*\*\*\*\*  
\* IDN \*  
\*\*\*\*\*

Format:

4 BITS	3 BITS	9 BITS
-----		
1	222	1 DESTINATION TYPE 1 DESTINATION NAME 1
-----		

Function:

The IDN OP checks that the array is a square matrix and then assigns the value 1 to the diagonal and 0 to all the other elements.

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## MATRIX INPUT

\*\*\*\*\*  
 \* INPUT \*  
 \*\*\*\*\*

### Format:

4 BITS	4+ BITS	3 BITS	9 BITS	1 BIT
030	STD.SOURCE		ARRAY TYPE	
			ARRAY NAME	
			VARIABLE	
			INPUT.FLAG	

### Function:

The prompt string defined by the standard source is sent to the terminal and elements of the specified array are solicited. If the variable flag is set, then this reply defines the new upperbound of the array.

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MATRIX LINE INPUT

\*\*\*\*\*  
\* LINPUT \*  
\*\*\*\*\*

Format:

4 BITS

-----  
| 342 | TO BE DEFINED |  
-----

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NULL STRING MATRIX CONSTANT

\*\*\*\*\*  
\* NUL\$ \*  
\*\*\*\*\*

Format:

4 BITS	3 BITS	9 BITS
-----		
1	253	1 DESTINATION TYPE 1 DESTINATION NAME 1
-----		

Function:

The NUL\$ OP causes each element in the specified array to have the value of the null string ("").



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MATRIX PRINT

\*\*\*\*\*  
 \* PRINT \*  
 \*\*\*\*\*

Format:

4 BITS	3 BITS	9 BITS	1 BIT
262	SOURCE TYPE	SOURCE NAME	SEMICOLON BIT

Function:

The specified array is printed row by row with each row beginning on a new line. If the semicolon bit is true then the printing is done as if there were a semicolon delimiter between each element printed (if the plain PRINT OP). If the semicolon bit is false then each element of the array is printed beginning at the beginning of a print zone. If the row print exceeds the margin of the buffer then the buffer is written and a new buffer is initialised.

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MATRIX READ

\*\*\*\*\*  
\* READ \*  
\*\*\*\*\*

Format:

4 BITS	3 BITS	9 BITS
-----		
272	DESTINATION TYPE	DESTINATION NAME
-----		

Function:

The destination array is filled with sufficient data values from the list of internal data maintained by any data statements in the program. The type of data must match the data read, and there must be at least enough data items to fill the array.

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MATRIX TRANSPOSE

\*\*\*\*\*  
\* TRN \*  
\*\*\*\*\*

Format:

4 BITS	3 BITS	9 BITS	3 BITS	9 BITS
282	SOURCE TYPE	SOURCE NAME	DEST TYPE	DEST NAME

Function:

The destination array is shaped to conform with the element transpose of the source array and then the destination array is assigned the transpose of the source array. If the source and destination array are the same then an 'IN PLACE' algorithm is used.

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ZERO MATRIX CONSTANT

\*\*\*\*\*  
\* ZER \*  
\*\*\*\*\*

Format:

4 BITS	3 BITS	4 BITS
-----		
292	DESTINATION TYPE	DESTINATION NAME
-----		

Function:

The destination array has all its elements cleared to the value 0.

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### CALL EXTERNAL INTRINSIC FUNCTION

\*\*\*\*\*  
 \* EXT.INTRIN.CALL \*  
 \*\*\*\*\*

#### Format:

```

  6 BITS   6 BITS       3 BITS
  -----
  | 23C2 | WHICH | # OF PARAMS |
  -----
  
```

#### Function:

Performs bookkeeping necessary to transfer control to an external intrinsic (such as SIN or COS). Maintenance is performed on the evaluation and control stacks, passing the address of the specified standard destination to the intrinsic. If the requested intrinsic is not in memory then control is returned to the compiler which fetches and fixes up the code from the external intrinsic file.

The "WHICH" field has the following values:

```

2002 - ACOS
2012 - ASIN
2022 - ATN
2032 - ATN2
2042 - COS
2052 - COSH
2062 - COT
2072 - CSC
2082 - EXP
2092 - LOG
20A2 - LOG10
20B2 - LOG2
20C2 - MADD (ARRAY ADD)
20D2 - MDET (DETERMINANT OF MATRIX)
20E2 - MDOT (DOT PRODUCT OF VECTORS)
20F2 - MIMUL (IN PLACE MULTIPLY)
2102 - MINV (INVERSE OF MATRIX)
2112 - MMUL (MATRIX MULTIPLY)
2122 - MSMUL (MULTIPLY ARRAY BY SCALAR VALUE)
2132 - MSUB (ARRAY SUBTRACT)
2142 - PWR (GENERALISED EXPONENTIATION)
2152 - RND
2162 - SEC
  
```

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2172 - SIN  
2182 - SINH  
2192 - TAN  
21A2 - TANH

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CALL USER DEFINED FUNCTION

\*\*\*\*\*  
\* USER.FUNCTION.CALL \*  
\*\*\*\*\*

Format:

6 BITS	16 BITS
-----	
3303	ADDRESS OF FUNCTION CODE
-----	

Function:

Sets up the control stack to point to the result destination, then branches to the function itself.

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**DEBUG FUNCTIONS**

The DEBUG OPS have various functions documented below.

**DEBUG OPS**

\*\*\*\*\*  
\* DEBUG.OPS \*  
\*\*\*\*\*

**Format:**

6 BITS	3 BITS	N BITS
-----		
23F3	VARIANT	VARIANT DEPENDENT DATA
-----		



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ACTIVATE DEBUG

\*\*\*\*\*  
\* ACTIVATE\_DEBUG \*  
\*\*\*\*\*

Format:

3 BITS      1 BIT  
-----  
| 0000 | ON OR OFF BIT |  
-----

Function:

Causes the activation of trace and break OPS. A bit,  
HINTS.DEBUG\_ACTIVE, is set appropriately.

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BREAK EXECUTION

\*\*\*\*\*  
\* BREAK \*  
\*\*\*\*\*

Format:

3 BITS  
-----  
0010

Function:

If the debug system is active then execution of the program is suspended such that execution may be continued.

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HARDWARE MONITOR

\*\*\*\*\*  
\* HARDWARE\_MONITOR \*  
\*\*\*\*\*

Format:

3 BITS      4+ BITS  
-----  
| 00100 | STD.SOURCE |  
-----

Function:

The least significant 8 bits of the 'INTEGERISED' value of the source values are displayed on the hardware back plane as per the hardware monitor features in the other languages.

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SET TRACE

\*\*\*\*\*  
\* TRACE \*  
\*\*\*\*\*

Format:

3 BITS	1 BIT
-----	
00110   ON OR OFF BIT	
-----	

Function:

If the debug system is active then initiate (or discontinue) source statement tracing accordingly.

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SPI\_MONITOR\_START

\*\*\*\*\*  
\* MONITOR START \*  
\*\*\*\*\*

Format:

3 BITS	4+ BITS	4+ BITS
01000	STD.SOURCE	STD.SOURCE

Funtion:

This op activates a particular family/member event for the SPI monitor.

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SPI MONITOR STOP

\*\*\*\*\*  
\* MONITOR STOP \*  
\*\*\*\*\*

Format:

3 BITS	4+ BITS	4+ BITS
1 01010	1 STD.SOURCE	1 STD.SOURCE 1

Function:

This op deactivates a particular family/member event for the SPI monitor.

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SPI MONITOR COUNT

\*\*\*\*\*  
\* MONITOR COUNT \*  
\*\*\*\*\*

Format:

3 BITS	4+ BITS	4+ BITS
01102	STD.SOURCE	STD.SOURCE

Function:

This op causes a particular counter to be incremented in the SPI MONITOR.

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**COMMAND FUNCTIONS**

The particular values of the variants are documented below.

**COMMAND**

\*\*\* NOT MICROCODED \*\*\*

\*\*\*\*\*  
\* COMMAND \*  
\*\*\*\*\*

**Format:**

6 BITS	6 BITS
-----	
03F3	VARIANT   VARIANT DEPENDENT INFORMATION
-----	

**Function:**

The COMMAND OP is used to encode all the command interactions from the remote terminal.



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LOG OFF

\*\*\*\*\*  
\* BYE \*  
\*\*\*\*\*

Format:

6 BITS  
-----  
1 0002 1  
-----

Function:

The user is requesting to log off the BASIC system and cause the compiler to stop run.

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CHANGE FILE NAME

\*\*\*\*\*  
\* CHANGE \*  
\*\*\*\*\*

Format:

6 BITS	80 BITS	80 BITS	80 BITS
0010	FROM FILE NAME	PACK NAME	TO FILE NAME

Function:

The function of this OP is temporary and will probably change in a future release.

The first file name on the pack specified has its name changed to the second file name.

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COMPILE PROGRAM

\*\*\*\*\*  
\* COMPILE \*  
\*\*\*\*\*

Format:

```
      6 BITS      80 BITS      80 BITS  
-----  
1 0020 1 FILE NAME 1 PACK NAME 1  
-----
```

Function:

If both the file and pack names are blank then this OP has a special meaning for in house use only. In this case it will cause any intrinsic code present in the current file to be manipulated into a form suitable for the external intrinsic file and will be written there overwriting whatever function was previously there.

For the file and pack name being non blank the function is currently neither defined nor implemented.

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CONTINUE EXECUTION

\*\*\*\*\*  
\* CONTINUE \*  
\*\*\*\*\*

Format:

6 BITS	1 BIT	1 BIT
3042	PRINT REQUEST	TRACE REQUEST

Function:

The CONTINUE OP causes the current program to be continued from wherever the next instruction pointer points assuming that the program is in a state to be continued. Any fixup required is performed and any syntax errors will terminate the continue request.

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DELETE LINES

\*\*\*\*\*  
\* DELETE \*  
\*\*\*\*\*

Format:

6 BITS	17 BITS	17 BITS
-----		
1 3043 1	FROM LINE NO 1	TO LINE NO 1
-----		

Function:

The lines in the number range specified (inclusive) are deleted from the current workfile. If the line at which the next instruction pointer points is deleted then the workfile may not be 'CONTINUED'.

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INITIATE EDIT MODE

\*\*\*\*\*  
\* EDIT \*  
\*\*\*\*\*

Format:

6 BITS	1 BIT	17 BITS
-----		
1 2052	1	ERRORS FLAG 1 START LINE NO 1
-----		

Function:

This op causes the compiler to enter edit mode on a screen type terminal.

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FILE ATTRIBUTE INQUIRY

\*\*\*\*\*  
\* FILE \*  
\*\*\*\*\*

Format:

6 BITS	80 BITS	80 BITS	80 BITS
3062	PACK NAME	FAMILY NAME	FILE NAME

Function:

Some information on the requested file is displayed on the remote terminal.

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## STATEMENT EDIT

\*\*\*\*\*  
 \* FIX \*  
 \*\*\*\*\*

## Format:

```

  6 BITS      17 BITS      17 BITS
  -----
  | 2072 | FROM LINE NO | TO LINE NO |
  -----

  11 BITS      N BITS
  -----
  | LENGTH SEARCH STRING | SEARCH STRING |
  -----

  11 BITS      N BITS
  -----
  | LENGTH REPLACE STRING | REPLACE STRING |
  -----

```

## Function:

The fix command searches the requested source statements for occurrences of the search string and replaces all occurrences by the replace string. The resulting source statement is recompiled and any errors will be noted at this time.



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LOAD FILE

\*\*\*\*\*  
\* GET \*  
\*\*\*\*\*

Format:

6 BITS	80 BITS	80 BITS	80 BITS
-----			
3083	PACK NAME	FAMILY NAME	FILE NAME
-----			

Function:

The requested file is loaded as the current workfile. This process is analagous to a compilation process and any syntax errors in statements will be described on the remote terminal.

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HALT

\*\*\* NOT YET IMPLEMENTED \*\*\*

\*\*\*\*\*  
\* HALT \*  
\*\*\*\*\*

Format:

6 BITS

-----  
1 2092 1

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LOG ON

\*\*\*\*\*  
\* HELLO \*  
\*\*\*\*\*

Format:

6 BITS	80 BITS	80 BITS	80 BITS
30A2	ACTUAL KEY WORD	USER CODE	PASSWORD

Function:

The actual key word can be either 'US', 'USER' or 'HELLO'. It is used in any error message generated. An attempt is made to log on the user with the specified usercode and password and a workfile is sought so that a previous session may be recovered. The usercode and password are verified against the MCP usercode file if the BASIC system is using the usercode system.

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LIST PROGRAM STATEMENTS

\*\*\*\*\*  
\* LIST \*  
\*\*\*\*\*

Format:

6 BITS	17 BITS	17 BITS	1 BIT
-----			
3093	FROM LINE NO	TO LINE NO	PRINT BIT
-----			

Function:

The requested portion of the current workfile is listed on the terminal unless the print bit is set, in which case a printer backup file will be created at the host site.

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INITIALISE FILE

\*\*\*\*\*  
\* MAKE \*  
\*\*\*\*\*

Format:

6 BITS    80 BITS  
-----  
| 20C3 | FILE NAME |  
-----

Function:

The MAKE OP checks for the pre-existence of a file with the specified name and if not present then makes an empty workfile with the specified name.

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MERGE SOURCE STATEMENTS

\*\*\*\*\*  
\* MERGE \*  
\*\*\*\*\*

Format:

6 BITS	17 BITS	17 BITS	240 BITS
-----			
30D3	FROM LINE NO	TO LINE NO	PACK,FAMILY,FILE
-----			

Function:

The requested inclusive range of lines from the file are merged into the current workfile. If an already existing line would be overwritten then it is.

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PAGE

\*\*\* NOT YET IMPLEMENTED \*\*\*

\*\*\*\*\*  
\* PAGE \*  
\*\*\*\*\*

Format:

6 BITS

-----  
| 0000 | TO BE DEFINED |  
-----

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CHANGE PASSWORD

\*\*\*\*\*  
\* PASSWORD \*  
\*\*\*\*\*

Format:

```
  6 BITS   80 BITS  
-----  
| 20F2 | NEW PASSWORD |  
-----
```

Function:

The password for the current user is changed in the MCP usercode file.



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PROFILE

\*\*\* NOT YET IMPLEMENTED \*\*\*

\*\*\*\*\*  
\* PROFILE \*  
\*\*\*\*\*

Format:

6 BITS

-----  
| 3103 | TO BE DEFINED |  
-----

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RENAME EXTERNAL FILE

\*\*\*\*\*  
\* RENAME \*  
\*\*\*\*\*

Format:

6 BITS	80 BITS	80 BITS	80 BITS
0110	FROM FILE NAME	PACK NAME	TO FILE NAME

Function:

The FROM FILE on the requested pack is renamed as the TO FILE name. A change MCP control instruction is zipped.

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RENUMBER SOURCE STATEMENTS

\*\*\*\*\*  
\* RENUMBER \*  
\*\*\*\*\*

Format:

6 BITS	17 BITS	17 BITS	17 BITS	17 BITS
0123	FROM LINE NO	TO LINE NO	START	INCREMENT

Function:

The specified line number range of the workfile is renumbered according to the start and increment values. All references to lines in the renumbered range are updated and any unresolved reference must remain unresolved.

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 SANTA BARBARA PLANT

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 81000 IBASIC S-LANGUAGE  
 P.S. 2228 3410 (C)

INITIATE PROGRAM EXECUTION

\*\*\*\*\*  
 \* RUN \*  
 \*\*\*\*\*

Format:

6 BITS	17 BITS	1 BIT	1 BIT
-----			
2132	FROM LINE NO	PRINT REQUEST	TRACE REQUEST
-----			

Function:

The program in the current workfile is checked for syntax errors and, if none, the program begins execution at the requested line number. If the print bit is on then output from the print statement will be duplicated on a printer backup file at the host site. If the trace bit is on then source level tracing is initiated. All data values are cleared to either zero or the null string according to their type.

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SAVE SOURCE STATEMENTS

\*\*\*\*\*  
\* SAVE \*  
\*\*\*\*\*

Format:

```
6 BITS   80 BITS   80 BITS   1 BIT
-----
1 3143 1 FILE NAME 1 PACK NAME 1 CANDE BIT 1
-----
```

Function:

The file name and pack name specify the name of the source file to be created from the workfile. (The family name of the file will be the current usercode.) If the CANDE bit is set then the line numbers in each source line will be forced to be 5 digits long (by appending some leading zeros if necessary). If the resulting source line exceeds 80 characters then the save will be terminated with an indication of the line(s) that are incompatible with CANDE.

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CLEAR FILE

\*\*\*\*\*  
\* SCRATCH \*  
\*\*\*\*\*

Format:

6 BITS	80 BITS	80 BITS
3153	FILE NAME	PACK NAME

Function:

The specified file will be removed from the disk directory. If both the file name and pack name are blank then the current workfile is purged. If there is no current workfile then the BASIC environment will be cleared.

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INITIATE SEQUENCE MODE

\*\*\*\*\*  
\* SEQUENCE \*  
\*\*\*\*\*

Format:

6 BITS	17 BITS	17 BITS
-----		
0160	START LINE NO	INCREMENT
-----		

Function:

This op causes the compiler to enter sequence mode for a screen type terminal.

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SINGLE STEP EXECUTION

\*\*\*\*\*  
\* STEP \*  
\*\*\*\*\*

Format:

```
  6 BITS  
-----  
 1 2172 1  
-----
```

Function:

If the current workfile is in a state such that execution may continue then the program is checked for syntax errors (if necessary) and the next statement is executed. Program execution stops after this one statement is executed. A series of step commands will cause single step execution of the program.



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TEACH FUNCTION

\*\*\*\*\*  
\* TEACH \*  
\*\*\*\*\*

Format:

```
6 BITS    80 BITS  
-----  
| 2182 | TEACH OBJECT |  
-----
```

Function:

A syntax diagram of the requested teach object is displayed on the remote terminal.

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CHANGE WORKFILE NAME

\*\*\*\*\*  
\* TITLE \*  
\*\*\*\*\*

Format:

```
6 BITS    80 BITS
-----
| 0190 | FILE NAME |
-----
```

Function:

The name associated with the current workfile is changed to the given file name.

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INITIATE SINGLE STEP EXECUTION

\*\*\*\*\*  
\* WALK \*  
\*\*\*\*\*

Format:

6 BITS      17 BITS  
-----  
I 21A2 I FROM LINE NO I  
-----

Function:

Single step program execution from the requested line number is initiated. All defined data values are cleared to the value 0 (for numeric variables) or to the null string value "" (for string variables). Any syntax errors in the program will be detected at this time.

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ENVIRONMENT STATUS INQUIRY

\*\*\*\*\*  
\* WHAT \*  
\*\*\*\*\*

Format:

6 BITS  
-----  
! 2182 !  
-----

Function:

The status of the BASIC environment is displayed on the remote terminal.

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PROGRAM EXECUTION INQUIRY

\*\*\*\*\*  
\* WHERE \*  
\*\*\*\*\*

Format:

```
  6 BITS    2 BITS  
-----  
|  @10@ | VARIANT |  
-----
```

Function:

The WHERE OP displays on the remote terminal the status of the next instruction pointer. If the variant has the value @01@ then the wraparound trace of execution history is displayed on the remote terminal. If the variant is @10@ then the stack of user defined function and gosub calls is displayed on the remote terminal. The variant value @11@ is reserved.

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CROSS REFERENCE

\*\*\*\*\*  
 \* XREF \*  
 \*\*\*\*\*

Format:

6 BITS	4+ BITS	17 BITS	17 BITS
-----			
I	3102	I SEARCH OBJECT	I FROM LINE NO 1 TO LINE NO 1
-----			

Function:

The XREF OP searches the specified range of line numbers in the current workfile for occurrences of the specified object. The source line containing the object is displayed on the remote terminal.

The search object is encoded as follows:

4 BITS	
-----	
I	TYPE I TYPE DEPENDENT INFORMATION I
-----	

202	THROUGH	9 BIT DATA VARIABLE NAME.
252		
262	17 BIT LINE NUMBER.	
272	34 BIT LINE NUMBER RANGE (2*17).	
282	11 BIT LENGTH OF FOLLOWING STRING (WHICH IS THIS NUMBER OF BITS LONG).	
292	THROUGH	RESERVED.
3F2		

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