

/**** FOCAL 5/69 ****

/E.A.TAFT - REVISION OF FOCALW 8/68

/EAT/ 25-JUL-72

/ASSEMBLY INSTRUCTIONS FOR DECUS VERSION:

/INPUT FILES:

```
/      FOCAL.569      FOCAL LANGUAGE PROCESSOR
/      FLOAT.569      FLOATING POINT PACKAGE
/      EXTEND.569      EXTENDED FUNCTION PACKAGE
/      2USER.569      2-USER OVERLAY
```

/ASSEMBLY USING PAL10 V.141

```
/      .R PAL10
/      *FOCAL.BIN@FOCAL.569,FLOAT.569
/      *EXTEND.BIN@EXTEND.569
/      *2USER.BIN@2USER.569
/      *AC
/      .R PIP
/      *FOCAL.BIN/B@FOCCAL.BIN,EXTEND.BIN,2USER.BIN
/      *PTP:/I@FOCAL.BIN
```

/WHEN READ-IN ON A PDP-8, THE LOADER WILL STOP 3 TIMES. THE FIRST
/ SECTION CONTAINS THE BASIC PROCESSOR AND FLOATING POINT PACKAGE
/ THE SECOND SECTION CONTAINS THE EXTENDED FUNCTIONS. THE LAST
/ SECTION CONTAINS THE 2-USER OVERLAY (REQUIRES 2 TERMINALS AND 8

K).

EXPUNGE

/PROCESSOR INSTRUCTIONS

0000 FIXMRI AND=0000
1000 FIXMRI TAD=1000
2000 FIXMRI ISZ=2000
3000 FIXMRI DCA=3000
4000 FIXMRI JMS=4000
5000 FIXMRI JMP=5000

/FLOATING POINT INSTRUCTIONS

0000 FIXMRI FPW=0000
1000 FIXMRI FAD=1000
2000 FIXMRI FSB=2000
3000 FIXMRI FMY=3000
4000 FIXMRI FDV=4000
5000 FIXMRI FGT=5000
6000 FIXMRI FPT=6000

7000 FNR=7000
0000 FEXT=0
4407 FENT=JMS I 7
7000 NOP=7000
7200 CLA=7200
7100 CLL=7100
7040 CMA=7040
7004 RAL=7004
7020 CML=7020
7010 RAR=7010
7012 RTR=7012
7006 RTL=7006
7001 IAC=7001
7500 SMA=7500
7440 SZA=7440
7510 SPA=7510
7450 SNA=7450
7420 SNL=7420
7430 SZL=7430
7410 SKP=7410
7041 CIA=7041
6001 ION=6001
6002 IOF=6002
6031 KSF=6031
6036 KRB=6036
6041 TSF=6041
6042 TCF=6042
6044 TPC=6044
6046 TLS=6046
6011 RSF=6011
6012 RRB=6012
6014 RFC=6014

FIXTAB

/ * FOCAL * - BY RICK MERRILL - FOR THE FAMILY OF 8.
/REVISED BY EDWARD TAFT 5/69

/MISCELLANEOUS ITEMS

*1

00001	5402	JMP I .+1	/INTERRUPT PROCESSOR ENTRY
00002	2603	INTRPT	
00003	7477	MINUSA, -301	/CONSTANT
00004	0000	FMESW, 0	/USED FOR CALCULATING SIGNS
00005	0013	P13, 13	/CONSTANT
00006	0100	C100, 100	/CONSTANT
00007	6600	FPNT	/ADDRESS OF FLOATING POINT INTERPRETER.

/AUTO-INDEX REGISTERS

00010	0000	AXIN, 0	/STORAGE INDEX
00011	0000	XRT, 0	/EXTRA XR
00012	0000	XRT2, 0	/EXTRA XR
00013	0000	PDLXR, 0	/PUSHDOWN LIST INDEX REGISTER.
00014	3377	FLTXR, IOBUF-1	/XR15 FOR FLOATING POINT
00015	0200	C200, 200	/CONSTANT
00016	0000	XRT3, 0	/USED BY PUSHDOWN LIST CONTROLS

0017 TEXTP=, /TEXT POINTERS

00017	3430	AXOUT, FRSTX	/OUTPUT INDEX
00020	0000	XCT, 0	/UNPACK SWITCH
00021	0000	GTEM, 0	/UNPACK STORAGE

/NUMBERS

00022	0256	PER, 256	/PERIOD
00023	7701	M77, -77	/RIGHT MASK
00024	7600	P7600, 7600	/GROUP MASK
00025	7760	M20, -20	/CONSTANT
00026	0177	P177, 177	/STEP MASK
00027	5577	BOTTOM, DBCONV-1	/END OF TEXT BUFFER
	4430	FLOAT= JMS I .	/FLOAT C(AC) SUBROUTINE
00030	7332	XFLOAT	
00031	0017	P17, 17	/BCD MASK
00032	0277	P277, 277	/"?"
00033	0240	C240, 240	/SPACE
00034	7776	M2, -2	/CONSTANT
00035	0002	P2, 2	/CONSTANT
00036	0260	C260, 260	/ASCII FOR ZERO
00037	0000	HINBUF, 0	/HIGH SPEED INPUT BUFFER

```

00040 0040 FLOP=. /FLOATING OPERAND STORAGE
00040 0000 FLOP0, 0
00041 0000 FLOP1, 0
00042 0000 FLOP2, 0
00043 0000 FLOP3, 0
00044 0044 FLAC=. /FLOATING POINT ACCUMULATOR
00044 0000 FLAC0, 0
00045 0000 FLAC1, 0
00046 0000 FLAC2, 0
00047 0000 FLAC3, 0
00050 4450 NEGATE= JMS I . /NEGATE FLAC ROUTINE
00050 6676 NEGAC
00051 0010 TODDIG, 10 /TOTAL DIGITS IN OUTPUT FIELD
00051 4452 FIX= JMS I . /FIX FLAC ROUTINE
00052 7311 XFIX
00053 0000 TABCTR, 0 /CARRIAGE INDEX

```

/CONSTANTS

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00054 0054 LIST6=. /INPUT LIST FOR "SFOUND".
00054 0337 P337, 337 /LEFT ARR
00055 0214 214 /F.F.
00056 0207 207 /BELL
00057 0212 CLF, 212 /L.F.
00060 0260 LIST3=. /EXCRETION LIST
00060 0215 CCR, 215 /LIST BRANCHER.
00061 0000 0 /SEARCH CHARACTER (VARIABLE)

00062 0062 M100=.
00062 7700 P7700, 7700 /LEFT MASK
00063 7540 M240, -240 /SPACE TEST
00064 7522 MPER, -256 /PERIOD TEST
00065 7563 MCR, -215 /C.R. TEST
00066 0066 MFLT=. /3-WORD FLOATING POINT
00066 7775 M3, -3
00067 7773 M5, -5 /PAREN TEST
00070 7767 M11, -11 /PAREN TEST
00071 0077 P77, 77 /RIGHT MASK

00072 6170 FOUTPUT, BD CONV /FLOATING OUTPUT
00073 5600 FINPUT, DB CONV /FLOATING INPUT
00074 2527 COMBUF, COMEIN /COMMAND BUFFER START
00075 3420 CFRS, FRST /ADDRESS OF DUMMY LINE.
00076 3432 END, BUF BEG /FIRST LOCATION USED.
00077 3432 ENDT, BUF BEG /START OF STORAGE AREA **
00100 5500 RETURN= JMP I . /FUNCTION RETURN
00100 2056 EFUN3I, EFUN3

```

/NEW INSTRUCTIONS:

00101	4501	PUSHJ=JMS I .	/RECURSIVE SUBROUTINE CALL
	0523	XPUSHJ	
	1413	POPA=TAD I PDLXR/RESTORE AC	
	5502	POPJ=JMP I .	/SUBROUTINE RETURN
00102	1556	XPOPJ	
	4503	PUSHA=JMS I .	/SAVE AC
00103	0501	XPUSHA	
	4504	PUSHF=JMS I .	/SAVE GROUP OF DATA
00104	0532	PD2	
	4505	POPF=JMS I .	/RESTORE GROUP
00105	0550	PD3	
	4506	GETC=JMS I .	/UNPACK A CHARACTER
00106	2315	UTRA	
	4507	PACKC=JMS I .	/PACK A CHARACTER
00107	3023	PACBUF	
	4510	SORTJ=JMS I .	/SORT AND BRANCH ON AC OR CHAR
00110	1333	SORTB	
	4511	SORTC=JMS I .	/SORT CHAR
00111	0733	XSORTC	
	4512	PRINTC=JMS I .	/PRINT AC OR CHAR
00112	2477	OUT	
	4513	READC=JMS I .	/READ ASR-33 INTO CHAR AND PRINT IT
00113	2463	CHIN	
	4514	PRTLN=JMS I .	/PRINT C(LINENO)
00114	6151	XPRNTLN	
	4515	GETLN=JMS I .	/UNPACK AND FORM A LINENUMBER
00115	0312	XGETLN	
	4516	FINDLN=JMS I .	/SEARCH FOR A GIVEN LINE
00116	2265	XFIND	
	4517	ENDLN=JMS I .	/INSERT LINE POINTERS
00117	2417	XENDLN	
	4520	RTL6=JMS I .	/ROTATE LEFT SIX
00120	0305	XRTL6	
	4521	SPNOR=JMS I .	/IGNORE SPACES AND LEADING ZEROS
00121	1524	XSPNOR	
	4522	TESTN=JMS I .	/PERIOD; OTHER; NUMBER
00122	1533	XTESTN	
	4523	TSTLPR=JMS I .	/SKIP IF 5<SORTCN<= 11 (I.E. AN L-PAR)
00123	2077	LPRTST	
	4524	TSTGRP=JMS I .	/SKIP IF G(AC) = G(LINENO)
00124	2451	GRPTST	
	4525	TESTC=JMS I .	/TERM; NUMBER; FUNCTION; LETTER
00125	0713	XTESTC	
	4526	ERROR=JMS I .	/GENERAL ERROR ROUTINE
00126	2736	ERR2	

00127	0000	SORTCN, 0	/NUMBER IN TABLE FROM SORTC
00130	0000	LASTOP, 0	/LAST OPERATION FOR EVAL
	0131	EFOP=.	/FUNCTION CODE.
00131	0000	ATSW, 0	/ASK-TYPE SWITCH
00132	7760	CNTR, -20	/DELETE AND ERROR COUNTER(USED BY F.P. ALSO)
00133	0004	DECP, 4	/NUMBER OF DECIMAL POINTS
	0134	STARTV=.	/=END FOR 8K
00134	3432	BUFR, BUFBE	/NEXT LOCATION IN BUFFER = LAST LOCATION OF TEXT.
00135	0000	ADD, 0	/CHAR BUF INPUT
00136	0000	XCTIN, 0	/PACK SWITCH
00137	2675	OUTDEV, XOUTL	/OUTPUT SUBROUTINE
00140	2665	INDEV, XI33	/INPUT SUBROUTINE
00141	0001	NAGSW, 0001	/NOT ALL AND/OR GROUP SWITCH (4000=ONE;1=ALL;0=GROU
00142	0215	CHAR, 215	/THE MOST IMPORTANT REGISTER
00143	0000	LINENO, 0000	/LINE NUMBER READ BY GETLN
00144	0005	GINC, 5	/WORDS TO STORE 1 VARIABLE
00145	1575	PC, FLTZER	/PROGRAM COUNTER
00146	0000	THISLN, 0	/LINE POINTER FROM 'FINDLN'
00147	0000	THISOP, 0	/CURRENT 'EVAL' OPERATION
00150	0000	LASTLN, 0	/BACK POINTER FROM 'FINDLN'
00151	0001	DEBGSW, 1	/DEBUG SWITCH ; NON-ZERO FOR LITERAL.
00152	0001	DMPST, 1	/=0 FOR TRACE ON.
00153	0000	PACKST, 0	/RUBOUT PROTECTION
00154	0000	PT1, 0	/VARIABLE POINTER
00155	3432	LASTV, BUFBE	/ADDRESS OF LAST VARIABLE
00156	0000	T1, 0	/TEMPORARY REGISTER - MAIN
00157	0000	T2, 0	/TEMP REGISTER - FOR NEW INST. ROUTINES.
00160	2034	FLARGP, FLARG	/DATA ADDRESS
00161	2463	PTCH, CHIN	/GENERAL CHARACTER INPUT ROUTINE.
			/USED BY NEW FLOATING PT. PACKAGE
00162	0000	TEMP1, 0	
00163	0000	TEMP2, 0	
00164	0000	TEMP3, 0	
	4565	TSTERM= JMS I .	/TEST FOR ,;CR
00165	2514	XTSTERM	/RETURNS: OTHER, ; OR CR, COMMA
	0006	DIGITS=6	/SIGNIFICANT DIGITS

/FOCAL'S COMMAND/INPUT DRIVER

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00176 0176 *176
00176 3432 BEGIN / (RECOVR+1 AFTER INITIALIZATION)
00177 7610 START, SKP CLA / PROGRAM START FROM SELF
00200 5576 JMP I .-2 / CONSOLE START: SW=200.
00201 1227 TAD CFRSX / (PC) => 0
00202 3145 DCA PC / FOR COMMAND MODE
00203 3151 DCA DEBGSW / ENABLE TRACE FOR INPUT OF (?).
00204 1226 TAD COMBOT / PROTECT COMMAND BUFFER.
00205 3013 DCA PDLXR / NO PATCH TEST.
00206 2152 ISZ DMP SW / INIT UNPACK AND TRACE SWITCH.
00207 3061 DCA LIST3+1 / CLEAR SEARCH CHARACTER FOR INPUT.
00210 1054 TAD P337 / ANNOUNCE PRESENCE
00211 4512 PRINTC / BY TYPING THE LEAD-IN CHARACTER
00212 1074 IBAR, TAD COMBUF / INITIALIZE COMMAND BUFFER
00213 3010 DCA AXIN / FOR UNPACKING.
00214 3136 DCA XCTIN
00215 1074 TAD COMBUF / RUBOUT PROTECTION
00216 3153 DCA PACKST
00217 4513 IGNOR, READC / READ COMMAND STRING
00220 4510 SORTJ
00221 0053 LIST6-1
00222 0510 INLIST-LIST6
00223 4507 PACKC / SAVE STRING CHARACTER.
00224 5217 JMP IGNOR

/////
00225 4000 P4000, 4000 / LINE NUMBER TEST
00226 2612 COMBOT, COMOUT+12 / END OF COMMAND BUFFER, LESS PROTECTION COUN
00227 1575 CFRSX, FLTZER / POINTER FOR PC=COMMAND OR INPUT
/////

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/COMMAND/INPUT PROCESSOR

00230	4507	IRETN,	PACKC	/START TO PACK C.R.
00231	4507		PACKC	/FINISH C.R.
00232	1074		TAD COMBUF	/INITIALIZE "TEXT"
00233	3017	GONE,	DCA AXOUT	/SETUP CURRENT LINE
00234	3020		DCA XCT	
00235	4506		GETC	/READ FIRST CHARACTER.
00236	1027		TAD BOTTOM	/INIT PUSH-DOWN-LIST
00237	3013		DCA PDLXR	
00240	4521		SPNOR	/IGNORE LEADING BLANKS
00241	4522		TESTN	/DOES THE LINE BEGIN WITH 1-9?
00242	4526		ERROR4	/ILLEGAL GROUP ZERO USAGE
00243	5274		JMP INPUTX	/NO
00244	6002		IOF	/YES, STOP INPUT MOMENTARILY.
00245	2151		ISZ DEBSW	/DISABLE TRACE FOR REPACKING
00246	4515		GETLN	/READ THIS LINE NUMBER
00247	1141		TAD NAGSW	
00250	1225		TAD P4000	/TEST FOR SINGLE LINE
00251	7640		SZA CLA	
00252	4526		ERROR3	/ILLEGAL LINE NUMBER ON INPUT
00253	1134		TAD BUFR	/SET POINTERS
00254	3010		DCA AXIN	
00255	3136		DCA XCTIN	
00256	1143		TAD LINENO	/SAVE LINE #
00257	3410		DCA I AXIN	/(X-MEM)
00260	4521		SPNOR	/IGNORE SPACES AFTER LINE NUMBER
00261	7410		SKP	
00262	4506		GETC	/READ 1ST AFTER LINENO TERMINATOR.
00263	4507		PACKC	/SAVE TEXT AND RESTORE DATA FIELD
00264	1142		TAD CHAR	/TEST FOR END OF INPUT STRING
00265	1065		TAD MCR	
00266	7640		SZA CLA	
00267	5262		JMP .-5	
00270	4501		PUSHJ	/REMOVE OLD LINE, IF ANY.
00271	2111			
00272	4517		ENDLN	/INSERT NEW LINE
00273	5177		JMP START	
/////				
00274	4501	INPUTX,	PUSHJ	/PROCESS IMMEDIATE COMMAND.
00275	0616			
00276	1545		PROC	
00277	7450		TAD I PC	/CHECK NEXT LINE (X-MEM)
00300	5177		SNA	/END OF PROGRAM?
00301	3145		JMP START	/YES
00302	1145		DCA PC	/SAVE NEW LINE NO.
00303	7001		TAD PC	/START NEW LINE
00304	5233		IAC	
			JMP GONE	/PROCESS OTHER COMMANDS
/TEXT LINE BUFFER FORMAT*				
/ #1 : POINTER OR ZERO IN LAST				
/ #2 : LINENO				
/ #3 - #N+1 : TEXT				
/ #N : C.R.				

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00305 0000 XRTL6, 0 /ROTATE AC LEFT 6
00306 7106 CLL RTL
00307 7006 RTL
00310 7006 RTL
00311 5705 JMP I XRTL6

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/
/PROCESS A LINE NUMBER - "GETLN"
XGETLN, 0

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00312 0000 SPNOR
00313 4521 TAD P4000 /INITIALIZE TO SINGLE LINE
00314 1225 DCA NAGSW
00315 3141 SORTC /TEST FOR A SIGN
00316 4511 SNLIST-1
00317 6114 JMP EVLN /EVALUATE IN FLOATING POINT
00320 5370 JMS I INPINT /FIXED POINT: GET GROUP
00321 4766 TESTN
00322 4522 GETC /GO PAST . IF THERE
00323 4506 JMS GEG /GET 1ST STEP DIGIT
00324 4356 CLL RTL /MULTIPLY BY TEN
00325 7106 TAD SORTCN
00326 1127 RAL
00327 7004 JMS GEG /GET 2ND STEP DIGIT
00330 4356 TAD LINENO /COMBINE
00331 1143 GEXIT, SNA
00332 7450 DCA NAGSW /MUST BE GROUP
00333 3141 DCA LINENO /SAVE STEP NUMBER
00334 3143 TAD DECNUM /GROUP
00335 1164 SNA
00336 7450 JMP GTESTA /GROUP 0: MUST BE "ALL"
00337 5347 RTL6 /CONSTRUCT LINE NUMBER
00340 4520 RAL
00341 7004 TAD LINENO
00342 1143 DCA LINENO
00343 3143 TAD DECNUM
00344 1164 AND C7760 /TEST FOR LEGAL GROUP
00345 0367 JMP .+3
00346 5351 GTESTA, ISZ NAGSW /SET TO "ALL"
00347 2141 TAD LINENO /MAKE SURE LINE # IS ZERO
00350 1143 SNA CLA
00351 7650 TESTN /OK, TEST FOR EXTRA DIGITS
00352 4522 JMP LNERR /DOUBLE ., ILLEGAL G. 0, OR G.>15
00353 5361 JMP I XGETLN /OK
00354 5712 JMP LNERR /TOO MANY DIGITS
00355 5361

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00356 0000 GEG, 0 /GET A STEP DIGIT
00357 3143 DCA LINENO
00360 4522 TESTN
00361 4526 LNERR, ERROR /DOUBLE PERIODS
00362 5331 JMP GEXIT-1 /NO DIGIT
00363 4506 GETC /DIGIT, PASS IT
00364 1127 TAD SORTCN /EXIT WITH VALUE
00365 5756 JMP I GEG

/////
00366 6010 INPINT, DECINT
00367 7760 C7760, 7760
/////
/EVALUATE A LINE NUMBER IN FLOATING POINT
00370 4501 EVLN, PUSHJ /GET VALUE
00371 1601 EVAL
00372 4452 FIX /GET GROUP #
00373 4503 PUSHA
00374 1045 TAD FLAC1
00375 7640 SZA CLA
00376 5361 JMP LNERR /TOO BIG
00377 4407 FENT /GET STEP #
00400 7000 FNR
00401 2560 FSB I FLARGP /THIS GIVES -(FRACTIONAL PART)
00402 3614 FMY I F10P
00403 3614 FMY I F10P
00404 2615 FSB I FP10P /KILL ANY ROUNDOFF ERROR
00405 0000 FEXT
00406 4450 NEGATE
00407 1413 POPA /RESTORE GROUP
00410 3164 DCA DECNUM
00411 4452 FIX
00412 5613 JMP I .+1
00413 0332 GEXIT

/////
00414 5770 F10P, FLTEN
00415 5773 FP10P, FLPTEN

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/RANGE OF ACCEPTIBLE LINE NUMBERS = 1.01 TO 15.99

/NAGSW:
 /GROUP=0000
 /LINE=4000
 /ALL=0001

/RECURSIVE OPERATE, EXECUTE, OR CALL

00416	4515	DO,	GETLN	/EXECUTE ONE LINE, A GROUP, OR ALL
00417	1145		TAD PC	/SAVE ADDRESS
00420	4503		PUSHA	/OF CURRENT LINE
00421	4504		PUSHF	/SAVE REST OF THIS LINE
00422	0017		TEXTPT	/ADDRESS OF TEXT POINTERS
00423	4504	DGRP,	PUSHF	/SAVE NAGSW, CHAR, AND LINENO.
00424	0141		NAGSW	
00425	1141		TAD NAGSW	/CHECK DATA FROM GETLN.
00426	7710		SPA CLA	/SKIP IF GROUP OR ALL
00427	5254		JMP DOONE	/DO ONE LINE
00430	4516		FINDLN	/INIT FOR GROUP AND SET THISLN
00431	5273		JMP TGRP2	
00432	4501	DGRP1,	PUSHJ	/EXECUTE OBJECT LINE AND SET PC.
00433	0613		PROCESS-2	
00434	4505		POPF	/RESTORE THE DATA
00435	0141		NAGSW	
00436	1545		TAD I PC	/CHECK FOR END OF TEXT (X-MEM)
00437	7450		SNA	
00440	5262		JMP DCONT	/ALL DONE
00441	7001		IAC	
00442	3154		DCA PT1	/SAVE POINTER TO LINENO
00443	1141		TAD NAGSW	/CHECK FOR GROUP
00444	7740		SMA SZA CLA	
00445	5251		JMP .+4	/DO ALL
00446	1554		TAD I PT1	/TEST GROUP (X-MEM)
00447	4524		TSTGRP	
00450	5262		JMP DCONT	/NOT IN GROUP
00451	1554		TAD I PT1	/READ NEXT LINE NO. (X-MEM)
00452	3143		DCA LINENO	
00453	5223		JMP DGRP	/CONTINUE THE SUBROUTINE
/////				
00454	4516	DOONE,	FINDLN	/FIND THE LINE
00455	4526		ERROR2	/NO SUCH LINE NUMBER
00456	4501		PUSHJ	/EXECUTE IT
00457	0615		PROCESS	
00460	4505		POPF	/RESTORE CHAR
00461	0141		NAGSW	
00462	4505	DCONT,	POPF	/RESTORE TEXT POINTERS
00463	0017		TEXTPT	
00464	1413		POPA	/RESTORE ADDRESS OF CURRENT LINE.
00465	3145		DCA PC	
00466	4505		TSTERM	/GO TO TERMINATOR
00467	5266		JMP .-1	
00470	5672		JMP I .+2	/END OF DO, CONTINUE PROCESSING
00471	5216		JMP DO	/COMMA, DO ANOTHER
00472	0616		PROC	

00473	1146	TGRP2,	TAD THISLN	/TEST FOR GOOD GROUP NUMBER.
00474	3011		DCA XRT	
00475	1411		TAD I XRT	
00476	4524		TSTGRP	
00477	4526		ERROR2	/NO SUCH GROUP NUMBER
00500	5232		JMP DGRP1	

/PUSHDOWN LIST CONTROLS

/

00501	0000	XPUSHA, 0	/PUSHDOWN THE AC - "PUSHA"
00502	3332	DCA PD2	/SAVE AC
00503	7040	CMA	/BACK UP POINTER
00504	4310	JMS PCHK	/CHECK CORE USAGE
00505	1332	TAD PD2	
00506	3416	DCA I XRT3	/SAVE
00507	5701	JMP I XPUSHA	

/////

PCHK,

00510	0000	0	
00511	1013	TAD PDLXR	/INC IN AC
00512	3013	DCA PDLXR	
00513	1013	TAD PDLXR	
00514	3016	DCA XRT3	/DUPLICATE POINTER
00515	1013	TAD PDLXR	
00516	7141	CLL CIA	
00517	1155	TAD LASTV	
00520	7630	SZL CLA	
00521	4526	ERROR	/STORAGE FILLED BY PUSHDOWN LIST
00522	5710	JMP I PCHK	

/////

XPUSHJ,

00523	0000	0	/RECURSIVE SUBROUTINE CALL - "PUSHJ"
00524	7201	CLA IAC	
00525	1323	TAD XPUSHJ	/SAVE RETURN
00526	4301	JMS XPUSHA	/(PUSHA)
00527	1723	TAD I XPUSHJ	/TO NEW ROUTINE
00530	3323	DCA XPUSHJ	
00531	5723	JMP I XPUSHJ	

/////

PD2,

00532	0000	0	/SAVE A FLOATING PT NUMBER - "PUSHF"
00533	7240	CLA CMA	/COMPUTE ADDRESS
00534	1732	TAD I PD2	
00535	3011	DCA XRT	
00536	2332	ISZ PD2	
00537	1066	TAD M3	/BACKUP THREE
00540	4310	JMS PCHK	
00541	1411	TAD I XRT	/SAVE 3 WORDS
00542	3416	DCA I XRT3	
00543	1411	TAD I XRT	
00544	3416	DCA I XRT3	
00545	1411	TAD I XRT	
00546	3416	DCA I XRT3	
00547	5732	JMP I PD2	


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00550 0000 PD3, 0 /RESTORE A FLOATING PT # = "POPF"
00551 7240 CLA CMA
00552 1750 TAD I PD3
00553 2350 ISZ PD3
00554 3011 DCA XRT
00555 1413 TAD I PDLXR
00556 3411 DCA I XRT
00557 1413 TAD I PDLXR
00560 3411 DCA I XRT
00561 1413 TAD I PDLXR
00562 3411 DCA I XRT
00563 5750 JMP I PD3

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/

/INPUT CONTROL CHARACTERS

```

00564 0212 INLIST, IBAR /B.A.=RESTART
00565 0223 IGNOR+4 /F.F.
00566 0223 IGNOR+4 /BELL
00567 0217 IGNOR /L.F.=IGNORED
00570 0230 IRETN /C.R.=TERMINATE INPUT

```

/

/LIST OF FUNCTION ADDRESSES

```

00571 2053 FNTABF, XABS /ABSOLUTE VALUE
00572 7535 FSGN /SIGN PART
00573 1156 XINT /INTEGER PART
00574 1145 XDYS /FDIS= DISPLAY Y AND INTENSIFY
00575 7351 FRAN /RANDOM NUMBER
00576 1153 XDXS /SET X-COORDINATE FOR DISPLAY
00577 2414 XADC /READ ANALOG-DIGITAL CONVERTER
00600 2735 ERRORS /ATN THESE ROUTINES NOT IN PACKAGE
00601 2735 ERRORS /EXP
00602 2735 ERRORS /LOG
00603 2735 ERRORS /SIN
00604 2735 ERRORS /COS
00605 7462 FSQT /SQUARE ROOT
00606 2735 ERRORS /NEW= USER-DEFINED FUNCTION
/
00607 7472 NF, -306 /USED BY TESTC

```

/PRIMARY CONTROL AND TRANSFER

```

00610 4515 GOTO, GETLN /READ THE LINE NUMBER REQUESTED
00611 4516 FINDLN /LOCATE IT AND RESET TEXTP
00612 4526 ERROR2 /NOT THERE OR A TIGHT LOOP.
00613 1146 TAD THISLN /SET PC
00614 3145 DCA PC
00615 4506 PROCESS,GETC /TEST FOR END OF LINE
00616 4511 PPOC, SORTC /FIRST CHARACTER READY = USE PROC
00617 0057 CCR-1
00620 5502 PC1, POPJ /EXIT "PROCESS"
00621 4511 SORTC /IGNORE SPACE ; ,
00622 1140 GLIST-1
00623 5215 JMP PROCESS
00624 1142 TAD CHAR /SAVE COMMAND CHARACTER
00625 4503 PUSHA
00626 4506 GETC /GO TO TERMINATOR
00627 4511 SORTC
00630 2002 TERMS-4
00631 7410 SKP
00632 5226 JMP .-4
00633 4521 SPNOR
00634 1413 POPA
00635 4510 SORTJ /GO DO COMMAND
00636 0755 COMLST-1
00637 0206 COMGO-COMLST
00640 4526 ERROR2 /ILLEGAL COMMAND

```

/////

```

0620 COMMENTS=PC1 /ALSO IS CONTINUE

```

/OUTPUT COMMAND TEXT

00641	4711	WRITE,	JMS I WTXS	/SAVE CHAR AND TEXT POINTERS
00642	4515		GETLN	/SET LINENO
00643	2151		ISZ DEBGSW	/DISABLE TRACE
00644	4516		FINDLN	/SEARCH FOR LINE NUMBER
00645	5274		JMP WTESTG	/NOT THERE OR GROUP
00646	1143		TAD LINENO	
00647	7640		SZA CLA	
00650	4514		PRNTLN	/PRINT LINE NUMBER AND A SPACE.
00651	4506		GETC	
00652	4512		PRINTC	/PRINT TEXT OF A LINE.
00653	1142		TAD CHAR	
00654	1065		TAD MCR	
00655	7640		SZA CLA	/SKIP IF END OF LINE
00656	5251		JMP .-5	
00657	1546		TAD I THISLN	/TEST FOR END OF TEXT (X-MEM)
00660	7450	WTEST2,	SNA	
00661	5303		JMP WEXIT	/WRITE FINISHED
00662	7001		IAC	
00663	3154		DCA PT1	/SAVE POINTER TO LINENO OF NEXT (X-MEM)
00664	1141		TAD NAGSW	
00665	7700		SMA CLA	
00666	1554		TAD I PT1	/(X-MEM)
00667	4524		TSTGRP	/TRY NEXT LINENO FOR GROUP.
00670	5276		JMP WX	
00671	1554	WALL,	TAD I PT1	/SET LINENO (X-MEM)
00672	3143		DCA LINENO	
00673	5244		JMP WRITE+3	
///				
00674	1146	WTESTG,	TAD THISLN	/INIT GROUP PRINTOUT
00675	5260		JMP WTEST2	
/////				
00676	1141	WX,	TAD NAGSW	
00677	7750		SPA SNA CLA	/SKIP IF ALL
00700	5303		JMP WEXIT	
00701	4512		PRINTC	/PRINT C.R. AGAIN
00702	5271		JMP WALL	
/////				
00703	4712	WEXIT,	JMS I WTXR	/RESTORE CURRENT LINE
00704	3151		DCA DEBGSW	/RESTORE TRACE
00705	4565		TSTERM	
00706	5305		JMP .-1	
00707	5216		JMP PROC	/END OF WRITE
00710	5241		JMP WRITE	/COMMA, MORE TO WRITE
/////				
00711	2435	WTXS,	TXTSV	
00712	2443	WTXR,	TXTR	


```

00713 0000 XTESTC, 0 /TEST THE NATURE OF THE NEXT ALPHANUMERIC - "TESTC"
00714 4521 SPNOR /IGNORE SPACES
00715 4511 SORTC /TEST THE VARIABLE TERMINATORS
00716 2005 TERMS=1
00717 5713 JMP I XTESTC /YES - SORTCN IS SET
00720 2313 ISZ XTESTC
00721 4522 TESTN
00722 5713 JMP I XTESTC /. (PART OF NUMBER)
00723 7410 SKP /OTHER
00724 5713 JMP I XTESTC /NUMBER
00725 1142 TAD CHAR /TEST FOR "F"
00726 1207 TAD MF
00727 7640 SZA CLA
00730 2313 ISZ XTESTC /NO
00731 2313 ISZ XTESTC /RETURNS:
00732 5713 JMP I XTESTC /TERMINATOR;NUMBER;FUNCTION;OTHER

/////
00733 0000 XSORTC, 0 /SORT CHAR AGAINST TABLE - "SORTC"
00734 1733 TAD I XSORTC
00735 3012 DCA XRT2 /1ST ARG IS LIST-1
00736 1412 TAD I XRT2
00737 7510 SPA /LIST IS ENDED BY A NEGATIVE NUMBER
00740 5352 JMP SEXC /2ND EXIT = NOT IN LIST
00741 7041 CIA
00742 1142 TAD CHAR
00743 7640 SZA CLA /COMPARE
00744 5336 JMP .-6
00745 1733 TAD I XSORTC /COMPUTE INCREMENT : 0 - N
00746 7040 CMA
00747 1012 TAD XRT2
00750 3127 DCA SORTCN
00751 7410 SKP /1ST EXIT = YES
00752 2333 SEXC, ISZ XSORTC
00753 2333 ISZ XSORTC
00754 7300 CLA CLL
00755 5733 JMP I XSORTC

```

/COMMAND DECODING LIST

00756	0323	CMLST, 323	/SET
00757	0306	306	/FOR
00760	0311	311	/IF
00761	0304	304	/DO
00762	0307	307	/GOTO
00763	0303	303	/COMMENT OR CONTINUE
00764	0301	301	/ASK
00765	0324	324	/TYPE
00766	0314	314	/LIBRARY
00767	0305	305	/ERASE
00770	0327	327	/WRITE
00771	0315	315	/MODIFY
00772	0321	321	/QUIT
00773	0322	322	/RETURN
00774	0317	317	/OPTION
00775	0310	310	/HELLO

/CONDITIONAL TRANSFER PROCESS

/ IF (EXP) A,B,C

00776	4511	IF,	SORTC	/LOOK FOR L-PAR
00777	1022		PLPR-1	
01000	7410		SKP	
01001	4526		ERROR	/NO (AFTER IF
01002	4501		PUSHJ	/EVALUATE EXPRESSION
01003	1600		EVAL-1	
01004	4506		GETC	/PASS)
01005	1045		TAD FLAC1	/TEST FOR =,0,+
01006	7710		SPA CLA	
01007	5622		JMP I PGOTO	/NEGATIVE, USE 1ST REF
01010	4565		TSTERM	/0 OR POS, GET TO NEXT
01011	5210		JMP .-1	
01012	5703		JMP I PRCP	/) OR CR, CONTINUE SAME LINE
01013	1045		TAD FLAC1	/COMMA, SEE IF 0 OR POS
01014	7650		SNA CLA	
01015	5622		JMP I PGOTO	/ZERO, USE 2ND REF
01016	4565		TSTERM	/POSITIVE, GET TO NEXT
01017	5216		JMP .-1	
01020	5703		JMP I PRCP	/) OR CR
01021	5622		JMP I PGOTO	/COMMA, USE 3RD REF
01022	0610	PGOTO,	GOTO	
01023	0250	PLPR,	250	

/ASSIGNMENT AND LOOP CONTROL

01024	4501	SFT=.	
01024	4501	FOR,	PUSHJ
01025	1404		GETARG
01026	4521		SPNOR
01027	4511		SORTC
01030	2024		TERMS+17-1
01031	7410		SKP
01032	4520		ERROR
01033	1154		TAD PT1
01034	3332		DCA PT2
01035	4501		PUSHJ
01036	1600		EVAL=1
01037	4407		FENT
01040	6732		FPT I PT2
01041	0000		FEXT
01042	4565		TSTERM
01043	4526		ERROR
01044	5703		JMP I PRCP
01045	1332		TAD PT2
01046	4503		PUSHA
01047	4501		PUSHJ
01050	1601		EVAL
01051	4565		TSTERM
01052	4526		ERROR
01053	5317		JMP ONEINC
01054	4504		PUSHF
01055	2034		FLARG
01056	4501		PUSHJ
01057	1601		EVAL
01060	4504	SFINAL,	PUSHF
01061	2034		FLARG
01062	4724		JMS I FTXS
01063	4430		FLOAT
01064	4407	FCONT,	FENT
01065	1732		FAD I PT2
01066	6732		FPT I PT2
01067	2560		FSB I FLARGP
01070	0000		FEXT
01071	1013		TAD PDLXR
01072	1322		TAD PINC
01073	3332		DCA PT2
01074	1732		TAD I PT2
01075	7710		SPA CLA
01076	4450		NEGATE
01077	1045		TAD FLAC1
01100	7740		SMA SZA CLA
01101	5326		JMP FEND

	/GET POINTER TO VAR.
	/SEARCH FOR =
	/LEFT OF = IN ERROR: "FOR" OR "SET"
	/SAVE VARIABLE POINTER
	/EVALUATE INITIAL EXPRESSION
	/SAVE INITIAL VALUE
	/CHECK TERMINATOR
	/PROBABLY EXCESS R-PAR
	/I OR CR: THIS IS A SET; CONTINUE
	/COMMA, SAVE LOOP VAR POINTER
	/EVALUATE SECOND EXPRESSION
	/CHECK TERMINATOR
	/EXCESS R-PAR OR BAD TERMINATOR
	/I OR CR, THAT'S ALL (INC=1)
	/COMMA, SAVE INCREMENT
	/EVALUATE FINAL EXPRESSION
	/SAVE FINAL VALUE
	/SAVE CHAR AND TEXT POINTERS
	/FLOAT A ZERO TO START
	/COMPARE LOOP VAR TO FINAL
	/LOOP VAR
	/FINAL
	/CHECK SIGN OF INCREMENT
	/BACKWARD COUNTING
	/LIMIT REACHED OR EXCEEDED

01102	4501	PUSHJ	/NOT YET, DO OBJECT STATEMENTS
01103	0616	PRCP, PROC	
01104	4725	JMS I FTXR	/RESET TO BEGINNING OF OBJ. STMT.
01105	4505	POPF	/RESTORE LIMIT
01106	2034	FLARG	
01107	4505	POPF	/RESTORE INC
01110	0044	FLAC	
01111	1413	POPA	/RESTORE LOOP VAR POINTER
01112	3332	DCA PT2	
01113	1323	TAD M13	/PUSH DOWN ALL OF ABOVE
01114	1013	TAD PDLXR	
01115	3013	DCA PDLXR	
01116	5264	JMP FCONT	
/////			
01117	4504	ONEINC, PUSHF	/NO INCREMENT GIVEN, SET TO 1
01120	1573	FLTONE	
01121	5260	JMP SFINAL	
/////			
01122	0011	PINC, 11	
01123	7765	M13, -13	
01124	2435	FTXS, TXTSAV	
01125	2443	FTXR, TXTRES	
01126	1005	FEND, TAD P13	/END OF LOOP
01127	1013	TAD PDLXR	/REMOVE VALUES FROM PUSHDOWN LIST
01130	3013	DCA PDLXR	
01131	5522	POPJ	
01132	0000	PT2, 0	
/////			
/ASK/TYPE SPECIAL CHARACTERS			
01133	0246	ALIST, 246	/&
01134	0245	245	/%
01135	0242	242	/"
01136	0241	241	/!
01137	0243	243	/#
01140	0244	244	/\$
01141	0240	GLIST, 240	/SPACE
01142	0254	TLIST, 254	/,
01143	0273	273	/;
01144	0215	215	/C.R.

```

/SET Y AND INTENSIFY THE POINT
01145 4452 XDYS, FIX
01146 6063 6063 /DYL
01147 7200 CLA
01150 1361 TAD X0
01151 6053 6053 /DXL DIX
01152 7410 SKP

/
/SET X
01153 4452 XDYS, FIX
01154 3361 DCA X0 /(DXL)
01155 5500 RETURN

/
/TAKE THE INTEGER PART
01156 4452 XINT, FIX
01157 7200 CLA
01160 5500 RETURN
01161 0000 XP, 0

/////
01162 1252 TLIST3, TASK4 /"
01163 1210 TASK /C.R. - AUTOMATIC QUOTE MATCH

/COMMAND POINTERS
01164 1024 COMGO, SET
01165 1024 FOR
01166 0776 IF
01167 0416 DO
01170 0610 GOTO
01171 0620 COMMENTS
01172 1206 ASK
01173 1207 TYPE
01174 2735 LIBRARY
01175 2226 ERASE
01176 0641 WRITE
01177 1273 MODIFY
01200 0177 START
01201 1554 RETRN
01202 6446 OPTION
01203 3274 HELLO

/////
01204 3040 PACLS2, PQUES
01205 3065 RUB1
```

/INPUT-OUTPUT STATEMENTS

```

01206 7240 ASK, CLA CMA /REMEMBER WHICH CALL.
01207 3131 TYPE, DCA ATSW
01210 3151 TASK, DCA DEBSW /RE-ENABLE THE TRACE
01211 4510 SORTJ /SPECIAL CHARACTER?
01212 1132
01213 0426 ALIST-1
ATLIST-ALIST
01214 2131 ISZ ATSW /TEST QUOTE SWITCH
01215 5227 JMP TYPE2
01216 4501 PUSHJ /DO ASK; SETUP PT1
01217 1404 GETARG
01220 4636 JMS I TTXTS /PROTECT TEXT
01221 1233 TAD COL /TYPE COLON
01222 4512 TASKCL, PRINTC /((CLA) TO SUPPRESS ":"
01223 4626 JMS I INTERP /CALL INPUT CONVERSION ROUTINE
01224 4637 JMS I TTXTR /RESTORE TEXT
01225 5206 JMP ASK /CONTINUE PROCESSING
01226 3306 INTERP, INTASK
/////
01227 4501 TYPE2, PUSHJ /DO TYPE
01230 1601 EVAL
01231 4565 TSTERM
01232 4526 ERROR /BAD TERMINATOR IN "TYPE"
01233 0272 COL, 272
01234 4640 JMS I OUTS /PRINT
01235 5207 JMP TYPE
/////
01236 2435 TTXTS, TXTSAV
01237 2443 TTXTR, TXTRES
01240 3365 OUTS, OUTPT

```



```

01241 2151 TQUOT, ISZ DEBGSW      /DISABLE TRACE
01242 4506      GETC              /TYPE LITERALS
01243 4510      SORTJ
01244 1404      TLIST2=1
01245 7555      TLIST3=TLIST2
01246 4512      PRINTC
01247 5242      JMP TQUOT+1

/////
01250 1060 TCRLF, TAD CCR          /SLASH=CR,LF.
01251 4512      PRINTC
01252 4506 TASK4, GETC            /MOVE TO NEXT CHARACTER
01253 5210      JMP TASK

////
01254 1060 TCRLF2, TAD CCR        /SPLAT=CR
01255 4537      JMS I OUTDEV
01256 1015      TAD C200          /DELAY FOR C.R.
01257 5251      JMP TCRLF+1

/IF DEBGSW=0 : ENABLE FLIP-FLOP "DMPSW"
/      #0: DISABLE AND RETURN ALL"?" I S.
/IF DMPSW = 0: TRACE ON, IF ENABLED
/      #0: TRACE OFF
/IF BOTH = 0 : PRINT TRACE.

01260 4506 TINTR, GETC            /PASS PERCENT SIGN
01261 4672      JMS I INTG        /READ FORMAT CONTROL: "%7.3"
01262 1164      TAD DECNUM        /INTEGER PART (TOTAL DIGITS)
01263 3051      DCA TOTDIG
01264 4522      TESTN            /GET PAST . IF ANY
01265 4506      GETC
01266 4672      JMS I INTG        /RIGHT-HAND PART (DECIMAL PLACES)
01267 1164      TAD DECNUM
01270 3133      DCA DECP
01271 5210      JMP TASK
01272 6010 INTG, DECINT

```

/SEARCH ROUTINES

01273	4515	MODIFY, GETLN	/READ LINE NO.
01274	4516	FINDLN	/LOOK IT UP NOW.
01275	4526	ERROR2	/NOT THERE = BAD COMMAND UNLESS ZERO.
01276	1134	TAD BUFR	/SET POINTERS
01277	3010	DCA AXIN	/FOR INPUT
01300	3136	DCA XCTIN	
01301	1143	TAD LINENO	/COPY THE SAME LINE NUMBER.
01302	7450	SNA	/CHECK FOR ALL
01303	5275	JMP MODIFY+2	/ERROR IN ARG
01304	3410	DCA I AXIN	/(X=MEM)
01305	1010	TAD AXIN	/SAVE START OF NEW LINE
01306	3153	DCA PACKST	
01307	4540	SCONT, JMS I INDEV	/READ THE TELETYPE INPUT SILENTLY.
01310	3061	DCA LIST3+1	/SAVE SEARCH CHARACTER
01311	2151	ISZ DEBSW	/NO BREAKS.
01312	4506	SCHAR, GETC	/TYPE+TEST=F.F.
01313	4512	PRINTC	
01314	4510	SORTJ	/LOOK FOR MATCH
01315	0057		
01316	1322	LIST3-1	
01317	4507	LISTGO-LIST3	
01320	5312	PACKC	/SAVE NEW LINE.
		JMP SCHAR	
		/////	
01321	1134	SCHAR, TAD BUFR	/RESTART-B.A.
01322	7001	IAC	
01323	3010	DCA AXIN	/SET POINTERS
01324	3136	DCA XCTIN	
01325	4513	SFOUND, READC	/READ FROM KEYBOARD
01326	4510	SORTJ	/TEST
01327	0053		
01330	1322	LIST6-1	
01331	4507	SRNLST-LIST6	
01332	5325	SGOT, PACKC	/PACK CHAR.
		JMP SFOUND	/MORE

```
01333 0000 SORTB, 0 /SORT AND BRANCH ROUTINE. = "SORTJ"
01334 7450 SNA
01335 1142 TAD CHAR /ASSUME CHAR IF AC=0
01336 7041 CIA
01337 3157 DCA T2 /SAVE SORT ITEM
01340 1733 TAD I SORTB /FIRST ARG IS LIST LESS ONE
01341 2333 ISZ SORTB /2AND IS INTRA-LIST LENGTH
01342 3012 DCA XRT2
01343 1412 TAD I XRT2
01344 7510 SPA /**LISTS ENDED BY NEGATIVE NUMBERS**
01345 5357 JMP SEX /READ EXIT
01346 1157 TAD T2 /FIND ADDRESS
01347 7640 SZA CLA
01350 5343 JMP .-5
01351 1012 TAD XRT2 /MATCH FOUND.
01352 1733 TAD I SORTB
01353 3333 DCA SORTB /SETUP RETURN
01354 1733 TAD I SORTB
01355 3333 DCA SORTB
01356 7410 SKP
01357 2333 SEX, ISZ SORTB /MATCH NOT FOUND.
01360 7300 CLA CLL
01361 5733 JMP I SORTB /RETURN TO CALLING SEQUENCE.
```

```
01362 4501 TAB, PUSHJ /TABULATE TO A PARTICULAR COLUMN
01363 1600 EVAL-1
01364 4452 FIX /GET COLUMN NUMBER
01365 7141 CLL CIA
01366 7001 IAC
01367 1053 TAD TABCTR
01370 7630 SZL CLA
01371 5210 JMP TASK /ALREADY THERE OR PAST IT
01372 1033 TAD C240
01373 4512 PRINTC
01374 1046 TAD FLAC2 /TEST AGAIN
01375 5365 JMP TAB+3
1376 SRNLST=. /'MODIFY' CONTROL CHARACTER TABLE
01376 1321 SBAR /B.A. = RESTART
01377 1312 SCHAR /F.F. = CONTINUE
01400 1307 SCNT /BELL = CHANGE SEARCH CHARACTER
01401 1310 SCNT+1 /L.F. = FINISH THE LINE AS BEFORE.

/////
01402 0263 LISTGO, INPUTX-11 /C.R. = END THE MODIFIED LINE HERE
01403 1331 SGOT /FOUND SEARCH CHARACTER
```


/FIND OR ENTER A VARIABLE IN THE LIST.

01404	4525	GETARG, TESTC	/FIRST LETTER OF ARG
01405	0242	TLIST2, 0242	/"
01406	0215	0215	/C.R. - FUNCTION OR NUMBER IS NOT AN ARG.
01407	4526	ERROR4	/BAD ARGUMENT IN 'FOR', 'SET', OR 'ASK'
01410	7240	CLA CMA	/"GETARG" CAN CREATE NEW VAR.
01411	4503	GETVAR, PUSHA	/"GETVAR" WILL NOT
01412	3136	DCA XCTIN	/PACK INTO ADD.
01413	4507	PACKC	
01414	4506	GETC	/SECOND LETTER
01415	4511	SORTC	/TERMINATOR?
01416	2005		
01417	5222	JMP .+3	TERMS-1
01420	1142	TAD CHAR	/YES
01421	0071	AND P77	/NO
01422	1135	TAD ADD	/SAVE 2ND LETTER OF NAME
01423	4503	PUSHA	
01424	4511	SORTC	/IGNORE THE REST
01425	2005		TERMS-1
01426	5231	JMP .+3	
01427	4506	GETC	
01430	5224	JMP .-4	
01431	4523	TSTLPR	/LOOK FOR SUBSCRIPT VIA SORTON
01432	5243	JMP GS1	/NOT SUBSCRIPTED BY L-PAR.
01433	1130	TAD LASTOP	/SAVE LAST OPERATION
01434	4503	PUSHA	
01435	4501	PUSHJ	/MOVE PAST L-PAR AND
01436	1600		EVAL-1
01437	4506	GETC	/EVALUATE THE SUBSCRIPT.
01440	1413	POPA	/MOVE PAST R-PAR
01441	3130	DCA LASTOP	
01442	4452	FIX	/RECALL LAST OPERATION
01443	3324	GS1, DCA SUBS	/SAVE SUBSCRIPT
01444	1413	POPA	
01445	3135	DCA ADD	/RESTORE NAME
01446	1134	TAD STARTV	/SEARCH FOR VARIABLE
01447	3154	GS3, DCA PT1	
01450	1154	TAD PT1	
01451	3011	DCA XRT	
01452	1154	TAD PT1	
01453	7041	CIA	
01454	1155	TAD LASTV	/TEST FOR END OF LIST
01455	7750	SPA SNA CLA	
01456	5267	JMP GS2	/END SEARCH
01457	1554	TAD I PT1	/GET TABLE ENTRY
01460	7041	CIA	
01461	1135	TAD ADD	
01462	7650	SNA CLA	
01463	5312	JMP GFND1	/FOUND XX

01464	1154	GS4,	TAD PT1	/TRY NEXT ONE
01465	1144		TAD GINC	
01466	5247		JMP GS3	
01467	2413	GS2,	ISZ I PDLXR	/VAR. NOT FOUND, CAN I MAKE ONE?
01470	4526		ERROR	/UNDEFINED VAR. USED IN EXPRESSION
01471	1155		TAD LASTV	/OK, ADD THE VARIABLE
01472	1005		TAD P13	/TEST STORAGE LIMITS
01473	7141		CIA CLL	
01474	1013		TAD PDLXR	
01475	7620		SNL CLA	
01476	4526		ERROR3	
01477	1155		TAD LASTV	/UPDATE THE LIST.
01500	1144		TAD GINC	
01501	3155		DCA LASTV	
01502	1135		TAD ADD	/SAVE NAME
01503	3554		DCA I PT1	
01504	1324		TAD SUBS	/SAVE SUBSCRIPT
01505	3411		DCA I XRT	
01506	3411		DCA I XRT	/INITIALIZE VAR. TO ZERO
01507	3411		DCA I XRT	
01510	3411		DCA I XRT	
01511	5320		JMP GS5	/EXIT
		/////		
01512	1411	GFND1,	TAD I XRT	/FOUND NAME, TEST SUBSCRIPT
01513	7041		CIA	
01514	1324		TAD SUBS	
01515	7640		SZA CLA	
01516	5264		JMP GS4	/WRONG SUBSCRIPT
01517	2013		ISZ PDLXR	
01520	2154	GS5,	ISZ PT1	/SET POINTER TO DATA
01521	2154		ISZ PT1	
01522	5502		POPJ	
		/////		
01523	1575	FP,	FLTZER	

/IGNORE LEADING SPACES = "SPNOR"

```

1524 SUBS=.
01524 0000 XSPNOR, 0
01525 1142 TAD CHAR
01526 1063 TAD M240
01527 7640 SZA CLA
01530 5724 JMP I XSPNOR
01531 4506 GETC
01532 5325 JMP XSPNOR+1

/////
/SEE IF NEXT CHARACTER IS A NUMBER
01533 0000 XTESTN, 0 /RETURNS: .; OTHER; NUMBER = "TESTN"
01534 1142 TAD CHAR
01535 1064 TAD MPER /TEST FOR .
01536 7440 SZA
01537 2333 ISZ XTESTN /NOT A .
01540 1352 TAD NTST1 /COMPARE TO "9"
01541 7500 SMA
01542 5350 JMP NTEXT /TOO LARGE
01543 1353 TAD NTST2 /COMPARE TO "0"
01544 7510 SPA
01545 5350 JMP NTEXT /TOO SMALL
01546 3127 DCA SORTCN /FOUND DIGIT, SAVE IT
01547 2333 ISZ XTESTN
01550 7300 NTEXT, CLA CLL
01551 5733 JMP I XTESTN

/////
01552 7764 NTST1, 256-272
01553 0012 NTST2, 272-260

```

/EXIT FROM A "DO" SUBROUTINE

```
01554 1323 RETRN, TAD P0 /(PC) => 0
01555 3145 DCA PC
01556 1413 XPOPJ, TAD I PDLXR /RECURSIVE EXIT - "POPJ"
01557 3157 DCA T2
01560 5557 JMP I T2
```

```
01561 1362 /ASK-TYPE CONTROL CHARACTER TABLE
01562 1260 ATLIST, TAB /& = TABULATION DELIMITER
01563 1241 TINTR /% = FORMAT DELIMITER
01564 1250 TQUOT /" = LITERAL DELIMITER
01565 1254 TCRLF /! = CARRIAGE RETURN AND LINE FEED
01566 3125 TCRLF2 /# = CARRIAGE RETURN ONLY
01567 1252 TDUMP /$ = DUMP THE SYMBOL TABLE CONTENTS
01570 1252 TASK4 /SP = TERMINATOR FOR NAMES
01571 0615 TASK4 /, = TERMINATOR FOR EXPRESSIONS
01572 0620 PROCESS /; = TERMINATOR FOR COMMANDS
PC1 /C.R. = TERMINATOR FOR STRINGS

/////
01573 0001 FLTONE, 0001
01574 2000 2000
01575 0000 FLTZER, 0000
01576 0000 0000
01577 0000 0000
```


/EVALUATE AN EXPRESSION WHICH
 /TERMINATES WITH AN R-PAR, / OR C.R. AND
 /LEAVE THE RESULT IN FLAC AND IN FLARG.

01600	4506	GETC	/MOVE PAST EXTRA CHARACTER
01601	3130	EVAL, DCA LASTOP	/EVALUATION CONTROLLER (CHECKPOINT ?)
01602	4525	TESTC	/TEST CHARACTER AND IGNORE SPACES
01603	5215	JMP ETERM1	/TERMINATION
01604	5332	JMP ENUM	/NUMBER
01605	5342	JMP EFUN	/FUNCTION
01606	4501	PUSHJ	/LETTER OF VARIABLE
01607	1411		
01610	4525	OPNEXT, TESTC	/FIND OR CREATE VARIABLE, ALSO SET PT1.
01611	5236	JMP ETERMN	/PT1=>ARG
01612	0212	ECHOLST, 0212	/T
01613	0377	0377	/N=ERROR IN FORMAT
01614	4526	ERROR4	/F
		/////	/L = MISSING OPERATOR
01615	4504	ETERM1, PUSHF	/INITIALIZE RESULT TO ZERO.
01616	1575		
01617	4505	FLTZER	
01620	2034	POPF	
01621	1160	FLARG	
01622	3154	TAD FLARGP	/SET PT1.
01623	1034	DCA PT1	
01624	1127	TAD M2	/TEST FOR UNARY OPERATIONS
01625	7450	TAD SORTCN	
01626	5241	SNA	
01627	7001	JMP ETERM	/CREATE DUMMY FOR UNARY MINUS
01630	7650	IAC	
01631	5323	SNA CLA	
01632	1127	JMP ARGNXT	/IGNORE UNARY PLUS
01633	1070	TAD SORTCN	/TEST FOR NULL PARENS.
01634	7710	TAD M11	
01635	5353	SPA CLA	
01636	4523	JMP ELPAR	/MIGHT BE AN L-PAR.
01637	7410	ETERMN, TSTLPR	
01640	4526	SKP	
01641	1127	ERROR4	/OPERATOR MISSING BEFORE PAREN
01642	3147	ETERM, TAD SORTCN	/SET FROM "TESTC"="SORTC"
01643	1147	DCA THISOP	
01644	1070	TAD THISOP	
01645	7700	TAD M11	
01646	3147	SMA CLA	/END?
		DCA THISOP	/"THISOP" EQUIV. TO END OF EXP.

01647	7201	ETERM2, CLA	IAC	/COMPARE PRIORITIES
01650	0147		AND THISOP	/PRIORITIES ARE: (^),(* /),(+ -),PUT
01651	1147		TAD THISOP	
01652	7041		CIA	
01653	3274		DCA FLOPR	
01654	7001		IAC	
01655	0130		AND LASTOP	/CONTINUE
01656	1130		TAD LASTOP	/FIND OPERATION FROM TABLE
01657	1274		TAD FLOPR	
01660	7710		SPA CLA	
01661	5310		JMP EPAR	
01662	1130		TAD LASTOP	
01663	1331		TAD OPTABL	
01664	3274		DCA FLOPR	
01665	1674		TAD I FLOPR	
01666	3274		DCA FLOPR	
01667	1130		TAD LASTOP	
01670	7640		SZA CLA	/TEST FOR END OF DATA INTO FLOATING AC.
01671	4505		POPF	/GET LAST DATA
01672	0044			
01673	4407		FLAC	
01674	0000	FLOPR,	FENT 00	/((FLOPR I PT1) + -) / ^
01675	6560		FPT I FLARGP	/SAVE RESULT
01676	0000		FEXT	
01677	1160		TAD FLARGP	
01700	3154		DCA PT1	
01701	1147		TAD THISOP	
01702	1130		TAD LASTOP	/=0?
01703	7650		SNA CLA	
01704	5502		POPJ	/EXIT "EVAL"
01705	1413		POPA	/GET PRIOR OP
01706	3130		DCA LASTOP	
01707	5247		JMP ETERM2	/COMPARE THIS OP
		/////		
01710	4523	EPAR,	TSTLPR	/TEST FOR SUB-EXPRESSION
01711	7410		SKP	
01712	5355		JMP EPAR2	/GO EVALUATE EXPRESSION
01713	1130		TAD LASTOP	/CONTINUE READING THE EXPRESSION
01714	4503		PUSHA	/SAVE "LASTOP".
01715	1154		TAD PT1	
01716	3320		DCA .+2	
01717	4504		PUSHF	/SAVE LAST ARGUMENT
01720	0000		00	
01721	1147		TAD THISOP	/MORE TO COME
01722	3130		DCA LASTOP	
01723	4506	ARGNXT,	GETC	/READ 1ST CHAR OF AN ARG.
01724	4525		TESTC	/DO SPECIAL CHECK
01725	5353		JMP ELPAR	/COULD BE LEFT PAREN
01726	5332		JMP ENUM	/N
01727	5342		JMP EFUN	/F
01730	5206		JMP OPNEXT-2	/L
01731	2026	OPTABL,	OPTABS	
		/////		

```

01732 4504 ENUM,   PUSHF           /TO PROCESS A NUMBER,SAVE AC
01733 0044          FLAC
01734 1160          TAD FLARGP      /SET POINTER AS FOR A VARIABLE.
01735 3154          DCA PT1
01736 4473          JMS I FINPUT    /READ TEXT NUMBER => (PT1)
01737 4505          POPF           /RESTORE THE AC
01740 0044          FLAC
01741 5212          JMP OPNEXT      /CONTINUE

/////

01742 3274 EFUN,   DCA FLOPR      /SET CODE
01743 4506          GETC           /READ FUNCTION NAME.(1,2,OR 3 LETTERS)
01744 4511          SORTC         /LOOK FOR TERMINATION CHARACTER.
01745 2005          TERMS-1
01746 5364          JMP EFUN2      /YES
01747 1274          TAD FLOPR      /NO
01750 7104          CLL RAL        /MISH-MASH HASH CODE
01751 1142          TAD CHAR
01752 5342          JMP EFUN
01753 4523 ELPAR,  TSTLPR
01754 4526          ERROR4         /DOUBLE OPERATORS
01755 1127 EPAR2,  TAD SORTCN      /LEFT PARENS FOUND.
01756 4503          PUSHA
01757 1130          TAD LASTOP      /SAVE DATA
01760 4503          PUSHA
01761 4501          PUSHJ          /EVALUATE THE EXPRESSION
01762 1600          EVAL-1
01763 5500          JMP I EFUN3I

///

01764 1127 EFUN2,  TAD SORTCN      /SAVE 'SORTCN','LASTOP',AND FUNC CODE
01765 4503          PUSHA
01766 1130          TAD LASTOP
01767 4503          PUSHA
01770 1274          TAD FLOPR      /SAVE FUNCTION CODE.
01771 4503          PUSHA
01772 4523          TSTLPR
01773 4526          ERROR4         /MUST BE FOLLOWED BY PARENS TO SET ARGUMENT
01774 4501          PUSHJ          /YES
01775 1600          EVAL-1
01776 1413          POPA           /BRANCH ON FUNCTION CODE;RETURN VIA EFUN3I.
01777 4510          SORTJ
02000 2207          FNTABL-1
02001 6361          FNTABF-FNTABL
02002 4526          ERROR2        /ILLEGAL FUNCTION NAME.

/////

```



```

02003 0241      241      /!
02004 0242      242      /"
02005 0256      256      /. -FOR INPUT NUMBERS
                        2006 TERMS=. /TERMINATOR TABLE FOR 'EVAL' AND 'GETVAR'
02006 0240      240      /SPACE 0
02007 0253      253      /+ 1
02010 0255      255      /= 2
02011 0257      257      // 3
02012 0252      252      /* 4
02013 0336      336      /UP ARR 5
02014 0250      250      /( 6 L-PARS
02015 0333      333      /[ 7
02016 0274      274      /< 10
02017 0251      251      /) 11 R-PARS
02020 0335      335      /! 12
02021 0276      276      /> 13
02022 0254      254      /. 14
02023 0273      273      // 15
02024 0215      215      /C.R. 16
02025 0275      275      /= TO END GETARG FROM 'SET'
02026 5554      OPTABS, FGT I PT1
02027 1554      FAD I PT1
02030 2554      FSB I PT1
02031 4554      FDV I PT1
02032 3554      FMY I PT1
02033 0554      FPW I PT1

/////
02034 0000      FLARG, 0 /DATA TEMPORARY STORAGE
02035 0000      0
02036 0000      0

/////
02037 7056      /FOCAL TEXT FOR "HELLO" COMMAND
HPT, 7056 /[T %] 8.4;
02040 6473      6473
02041 1740      1740 /OPTION K,T,I,E,:,S;
02042 1354      1354
02043 2454      2454
02044 1154      1154
02045 0554      0554
02046 7254      7254
02047 2373      2373
02050 0540      0540 /ERASE ALL
02051 0177      0177
02052 1500      1500

/////
02053 1045      /ABSOLUTE VALUE FUNCTION
XABS, TAD FLAC1
02054 7710      SPA CLA
02055 4450      NEGATE

```


/CONTINUATION OF FUNCTION CALLS.

02056	1413	EFUN3,	POPA	/RESTORE LAST OPERATION
02057	3130		DCA LASTOP	
02060	4407		FENT	
02061	7000		FNR	/NORMALIZE FUNCTION RETURN
02062	6234		FPT FLARG	
02063	0200		FEXT	
02064	1160		TAD FLARGP	/SET POINTER
02065	3154		DCA PT1	
02066	1413		POPA	/GET LAST PAREN CODE.
02067	7041		CIA	/CHECK FOR PAREN MATCH.
02070	1066		TAD M3	
02071	1127		TAD SORTCN	/((STILL SET FROM THE LAST "EVAL")
02072	7640		SZA CLA	/SKIP IF MATCH
02073	4526		ERROR4	/PAREN ERROR
02074	4506		GETC	/MOVE PAST R-PAR, AND RETURN TO OPNEX.
02075	5676		JMP I .+1	/FUNCTION RETURN IS OK
02076	1610		OPNEXT	

////

02077	0000	LPRST, 0	/SKIP IF LEFT PAREN. = 'TSTLPR'
02100	1127	TAD SORTCN	
02101	1070	TAD M11	
02102	7700	SMA CLA	
02103	5677	JMP I LPRST	
02104	1127	TAD SORTCN	
02105	1067	TAD M5	
02106	7740	SMA SZA CLA	
02107	2277	ISZ LPRST	
02110	5677	JMP I LPRST	

/THE DELETE A LINE ROUTINE

02111	4516	DELETE, FINDLN	/SETS "THISLN" AND "LASTLN".
02112	5502	POPJ	/ALREADY GONE
02113	2151	ISZ DEBGSW	/DISABLE TRACE
02114	4506	GETC	/MEASURE LENGTH
02115	1142	TAD CHAR	
02116	1065	TAD MCR	
02117	7640	SZA CLA	
02120	5314	JMP .-4	
02121	1017	TAD AXOUT	/SAVE LAST ADDRESS
02122	7040	CMA	
02123	1146	TAD THISLN	
02124	3132	DCA CNTR	/LENGTH < 0
02125	1546	TAD I THISLN	/DISCONNECT
02126	3550	DCA I LASTLN	
02127	1075	TAD CFRS	/START LIST AT TOP
02130	3157	DCA T2	/EXAMINATION ADDRESS
02131	1557	TAD I T2	/GET THE NEXT ADDR.
02132	7450	SNA	/TEST FOR END
02133	5346	JMP DONE	/YES-WRAP UP ALL.
02134	3156	DCA T1	/SAVE NEXT ADDRESS.
02135	1146	TAD THISLN	/COMPARE LINE POSITIONS
02136	7141	CIA CLL	
02137	1156	TAD T1	
02140	7630	SZL CLA	/SKIP IF THISLN > X
02141	1132	TAD CNTR	/CHANGE (X) TO ACCOUNT FOR
02142	1156	TAD T1	/GARBAGE COLLECTION.
02143	3557	DCA I T2	
02144	1156	TAD T1	/GET NEXT
02145	5330	JMP DOK	

/////

/GARBAGE COLLECTION

02146	7040	DONE,	CMA	/BACKUP L FOR XR
02147	1146		TAD THISLN	
02150	3011		DCA XRT	
02151	1132		TAD CNTR	/SETUP END OF HOSE
02152	7040		CMA	
02153	1146		TAD THISLN	
02154	3012		DCA XRT2	
02155	1132		TAD CNTR	/CORRECT END OF BUFFER POINTER.
02156	1134		TAD BUFR	
02157	3134		DCA BUFR	
02160	1010		TAD AXIN	/COMPUTE COUNT
02161	7040		CMA	
02162	1012		TAD XRT2	
02163	3156		DCA T1	
02164	1010		TAD AXIN	
02165	1132		TAD CNTR	
02166	3010		DCA AXIN	
02167	1412		TAD I XRT2	/SIPHON LOWER PART.
02170	3411		DCA I XRT	
02171	2156		ISZ T1	
02172	5367		JMP .-3	
02173	5311		JMP DELETE	/RESET 'LASTLN', 'THISLN', AND DATA FIELD.

/////

/OPTION TABLE

02174	6457	OPTTBL,	OPTK	/SWITCH TO KEYBOARD INPUT
02175	6453		OPTR	/READER INPUT
02176	3237		OPTT	/TTY OUTPUT
02177	3234		OPTP	/PUNCH OUTPUT
02200	3303		OPTI	/INTERPRETIVE/NUMERIC I/O
02201	3302		OPTC	/SINGLE CHARACTER I/O
02202	3244		OPTCOL	/PRINT ":" AT "ASK"
02203	3243		OPTX	/SUPPRESS ":"
02204	3252		OPTE	/ECHO KEYBOARD INPUT
02205	3253		OPTN	/NO ECHO
02206	3256		OPTS	/SET VARIABLE TERMINATOR
02207	3271		OPTM	/START DISK MONITOR

FNTABL=.

02210	2533	2533	/ABS	
02211	2650	2650	/SGN	
02212	2636	2636	/ITR	
02213	2565	2565	/DIS	
02214	2630	2630	/RAN	
02215	2623	2623	/DXS	
02216	2517	2517	/ADC	
02217	2572	2572	/ATN	
02220	2624	2624	/EXP	
02221	2625	2625	/LOG	
02222	2654	2654	/SIN	/LIST OF CODED FUNCTION NAMES
02223	2575	2575	/COS	
02224	2702	2702	/SQT	
02225	2631	2631	/NEW	

```

/ERASE SINGLE LINES, GROUPS, OR VARIABLES
02226 1142 ERASE, TAD CHAR /SEE IF "ALL"
02227 1003 TAD MINUSA
02230 7640 SZA CLA
02231 5240 JMP ERVX
02232 1077 TAD ENDT /YES, ERASE ALL TEXT
02233 3134 DCA BUFR
02234 3475 DCA I CFRS
02235 1134 ERV, TAD STARTV /ERASE VARIABLES
02236 3155 DCA LASTV
02237 5177 JMP START /PROGRAM EXECUTION ENDS

/////
02240 4515 ERVX, GETLN /GET LINE NUMBER
02241 1143 TAD LINENO /SEE OF ZERO OR NONE
02242 7640 SZA CLA
02243 5250 JMP ERL /NO, ERASE LINES
02244 1134 TAD STARTV /YES, ERASE VARIABLES
02245 3155 DCA LASTV
02246 5647 JMP I .+1 /CONTINUE PROCESSING
02247 0616 PROC

/////
02250 1134 ERL, TAD BUFR /ERASE LINES
02251 3010 DCA AXIN
02252 4501 ERG, PUSHJ /EXTRACT ONE LINE
02253 2111 DELETE
02254 2146 ISZ THISLN
02255 1141 TAD NAGSW
02256 7700 SMA CLA
02257 1546 TAD I THISLN
02260 4524 TSTGRP /IF GROUP, SEE IF END OF GROUP
02261 5235 JMP ERV /YES
02262 1546 TAD I THISLN /NO, CONTINUE ERASING GROUP
02263 3143 DCA LINENO
02264 5252 JMP ERG

```


/ROUTINE CALLED VIA "FINDLN":

/SEARCH FOR A GIVEN LINE I.D. =["LINENO"]
/1ST RETURN IF NOT FOUND,
/2ND IF FOUND.
/"THISLN" = FOUND LINE OR NEXT LARGER.
/"LASTLN" = LESSER AND/OR LAST.
/"TEXTP" IS SET

02265	0000	XFIND,	0	
02266	1075		TAD CFRS	/INITIALIZE POINTERS TO FIRST LINE
02267	3150		DCA LASTLN	
02270	1075		TAD CFRS	
02271	3146	FINDN,	DCA THISLN	/SAVE THIS ONE
02272	1146		TAD THISLN	
02273	3012		DCA XRT2	
02274	1143		TAD LINENO	
02275	7041		CIA	
02276	1412		TAD I XRT2	/LINENO=0 WILL ALSO BE FOUND
02277	7450		SNA	
02300	2265		ISZ XFIND	/FOUND IT (2ND EXIT)
02301	7700		SMA CLA	
02302	5310		JMP FEND3	/PAST IT.
02303	1146		TAD THISLN	/MOVE POINTERS
02304	3150		DCA LASTLN	
02305	1546		TAD I THISLN	
02306	7440		SZA	/SKIP IF END OF TEST
02307	5271		JMP FINDN	
02310	1146	FEND3,	TAD THISLN	
02311	7001		IAC	
02312	3017		DCA AXOUT	/SET "TEXTP".
02313	3020		DCA XCT	
02314	5665		JMP I XFIND	

02315	0000	UTRA,	0	/UNPACK CHARACTER. = "GETC"
02316	4351		JMS GET1	
02317	7710	UTE,	SPA CLA	/NORM & EXTEND
02320	1006		TAD C100	/300-337 & 340-376
02321	1377		TAD M137	/240-276 & 200-236
02322	1142		TAD CHAR	
02323	7450		SNA	
02324	5337		JMP UTX	/"?" FOUND
02325	1054		TAD P337	
02326	3142	UTQ,	DCA CHAR	
02327	1151		TAD DEBGSW	
02330	1152		TAD DMPSW	
02331	7650		SNA CLA	/PRINT ONLY IF BOTH ARE ZERO.
02332	4512		PRINTC	
02333	5715		JMP I UTRA	
/////				
02334	4351	EXTR,	JMS GET1	
02335	7040		CMA	
02336	5317		JMP UTE	
///				
02337	1151	UTX,	TAD DEBGSW	/TEST FOR TRACE-ENABLED
02340	7640		SZA CLA	
02341	5347		JMP .+6	
02342	1152		TAD DMPSW	/FLIP THE TRACE FLOP
02343	7650		SNA CLA	
02344	7001		IAC	
02345	3152		DCA DMPSW	
02346	5316		JMP UTRA+1	/GET NEXT CHARACTER INSTEAD.
02347	1032		TAD P277	/TRACE DISABLED = RETURN "?"
02350	5326		JMP UTQ	
02351	0000	GET1,	0	/UNPACK 6-BITS
02352	2020		ISZ XCT	/STARTS=0
02353	5366		JMP GET3	
02354	1021		TAD GTEM	
02355	0071	GEND,	AND P77	
02356	3142		DCA CHAR	/SAVE
02357	1142		TAD CHAR	
02360	1023		TAD M77	
02361	7650		SNA CLA	
02362	5334		JMP EXTR	/EXTENDED
02363	1142		TAD CHAR	
02364	1376		TAD M40	
02365	5751		JMP I GET1	
/////				

```
02366 1417 GET3, TAD I AXOUT / (X-MEM)
02367 3021 DCA GTEM
02370 7040 CMA
02371 3020 DCA XCT
02372 1021 TAD GTEM
02373 4520 RTL6
02374 7004 RAL
02375 5355 JMP GEND
02376 7740 M40, -40
02377 7641 M137, -137
//////
/OPTION LIST
02400 0313 OPTLST, "K
02401 0322 "R
02402 0324 "T
02403 0320 "P
02404 0311 "I
02405 0303 "C
02406 0272 ":"
02407 0330 "X
02410 0305 "E
02411 0316 "N
02412 0323 "S
02413 0315 "M
//////
/ANALOG-DIGITAL CONVERSION
02414 6004 XADC, 6004
02415 3045 DCA FLAC1 /ARG MUST BE 0
02416 5500 RETURN
```

```

02417 0000 XENDLN, 0 /TERMINATE THE BUFFERED LINE - "ENDLN"
02420 1550 TAD I LASTLN /SAVE OLD POINTER
02421 3534 DCA I BUFR
02422 1134 TAD BUFR /POINT TO NEW LAST LINE
02423 3550 DCA I LASTLN
02424 1135 TAD ADD /CHECK FOR EXTRA INFO
02425 7440 SZA
02426 3410 DCA I AXIN
02427 1010 TAD AXIN /COMPUTE NEW END OF BUFFER
02430 7001 IAC
02431 3134 DCA BUFR
02432 1134 TAD STARTV /RESET VARIABLE LIST
02433 3155 DCA LASTV
02434 5617 JMP I XENDLN

/////
02435 0000 TXTSAV, 0 /SAVE CHAR AND TEXT POINTERS
02436 4504 PUSHF
02437 0017 TEXTP
02440 1142 TAD CHAR
02441 4503 PUSHA
02442 5635 JMP I TXTSAV

/
02443 0000 TXTRES, 0 /RESTORE SAME
02444 1413 POPA
02445 3142 DCA CHAR
02446 4505 POPF
02447 0017 TEXTP
02450 5643 JMP I TXTRES

/////
02451 0000 GRPTST, 0 /AC VS LINENO - "TSTGRP"
02452 0024 AND P7600
02453 7041 CIA
02454 3157 DCA T2
02455 1143 TAD LINENO
02456 0024 AND P7600
02457 1157 TAD T2
02460 7650 SNA CLA
02461 2251 ISZ GRPTST
02462 5651 JMP I GRPTST

```


/I-O SUBROUTINES

```

2463 VAL=.
02463 0000 CHIN, 0 /READ IN A CHARACTER SUBR. = "READC"
02464 4540 JMS I INDEV
02465 3142 DCA CHAR
02466 4511 SORTC /LINEFEED OR RUBOUT?
02467 1611 ECHOLST-1
02470 5663 JMP I CHIN /YES
02471 4512 ECHO, PRINTC
02472 1142 TAD CHAR /SEE IF 200 (L/T)
02473 1024 TAD P7600
02474 7640 SZA CLA
02475 5663 JMP I CHIN /NO, EXIT
02476 5264 JMP CHIN+1 /YES, GET ANOTHER

/////
02477 0000 OUT, 0 /OUTPUT A CHARACTER = "PRINTC"
02500 7450 SNA /USE (AC) OR (CHAR)
02501 1142 TAD CHAR
02502 1065 TAD MCR
02503 7450 SNA
02504 5310 JMP OUTCR
02505 1060 TAD CCR
02506 4537 JMS I OUTDEV
02507 5677 OUTX, JMP I OUT

/////
02510 1060 OUTCR, TAD CCR
02511 4537 JMS I OUTDEV
02512 1057 TAD CLF
02513 5306 JMP OUTX-1

/////
/TEST FOR A COMMA, SEMICOLON, OR CR = "TSTERM"
/RETURNS: OTHER, ; OR CR, COMMA
/GETS NEXT CHARACTER AFTER COMMA OR OTHER
02514 0000 XTSTER, 0
02515 4511 SORTC /LOOK FOR ,/CR
02516 1141 TLIST-1
02517 7410 SKP
02520 5326 JMP .+6 /OTHER, GO PAST IT
02521 1127 TAD SORTCN /FOUND ONE, SEE WHAT IT IS
02522 2314 ISZ XTSTER
02523 7640 SZA CLA
02524 5714 JMP I XTSTER // OR CR: 2ND EXIT
02525 2314 ISZ XTSTER /COMMA, 3RD EXIT
02526 4506 GETC
02527 5714 JMP I XTSTER

/////

2527 COMEIN=-1 /COMMAND=INPUT BUFFER LIVES HERE.

2600 COMOUT=2600

```

2600 *COMOUT

/INTERRUPT PROCESSOR.

```

02600 0000 SAVAC, 0 /CONTENTS OF AC
02601 0000 SAVLK, 0 /CONTENTS OF LINK
02602 7575 MBREAK, -203 /CONTROL-C
02603 3200 INTRPT, DCA SAVAC /SAVE WORKING DATA
02604 7010 RAR
02605 3201 DCA SAVLK
02606 6031 KSF /CHECK FOR KEYBOARD FIRST
02607 5225 JMP TINT
02610 6036 KRB /READ BUFFER AND CLEAR FLAG TO FETCH NEXT
02611 0026 AND P177 /IGNORE PARITY BIT
02612 1015 TAD C200
02613 3306 DCA SIN
02614 1306 TAD SIN
02615 1202 TAD MBREAK /MANUAL STOP?
02616 7650 SNA CLA
02617 5345 JMP RECOVR
02620 1264 TAD INBUF /ANY SPACE?
02621 7640 SZA CLA
02622 4526 ERROR2 /WILL WAIT FOR OUTPUT BUFFER
02623 1306 TAD SIN
02624 3264 DCA INBUF /SAVE INPUT
02625 6041 TINT, TSF
02626 5244 JMP EXIT
02627 6042 TCF
02630 3260 DCA TELSW /TURN OFF THE IN-PROGRESS FLAG.
02631 1663 TAD I OPTRI
02632 7450 SNA
02633 5244 JMP EXIT /DONE
02634 6044 TPC /TYPE NEXT.
02635 3260 DCA TELSW /CLEAR AC AND TURN ON THE FLAG.
02636 3663 DCA I OPTRI /ZERO OUT THE DATA AREA
02637 1263 TAD OPTRI
02640 7001 IAC
02641 0031 AND P17
02642 1261 TAD OPTR0
02643 3263 DCA OPTRI
02644 6244 EXIT, 6244 /RESTORE MEMORY FIELD
02645 6101 6101 /SMP
02646 7000 NOP / (HLT)-IF YOU HAVE MEMORY PARITY
02647 6011 RSF /TEST H.S. READER FLAG
02650 5253 JMP .+3
02651 6012 RRB /READ BUFFER AND CLEAR FLAG
02652 3037 DCA HINBUF /SAVE CHARACTER
02653 1201 TAD SAVLK
02654 7104 RAL CLL
02655 1200 TAD SAVAC
02656 6001 ION
02657 5400 EXITJ, JMP I 0

```

```

02660 0001 TELSW, 1 /INPUT SWITCH
02661 3400 OPTRO, IOBUF /OUTPUT POINTERS
02662 3400 OPTRO, IOBUF /VARS
02663 3400 OPTRI, IOBUF
02664 0000 INBUF, 0 /KEYBOARD BUFFER.
//////
02665 0000 XI33, 0 /VIA (INDEV)
02666 1264 TAD INBUF /ANY INPUT?
02667 7550 SPA SNA
02670 5266 JMP .-2 /NO = WAIT
02671 3275 DCA XOUTL
02672 3264 DCA INBUF /CLEAR INPUT BUFFER
02673 1275 TAD XOUTL
02674 5665 JMP I XI33
//////
02675 0000 XOUTL, 0 /VIA (OUTDEV)
02676 3265 DCA XI33 /SAVE CURRENT CHARACTER.
02677 1265 TAD XI33 /IS IT A CR?
02700 1065 TAD MCR
02701 7650 SNA CLA
02702 3053 DCA TABCTR /YES, RESET CARRIAGE INDEX
02703 1265 TAD XI33
02704 4732 JMS I SKPNP /SKIP IF A NON-PRINTING CHARACTER
02705 2053 ISZ TABCTR /PRINTING: INCREMENT INDFX
02706 0000 SIN, 0
02707 6001 ION /BE SURE INTERRUPT IS ON.
02710 1662 TAD I OPTRO /ANY ROOM?
02711 7640 SZL CLA /A CHARACTER IS NON-ZERO
02712 5310 JMP .-2 /NO = WAIT.
02713 1260 TAD TELSW /IN PROGRESS?
02714 7640 SZL CLA
02715 5322 JMP .+5
02716 1265 TAD XI33 /NO
02717 6046 TLS /TYPE CHARACTER.
02720 3260 DCA TELSW /SET IN-PROGRESS FLAG.
02721 5675 JMP I XOUTL /RETURN
02722 1265 TAD XI33 /SEND DATA
02723 3662 DCA I OPTRO
02724 1262 TAD OPTRO /SET POINTERS
02725 7001 IAC
02726 0031 AND P17
02727 1261 TAD OPTRO
02730 3262 DCA OPTRO
02731 5675 JMP I XOUTL
/////////
02732 3014 SKPNP, SKIPNP

```



```

4526 ERROR2=ERROR; ERROR3=ERROR; ERROR4=ERROR
4526
4526
02733 3225 WAITP, 0WAIT
02734 3203 OPTDOP, OPTTDO
02735 3336 ERRORS, DCA .+1
02736 0000 ERR2, 0
02737 7240 CLA CMA
02740 1336 TAD ERR2
02741 3143 DCA LINENO
02742 4733 JMS I WAITP
02743 6002 IOF
02744 5347 JMP .+3
02745 1015 RECOVR, TAD C200
02746 3143 DCA LINENO
02747 2260 ISZ TELSW
02750 1025 TAD M20
02751 3132 DCA CNTR
02752 7040 CMA
02753 1261 TAD OPTRO
02754 3011 DCA XRT
02755 3411 DCA I XRT
02756 2132 ISZ CNTR
02757 5355 JMP .-2
02760 3264 DCA INBUF
02761 1261 TAD OPTRO
02762 3263 DCA OPTRI
02763 1261 TAD OPTRO
02764 3262 DCA OPTRO
02765 4734 JMS I OPTDOP
02766 1161 TAD PTCH
02767 3113 DCA 113
02770 7040 CMA
02771 6046 TLS
02772 7200 CLA
02773 1060 TAD CCR
02774 4512 PRINTC
02775 1032 TAD P277
02776 4512 PRINTC
02777 4514 PRNTLN
03000 2145 ISZ PC
03001 1545 TAD I PC
03002 7450 SNA
03003 5211 JMP .+6
03004 3143 DCA LINENO
03005 1062 TAD P7700
03006 4512 PRINTC
03007 4512 PRINTC
03010 4514 PRNTLN
03011 1060 TAD CCR
03012 4512 PRINTC
03013 5177 JMP START

```

/ERROR CALLED FROM A TABLE
 /LIMIT EXCEEDED
 /COMPUTE CALLING ADDRESS (ALSO "SPACE")
 /AND USE IT AS ERROR NUMBER.
 /SAVE ERROR CODE.
 /WAIT FOR OUTPUT TO FINISH
 /DISABLE INTERRUPT FOR INITIALIZATIONS

 /SAVE ERROR NUMBER
 /TURN ON IN-PROGRESS SWITCH
 /SETUP INIT COUNT

 /INIT I/O BUFFERS.

 /INIT KEY-BUFR.
 /INIT TTY POINTERS.

 /SET TO TTY OUTPUT
 /RESET "READC"
 /IF AN ERROR OCCURS.
 /PREPARE A STOP BIT FOR TTY
 /AND RAISE FLAG

 /PRINT A CR

 /MAKE A ?
 /AND TURN ON THE INTERRUPT
 /PRINT ERROR NUMBER AND,

 /UNLESS IT IS ZERO, (X-MEM)

 /PRINT SPACE AGAIN AND
 /PRINT LINE OF ERROR.

 /INTERRUPT WILL BE RE-ENABLED SOON.

/////


```

/**** FOCAL 5/69 ****
                                /SKIP IF (AC) IS A NON-PRINTING CHARACTER
03014 0000 SKIPNP, 0
03015 4520 RTL6                                /PRINTING CHARACTERS ARE 240-337
03016 7710 SPA CLA
03017 7020 CML
03020 7420 SNL
03021 2214 ISZ SKIPNP
03022 5614 JMP I SKIPNP

/////
/PACK A CHARACTER INTO THE BUFFER - "PACKC"
03023 0000 PACBUF, 0
03024 4510 SORTJ                                /LOOK FOR ? OR RUBOUT
03025 3055 PACLST=1
03026 6126 PACLS2=PACLST
03027 1142 TAD CHAR
03030 4214 JMS SKIPNP                                /PRINTING CHARACTER?
03031 5234 JMP .+3                                /YES
03032 1071 TAD P77                                /NO, PACK 77 FIRST
03033 4242 JMS PCK1
03034 1142 TAD CHAR                                /PACK 6-BIT CHARACTER
03035 0071 AND P77
03036 4242 JMS PCK1
03037 5623 JMP I PACBUF

/////
03040 1054 PQUES, TAD P337                                /USE 337 FOR ?
03041 5235 JMP .-4

/////
/PACK ONE 6-BIT WORD
03042 0000 PCK1, 0
03043 2136 ISZ XCTIN
03044 5260 JMP ROT                                /PACK LEFT HALF
03045 1135 TAD ADD                                /PACK RIGHT HALF AND STORE
03046 3410 DCA I AXIN
03047 1013 TAD PDLXR                                /CHECK FOR SPACE
03050 7141 CLL CIA
03051 1005 TAD P13
03052 1010 TAD AXIN
03053 7630 SZL CLA
03054 4526 ERROR                                /BUFFER OR STORAGE OVERFLOW
03055 5642 JMP I PCK1

/////
03056 0277 PACLST, 277                                /?
03057 0377 377                                /RUBOUT

/////
03060 4520 ROT, RTL6                                /SAVE LEFT HALF
03061 3135 DCA ADD
03062 7040 CMA
03063 3136 DCA XCTIN
03064 5642 JMP I PCK1

```

```

      /RUBOUT ONE CHARACTER
03065 1010 RUB1, TAD AXIN /SAVE POINTER
03066 3242 DCA PCK1
03067 1136 TAD XCTIN /CHARACTER IN ADD?
03070 7640 SZA CLA
03071 5277 JMP RUB2 /YES
03072 1010 TAD AXIN /NO, BEGINNING OF BUFFER?
03073 7041 CIA
03074 1153 TAD PACKST
03075 7700 SMA CLA
03076 5322 JMP PKZERO /YES, IGNORE
03077 1324 RUB2, TAD SPLAT /ECHO A BACKSLASH
03100 4512 PRINTC
03101 2136 ISZ XCTIN
03102 5310 JMP RUB3 /BACKUP STORAGE
03103 1642 TAD I PCK1 /KILL ADD AND CHECK FOR 77
03104 0071 AND P77 /IN 2ND HALF OF LAST STORED WORD
03105 1023 TAD M77
03106 7640 SZA CLA
03107 5322 JMP PKZERO /NO, DONE
03110 1642 RUB3, TAD I PCK1 /KILL 2ND HALF OF LAST STORED WORD
03111 0062 AND P7700
03112 3135 DCA ADD
03113 7040 CMA
03114 1010 TAD AXIN /BACKUP POINTER
03115 3010 DCA AXIN
03116 1135 TAD ADD
03117 1006 TAD C100 /TEST FOR 77 IN ADD
03120 7640 SZA CLA
03121 7040 CMA
03122 3136 PKZERO, DCA XCTIN
03123 5623 JMP I PACBUF
03124 0334 SPLAT, 334

```

```

/DUMP THE SYMBOL TABLE CONTENTS
03125 4504 TDUMP, PUSHF /SAVE TEXT POINTERS
03126 0017 TEXTP
03127 7040 CMA
03130 1134 TAD STARTV /START VARIABLE LIST
03131 3014 TDLOOP, DCA FLT XR
03132 1014 TAD FLT XR /TEST FOR END OF LIST
03133 7040 CMA
03134 1155 TAD LASTV
03135 7650 SNA CLA
03136 5370 JMP TDEND /END FOUND
03137 1375 TAD TDTEXT /NO, SET UP POINTERS
03140 3017 DCA AXOUT
03141 3020 DCA XCT
03142 1414 TAD I FLT XR /2 LETTERS OF VAR. NAME
03143 3376 DCA TDTEXT+1
03144 4501 PUSHJ /PRINT NAME AND "("
03145 1241 TQUOT
03146 1414 TAD I FLT XR /GET AND PRINT SUBSCRIPT
03147 4774 JMS I TDOUTP
03150 4501 PUSHJ /PRINT ")"="
03151 1241 TQUOT
03152 1005 TAD P13 /SPACE TO 11TH COLUMN
03153 3046 DCA FLAC2
03154 4501 PUSHJ
03155 1374 TAB+12
03156 2014 ISZ FLT XR
03157 4407 FEXT /PICK UP VALUE
03160 5414 FGT I FLT XR /DOES NOT AUTOINDEX)
03161 0000 FEXT
03162 4472 JMS I FOUTPUT /PRINT VALUE
03163 1060 TAD CCR /AND A C.R.
03164 4512 PRINTC
03165 1014 TAD FLT XR /INCREMENT FOR NEXT VAR.
03166 1035 TAD P2
03167 5331 JMP TDLOOP
03170 4505 TDEND, POPF /RESTORE TEXT POINTERS
03171 0017 TEXTP
03172 5773 JMP I .+1
03173 1252 TASK4
03174 6100 TDOUTP, SIGOUT
03175 3175 TDTEXT, . /THE FOLLOWING IS FOCAL TEXT
03176 0000 /VAR. NAME GOES HERE
03177 5077 /"(" AND C.R.
03200 1551 /")=" AND C.R.
03201 7577
03202 1500

```

/OPTION ROUTINES

/

/ROUTINE TO SET UP OUTPUT

OPTTDO, 0

03203	0000		
03204	1220	TAD	CTSF
03205	3021	DCA	I OPTTL /TSF
03206	1621	TAD	I OPTTL
03207	7001	IAC	
03210	3622	DCA	I OPTTL+1 /TCF
03211	1622	TAD	I OPTTL+1
03212	1035	TAD	P2
03213	3623	DCA	I OPTTL+2 /TPC
03214	1623	TAD	I OPTTL+2
03215	1035	TAD	P2
03216	3624	DCA	I OPTTL+3 /TLS
03217	5603	JMP	I OPTTDO
03220	6041	CTSF,	TSF
03221	2625	OPTTL,	TINT
03222	2627		TINT+2
03223	2634		TINT+7
03224	2717		SIN+11

/////

/ROUTINE TO WAIT UNTIL OUTPUT FINISHES

OWAIT, 0

03225	0000		
03226	6001	ION	/(SWAP) - FOR 2-USER
03227	1633	TAD	I TSWP /LOOK AT TELSW
03230	7640	SZA	CLA
03231	5226	JMP	.-3
03232	5625	JMP	I OWAIT
03233	2660	TSWP,	TELSW

/////

03234	4225	UPTP,	JMS OWAIT /SET UP FOR PUNCH OUTPUT
03235	1025		TAD M20 /CONVERT TO PSF, ETC.
03236	7410		SKP
03237	4225	OPTT,	JMS OWAIT /SET UP FOR TTY OUTPUT
03240	4203		JMS OPTTDO
03241	5642	OPTXIT,	JMP I .+1 /EXIT OPTIONS
03242	6461		OPTRET


```

03243 1250 OPTX, TAD OPTC1 /SUPPRESS ":" ON ASK
03244 1247 OPTCOL, TAD CPRINT /RESTORE ":"
03245 3651 DCA I COLP
03246 5241 JMP OPTXIT
03247 4512 CPRINT, PRINTC
03250 2466 OPTC1, CLA-PRINTC
03251 1222 COLP, TASKCL
//////
03252 1247 OPTC, TAD CPRINT /SET UP FOR KEYBOARD ECHO
03253 3655 OPTN, DCA I ECHP /SUPPRESS ECHO
03254 5241 JMP OPTXIT
03255 2471 ECHP, ECHO
//////
03256 4506 OPTS, GETC /SET UP USER TERMINATOR FOR "ASK"
03257 4511 SORTC
03260 2003 TERMS=3
03261 7410 SKP
03262 5256 JMP .-4
03263 4501 PUSHJ /GET CHARACTER
03264 1601 EVAL
03265 4452 FIX
03266 3670 DCA I USERTP
03267 5241 JMP OPTXIT
03270 6002 USERTP, USERT
//////
03271 4225 OPTM, JMS QWAIT /EXIT TO DISK MONITOR
03272 6002 IOF
03273 5424 JMP I P7600
//////
/THIS IS THE INITIALIZATION COMMAND
03274 1301 HELLO, TAD HP
03275 3017 DCA AXOUT
03276 3020 DCA XCT
03277 4501 PUSHJ /START BY SETTING FORMAT
03300 1260 TINTR
//////
03301 2036 HP, HPT=1 /FOCAL TEXT "X8.4)O K.T.I.E.,S)E A"

```

```

/ I/O MODE OPTIONS
03302 7240 OPTC,   CLA CMA
03303 3305 OPTI,   DCA IOSW
03304 5241      JMP OPTXIT

/////
03305 0000 IOSW,   0
/ I/O MODE:      "I" = 0000 = INTERPRETIVE INPUT, NUMERIC OUTPUT
/                  "C" = 7777 = SINGLE CHARACTER I/O
/////
/"ASK" MASTER ROUTINE
03306 0000 INTASK, 0
03307 1154      TAD PT1          /SAVE VAR. POINTER
03310 3225      DCA QWAIT
03311 1305      TAD IOSW        /WHAT MODE OF INPUT?
03312 7650      SNA CLA
03313 5323      JMP STRING      /INTERPRETIVE
03314 4513      READC           /SINGLE CHARACTER
03315 1142      TAD CHAR        /CONVERT CHARACTER CODE TO FLOATING
03316 4430      FLOAT          /POINT NUMBER
03317 4407 ASKEND, FENT        /SAVE VALUE
03320 6625      FPT I QWAIT
03321 0000      FEXT
03322 5706      JMP I INTASK

/INTERPRETIVE BUFFERED INPUT
03323 1013 STRING, TAD PDLXR    /SAVE PUSHDOWN LIST POINTER
03324 3203      DCA OPTTDO
03325 1364      TAD BUFTOP      /PROTECT TOP OF ASKBUF
03326 3013      DCA PDLXR
03327 2151      ISZ DEBGSW      /DISABLE TRACE
03330 1363 INBARR, TAD BUFBOT   /INITIALIZE ASKBUF
03331 3010      DCA AXIN
03332 3136      DCA XCTIN
03333 1363      TAD BUFBOT
03334 3153      DCA PACKST
03335 4513      READC           /IGNORE SPACES
03336 4511      SORTC
03337 0032      C240-1
03340 5335      JMP .-3
03341 4510      SORTJ          /SEARCH FOR TERMINATOR
03342 5775      ASKLS1-1
03343 0774      ASKLS2=ASKLS1
03344 4507      PACKC          /PACK INTO BUFFER
03345 4513 INGT,  READC
03346 5341      JMP .-5

```

```

/TERMINATOR FOUND, PROCESS INPUT
03347 1060 INTERM, TAD CCR /PACK A C.R.
03350 3142 DCA CHAR
03351 4507 PACKC
03352 4507 PACKC
03353 1203 TAD OPTTDO /RESTORE PDLXR
03354 3013 DCA PDLXR
03355 1363 TAD BUFBOT /INITIALIZE UNPACKING
03356 3017 DCA AXOUT
03357 3020 DCA XCT
03360 4501 PUSHJ /EVALUATE EXPRESSION
03361 1600 EVAL=1
03362 5317 JMP ASKEND

/////
03363 7550 BUFBOT, ASKBUF /BOTTOM OF BUFFER
03364 7612 BUFTOP, ASKBND /TOP+12 OF BUFFER
/////
/"TYPE" OUTPUT
03365 0000 OUTPT, 0
03366 1305 TAD IOSW /WHAT KIND OF OUTPUT
03367 7640 SZA CLA
03370 5373 JMP COUTPT /SINGLE CHARACTER
03371 4472 JMS I FOUTPUT /NUMERIC OUTPUT, PRINT VALUE
03372 5765 JMP I OUTPT

/////
03373 4452 COUTPT, FIX /GET CODE FOR CHARACTER
03374 7450 SNA /MODULO 256
03375 7130 CLL CML RAR /TO ALLOW ZERO CODE TO BE PRINTED
03376 4537 JMS I OUTDEV
03377 5765 JMP I OUTPT

/NOTE: "TDUMP" PRINTS ONLY IN NUMERIC MODE

```

```
      3400 IOBUF=3400
      /
      3420 *IOBUF+20
03420 0000 FRST, 0 /TEXT POINTER
03421 0000 0000 /DUMMY LINE NO
03422 0355 0355 / C=
03423 0617 0617 / FO
03424 0301 0301 / CA
03425 1454 1454 / L,
03426 4040 4040
03427 6557 6557 / 5/
03430 6671 FRSTX, 6671 / 69
03431 7715 7715
      3432 BUFBEG=.
      /
2735 LIBRARY=ERROR5 /COMMAND NOT AVAILABLE
```


/FOCAL INITIALIZATION ROUTINE

```
3432 *BUFBEG
03432 7300 BEGIN, CLA CLL
03433 1377 TAD (RECOVR+1 /RESTORE RESTART
03434 3176 DCA START-1
03435 6002 IOF /CLEAR FLAGS TO PREVENT INTERRUPT
03436 6022 6022 /PCF
03437 6032 6032 /KCC
03440 6203 6203 /CDF CIF 00
03441 6402 6402 /CLEAR PT08'S
03442 6412 6412
03443 6422 6422
03444 6432 6432
03445 6442 6442
03446 6452 6452
03447 6462 6462
03450 6472 6472
03451 6764 6764 /CLEAR DECTAPE
03452 6772 6772
03453 7200 CLA
03454 6046 TLS /START LOW SPEED OUTPUT
03455 3414 DCA I FLTXR /CLEAR OUTPUT BUFFER
03456 2376 ISZ (-20
03457 5255 JMP .-2
03460 1027 TAD BOTTOM /INITIALIZE PUSHDOWN LIST
03461 3013 DCA PDLXR
03462 6001 ION
03463 4512 PRINTC /CHAR IS A C.R
03464 4512 PRINTC
03465 4512 PRINTC
03466 4501 PUSHJ /TYPE FOCAL HEADING
03467 0641 WRITE
03470 5671 JMP I .+1
03471 2232 ERV-3 /ERASE ALL
```

***** FLOAT -- FOR FOCAL 5/69 *****
/E.A.TAFT 25-JUL-72

03576	7760		
03577	2746		
	5600	*5600	
		/DECIMAL TO BINARY CONVERSION 2/10/69	
05600	0000	DBCONV, 0	
05601	4430	FLOAT	/FLOAT A ZERO
05602	3364	DCA DECEXP	/INITIALIZE
05603	7040	CMA	
05604	3260	DCA PSWIT	
05605	1363	TAD C43 /35(10)	
05606	3044	DCA FLAC0	
05607	4755	JMS I SGNTST	/SIGN OF MANTISSA
05610	3365	DCA INSIGN	
05611	5215	JMP NEWDIG+1	
05612	2260	PERIOD, ISZ PSWIT	/ . FOUND, SEE IF FIRST
05613	4526	ERROR	/DOUBLE PERIODS
05614	4506	NEWDIG, GETC	/LOOK FOR A DIGIT
05615	4522	TESTN	
05616	5212	JMP PERIOD	/ . FOUND
05617	5250	JMP NOTDIG	/NOT FOUND
05620	1260	TAD PSWIT	/DECREMENT DECIMAL EXPONENT
05621	7700	SMA CLA	/IF AFTER .
05622	7040	CMA	
05623	1364	TAD DECEXP	
05624	3364	DCA DECEXP	
05625	4342	JMS MULT10	/MULTIPLY FLAC BY 10
05626	1127	TAD SORTCN	/ADD NEW DIGIT
05627	3043	DCA FLOP3	
05630	3042	DCA FLOP2	
05631	3041	DCA FLOP1	
05632	4313	JMS TRPLAD	
05633	1162	OVCHEK, TAD REMAIN	/CHECK FOR OVERFLOW
05634	7640	SZA CLA	
05635	5241	JMP .+4	
05636	1045	TAD FLAC1	
05637	7700	SMA CLA	
05640	5214	JMP NEWDIG	/NO OVERFLOW
05641	1361	TAD IOVRL	/OVERFLOW, ROTATE RIGHT
05642	3760	DCA I IRARAC	/SET UP RETURN TO OVCHEK
05643	1162	TAD REMAIN	/ROTATE REMAIN
05644	7110	CLL RAR	
05645	3162	DCA REMAIN	
05646	1045	TAD FLAC1	
05647	5762	JMP I ROTRAC	/ROTATE REST OF FLAC

05650	4511	NOTDIG, SORTC	/TEST FOR LETTER E
05651	6145	C305-1	
05652	5301	JMP EINPUT	/FOUND E
05653	2365	DBTERM, ISZ INSIGN	/END OF INPUT, AFFIX SIGN
05654	4450	NEGATE	
05655	1366	TAD CFNR	/SET UP TO NORMALIZE
05656	3260	DBLOOP, DCA .+2	
05657	4407	FENT	
05660	7000	PSWIT, FNR	/OR FMY BY 10 OR .10
05661	6554	FPT I PT1	/SAVE RESULT
05662	0000	FEXT	
05663	1364	TAD DECEXP	/CHECK DECIMAL EXPONENT
05664	7450	SNA	
05665	5600	JMP I DBCONV	/DONE
05666	7500	SMA	
05667	5273	JMP .+4	
05670	7001	IAC	/NEGATIVE, SET UP TO FMY BY .10
05671	3364	DCA DECEXP	
05672	5277	JMP .+5	
05673	7240	CLA CMA	/POSITIVE, SET UP TO FMY BY 10
05674	1364	TAD DECEXP	
05675	3364	DCA DECEXP	
05676	1066	TAD M3	
05677	1367	TAD FLINST	/INSTRUCTION FMY FLTEN OR FLPTEN
05700	5256	JMP DBLOOP	
05701	4506	EINPUT, GETC	/FOUND "E"
05702	4755	JMS I SGNTST	/TEST FOR SIGN
05703	3040	DCA FLOP0	
05704	4757	JMS I DECIN1	/INPUT A DECIMAL INTEGER
05705	1164	TAD DECNUM	
05706	2040	ISZ FLOP0	/CHECK SIGN
05707	7041	CIA	
05710	1364	TAD DECEXP	
05711	3364	DCA DECEXP	
05712	5253	JMP DBTERM	


```

05713 0000 /ADD FLOP TO FLAC TRIPLE PRECISION WITH OVERFLOW
05714 7300 TRPLAD, 0
05715 1043 CLA CLL
05716 1047 TAD FLOP3
05717 3047 TAD FLAC3
05720 7004 DCA FLAC3
05721 1042 RAL
05722 1046 TAD FLOP2
05723 3046 TAD FLAC2
05724 7004 DCA FLAC2
05725 1041 RAL
05726 1045 TAD FLOP1
05727 3045 TAD FLAC1
05730 7004 DCA FLAC1
05731 1162 RAL
05732 3162 TAD REMAIN
05733 5713 DCA REMAIN
          JMP I TRPLAD

05734 0000 /MULTIPLY FLAC BY 2
05735 4756 MULT2, 0
05736 1162 JMS I MULT2I
05737 7004 TAD REMAIN
05740 3162 RAL
05741 5734 DCA REMAIN
          JMP I MULT2

05742 0000 /MULTIPLY FLAC BY 10
05743 4504 MULT10, 0
05744 0045 PUSHF
05745 4505 FLAC1
05746 0041 POPF
05747 3162 FLOP1
05750 4334 DCA REMAIN
05751 4334 JMS MULT2
05752 4313 JMS MULT2
05753 4334 JMS TRPLAD
05754 5742 JMS MULT2
05755 6030 JMP I MULT10
05756 7037 SGNIST, TSTSGN
05757 6010 MULT2I, RALAC
05760 7251 DECIN1, DECINT
05761 5633 IRARAC, RARAC
05762 7256 IOVRL, OVCHK
05763 0043 ROTRAC, RARAC+5
05764 0000 C43, 43
05765 0000 DECEXP, 0
05766 0000 INSIGN, 0
05767 7000 CFNR, FNR
05770 3373 FLINST, FMY .+4
05771 0004 FLTEN, 0004
05772 2400 2400
05773 0000 0000
05774 7775 FLPTEN, 7775
05775 3146 3146
          3147
0162 REMAIN=TEMP1

          /FLAC=>FLOP

          /CLEAR OVERFLOW
          /FLAC*10 = (FLAC*2*2+FLAC)*2

          /10(10) FLOATING

          /.10(10) FLOATING

```



```

/CHARACTER LIST FOR "ASK"
05776 0215 ASKLIST, 215 /CR
05777 0214          214 /FF
06000 0337          337 /BA
06001 0254          254 /COMMA
06002 0000 USERT, 0 /USER-SELECTED CHARACTER
06003 0212          212 /LF

```

```

/POWER OF 10 TABLE
06004 6030 INTABL, -1750 /1000
06005 7634 -144 /100
06006 7766 -12 /10
06007 7777 -1 /1
/INPUT A DECIMAL INTEGER <2048
06010 0000 DECINT, 0
06011 3164 DCA DECNUM
06012 4522 TESTN /GET A DIGIT
06013 7000 NOP
06014 5610 JMP I DECINT /NONE FOUND
06015 4506 GETC
06016 1164 TAD DECNUM /MULTIPLY PREV. # BY 10
06017 7106 CLL RTL
06020 7530 SPA SZL
06021 5226 JMP .+5 /OVERFLOW (>2047)
06022 1164 TAD DECNUM
06023 7004 RAL
06024 1127 TAD SORTCN /ADD NEW DIGIT
06025 7530 SPA SZL
06026 4526 ERROR
06027 5211 JMP DECINT+1
0164 DECNUM=TEMP3
/TEST FOR A SIGN
TSTSGN, 0
06030 0000
06031 4521 SPNOR
06032 3127 DCA SORTCN
06033 4511 SORTC /LOOK FOR + OR -
06034 6114 SNLIST=1
06035 4506 GETC /SIGN FOUND
06036 4521 SPNOR /NOT FOUND
06037 7240 CLA CMA
06040 1127 TAD SORTCN /SORTCN: 0=+, 1=-
06041 5630 JMP I TSTSGN /AC: 7777=+, 0=-
0163 DIGIT=TEMP2

```

```

/PRINT A 2-4 DIGIT UNSIGNED DECIMAL INTEGER
/FIRST 2 LEADING ZEROES NOT PRINTED
06042 0000 INTOUT, 0
06043 3164 DCA DECNUM
06044 1314 TAD INTPTR /POWER OF 10 POINTER
06045 3260 DCA INTSUB
06046 3210 DCA DECINT /DECINT=0 MEANS SKIP 0 OUTPUT
06047 4255 JMS INTDO /1ST DIGIT (1000S)
06050 4255 JMS INTDO /2ND DIGIT (100S)
06051 2210 ISZ DECINT /DECINT>0 MEANS PRINT 0S
06052 4255 JMS INTDO /3RD DIGIT (10S)
06053 4255 JMS INTDO /4TH DIGIT (UNITS)
06054 5642 JMP I INTOUT
06055 0000 INTDO, 0
06056 3163 DCA DIGIT /INITIALIZE
06057 1164 TAD DECNUM
06060 1204 INTSUB, TAD INTABL /SUBTRACT A POWER OF 10
06061 7510 SPA
06062 5267 JMP INTNEG
06063 3164 DCA DECNUM /POSITIVE RESULT
06064 2163 ISZ DIGIT /NONZERO DIGIT, SO IGNORE NO
06065 2210 ISZ DECINT /FURTHER ZEROES
06066 5257 JMP INTSUB-1
06067 7300 INTNEG, CLA CLL /NEGATIVE RESULT
06070 2260 ISZ INTSUB /SET UP NEXT POWER OF 10
06071 1210 TAD DECINT /IS IT A LEADING 0?
06072 7650 SNA CLA
06073 5655 JMP I INTDO /YES, SKIP IT
06074 1163 TAD DIGIT /NO, PRINT DIGIT
06075 1036 TAD C260
06076 4512 PRINTC
06077 5655 JMP I INTDO
/OUTPUT A SIGNED INTEGER IN AC
06100 0000 SIGOUT, 0
06101 3164 DCA DECNUM /SAVE NUMBER
06102 1164 TAD DECNUM
06103 7710 SPA CLA
06104 1035 TAD P2 /MAKE A =
06105 1315 TAD C253 /MAKE A +
06106 4512 PRINTC
06107 1164 TAD DECNUM /OUTPUT ABSOLUTE VALUE
06110 7510 SPA
06111 7041 CIA
06112 4242 JMS INTOUT /OUTPUT THE NUMBER
06113 5700 JMP I SIGOUT
06114 1204 INTPTR, TAD INTABL
06115 0115 SNLIST=, /FOR SIGN TESTING
06115 0253 C253, 253 /+
06116 0255 255 /-

```



```

/E FORMAT OUTPUT ROUTINE
06117 7200 XXX, CLA /CONVERT TO E FORMAT ON OVERFLOW
06120 1051 TAD TOTDIG
06121 7410 SKP
06122 1133 FLOUT, TAD DECP /E FORMAT (X0) FLOATING OUTPUT
06123 7041 CIA
06124 7450 SNA
06125 1347 TAD MDIG /6 DIGITS IF 0 GIVEN
06126 3164 DCA DECNUM /DIGIT COUNTER
06127 1022 TAD PER /PERIOD
06130 4512 PRINTC
06131 1412 FLDIG, TAD I XRT2 /NEXT DIGIT
06132 2157 ISZ T2 /OUT OF SIG DIGITS?
06133 5330 JMP .+3 /NO, PRINT DIGIT
06134 7240 CLA CMA /YES, RESET POINTER AND PRINT 0
06135 3157 DCA T2
06136 4750 JMS I OUTP
06137 7410 SKP /FIELD NOW FILLED, PRINT EXPONENT
06140 5331 JMP FLDIG

/B-D CONV EXPONENT OUTPUT
06141 1340 TAD C305 /PRINT LETTER E
06142 4512 PRINTC
06143 1156 TAD T1 /OUTPUT THE EXPONENT
06144 4300 JMS SIGOUT
06145 5770 BDEND, JMP I BDENV /DONE
06146 0305 C305, 305 /E
06147 7772 MDIG, -DIGITS
06150 6437 OUTP, OUTA
/PRINT A LINE NUMBER - "PRNTLN"
06151 0000 XPRNTL, 0
06152 1143 TAD LINENO
06153 4520 RTL6
06154 0071 AND P77
06155 4242 JMS INTOUT /2-DIGIT PART NUMBER
06156 1022 TAD PER
06157 4512 PRINTC /DECIMAL POINT
06160 1143 TAD LINENO
06161 0026 AND P177 /2-DIGIT STEP NUMBER
06162 4242 JMS INTOUT
06163 1033 TAD C240 /SPACE
06164 3142 DCA CHAR
06165 4512 PRINTC
06166 5751 JMP I XPRNTL

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06167 0015  NEGSGN, 255-240
          /BINARY TO DECIMAL CONVERSION AND OUTPUT
06170 0000  BDCONV, 0
06171 1045          TAD FLAC1          /CHECK SIGN
06172 7700          SMA CLA
06173 5376          JMP .+3
06174 4450          NEGATE          /NEGATIVE, TAKE ABSOLUTE VALUE
06175 1367          TAD NEGSGN        /MAKE A -
06176 1033          TAD C240          /MAKE A SPACE
06177 4512          PRINTC
06200 7240          CLA CMA          /DECREMENT BINARY EXPONENT
06201 1044          TAD FLAC0
06202 3044          DCA FLAC0
06203 3156  BDSCAL, DCA T1          /INITIALIZE DECIMAL EXPONENT
06204 1044          TAD FLAC0        /START SCALING: -4<EXP<0?
06205 7500          SMA
06206 5220          JMP SDOWN        /TOO BIG, SCALE DOWN
06207 1631          TAD I TENPT
06210 7700          SMA CLA
06211 5244          JMP SCALED
06212 4407          FEXT          /WITHIN LIMITS, DONE
06213 3631          FMY I TENPT      /TOO SMALL, SCALE UP
06214 0000          FEXT
06215 7240          CLA CMA
06216 1156          TAD T1          /DECREMENT DECIMAL EXPONENT
06217 5203          JMP BDSCAL
06220 4407  SDOWN, FEXT          /SCALE DOWN
06221 3632          FMY I PTENPT
06222 0000          FEXT
06223 7001          IAC          /INCREMENT DECIMAL EXPONENT
06224 5216          JMP .-6
          /CONSTANTS
06225 7771  DDCOUNT, -DIGITS-1
06226 7772  MDIGIT, -DIGITS
06227 0007  RND2, DIGITS+1
06230 7766  M12, -12
          /POINTERS
06231 5770  TENPT, FLTEN
06232 5773  PTENPT, FLPTEN
06233 5734  MULT2P, MULT2
06234 5742  MUL10P, MULT10
06235 7544  BUFST, DIGBUF-1
06236 6122  FLOUTP, FLOUT
06237 6117  XXXP, XXX
          /ROUTINE TO DECREMENT THE DIGIT POINTER
06240 7240  DECR, CMA
06241 1040          TAD FLOP0
06242 3040          DCA FLOP0
06243 5351          JMP RET

```

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/***** FINISHED SCALING, GENERATE DIGITS
06244 4633 SCALED, JMS I MULT2P /ROTATE FLAC LEFT
06245 1235 TAD BUFST /INITIALIZE DIGIT BUFFER
06246 3012 DCA XRT2
06247 4634 JMS I MUL10P /MULTIPLY BY 10
06250 1162 TAD REMAIN /OVERFLOW
06251 5266 JMP BDC1
06252 7110 BDC0, CLL RAR
06253 3004 DCA FNEGSW /TEMP STORAGE OF FIRST DIGIT
06254 1045 TAD FLAC1 /ROTATE FLAC RIGHT
06255 7010 RAR
06256 3045 DCA FLAC1
06257 1046 TAD FLAC2
06260 7010 RAR
06261 3046 DCA FLAC2
06262 1047 TAD FLAC3
06263 7010 RAR
06264 3047 DCA FLAC3
06265 1004 TAD FNEGSW /PREV. OVERFLOW
06266 2044 BDC1, ISZ FLAC0 /CHECK ROTATE COUNT
06267 5252 JMP BDC0
06270 7440 SZA
06271 5301 JMP BDC2
06272 7240 CLA CMA /FIRST DIGIT IS 0, IGNORE
06273 1156 TAD T1 /DECREMENT DECIMAL EXPONENT
06274 3156 DCA T1
06275 1045 TAD FLAC1
06276 7650 SNA CLA
06277 3156 DCA T1 /EXP=0 IF MANTISSA=0
06300 7410 SKP
06301 3412 BDC2, DCA I XRT2 /FIRST DIGIT WAS NOT 0
06302 1225 TAD DCOUNT /SET TO COUNT DIGITS
06303 3044 DCA FLAC0
06304 4634 JMS I MUL10P /MULTIPLY BY 10
06305 1162 TAD REMAIN
06306 3412 DCA I XRT2 /SAVE DIGIT JUST GENERATED
06307 2044 ISZ FLAC0
06310 5304 JMP .-4
06311 1235 TAD BUFST /REINITIALIZE POINTER
06312 3012 DCA XRT2
06313 1225 TAD DCOUNT /DIGITS AVAILABLE
06314 3157 DCA T2
06315 1051 TAD TOTDIG /DIGITS WANTED
06316 7450 SNA
06317 5340 JMP R6 /E FORMAT, ROUND TO 6 PLACES
06320 7041 CIA /COMPUTE FIELD SIZES
06321 1133 TAD DECP
06322 7550 SPA SNA
06323 5327 JMP .+4 /COMPARE DECP TO TOTDIG
06324 7200 CLA /MORE DECP THAN TOTAL DIGITS!
06325 1051 TAD TOTDIG
06326 3133 DCA DECP
06327 1156 TAD T1 /COMPARE EXPONENT TO FIELD SIZE
06330 7500 SMA
06331 7200 CLA /INTEGER FIELD >= EXPONENT

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06332	1051		TAD TOTDIG	
06333	7510		SPA	
06334	5362		JMP FPRNT-2	/NO ROUNDING NEEDED
06335	1226		TAD MDIGIT	/ROUND TO DECP+EXP PLACES
06336	7500		SMA	
06337	7200		CLA	
06340	1227	R6,	TAD RND2	/START ROUNDING
06341	3004		DCA FNEGSW	/PLACES TO ROUND TO
06342	1235		TAD BUFST	/ROUNDING START ADDRESS
06343	1004		TAD FNEGSW	/SET UP ROUND COUNT
06344	3040		DCA FLOP0	
06345	1004		TAD FNEGSW	
06346	7041		CIA	
06347	3004		DCA FNEGSW	/START ROUNDING PROCESS BY
06350	1031		TAD I TENPT	/ADDING 4 TO FIRST DIGIT
06351	2440	RET,	ISZ I FLOP0	/INCREMENT CURRENT DIGIT
06352	1440		TAD I FLOP0	
06353	1230		TAD M12	
06354	7710		SPA CLA	/DIGIT>9?
06355	5364		JMP FPRNT	/NO, END ROUNDING
06356	3440		DCA I FLOP0	/YES, SET DIGIT TO 0 AND CARRY
06357	2004		ISZ FNEGSW	/BEGINNING OF BUFFER?
06360	5240		JMP DECR	/NO DECREMENT BUFFER ADDRESS
06361	2440		ISZ I FLOP0	/YES, FAKE CARRY FROM FIRST DIGIT
06362	2156		ISZ T1	
06363	7200		CLA	

06364	1051	FPRNT,	TAD TOTDIG	/SET UP FIELD SIZES
06365	7450		SNA	
06366	5636		JMP I FLOUTP	/E FORMAT OUTPUT
06367	7041		CIA	
06370	3164		DCA DECNUM	/NUMBER OF PLACES TO PRINT
06371	1164		TAD DECNUM	
06372	1156		TAD T1	
06373	7540		SMA SZA	
06374	5637		JMP I XXXP	/TOO BIG, PRINT E FORMAT
06375	1133		TAD DECP	/OK, TEST DECIMAL PLACES
06376	7500		SMA	
06377	7200		CLA	/ADJUST DECIMAL POINT
06400	7041		CIA	
06401	1156		TAD T1	
06402	7141		CLL CIA	
06403	3004		DCA FNEGSW	/NUMBER OF INTEGER PLACES
06404	7430		SZL	
06405	5222		JMP IN+4	/NO INTEGER PLACES

```

/START PRINTING
06406 1156 BACK, TAD T1
06407 1004 TAD FNEGSW
06410 7650 SNA CLA
06411 5225 JMP DIG /PRINT A DIGIT
06412 1004 TAD FNEGSW
06413 7001 IAC
06414 7710 SPA CLA /PRINT 0 IF ONE INTEGER PLACE LEFT
06415 1025 TAD M20 /OTHERWISE A SPACE
06416 4237 IF, JMS OUTA /PRINT A CHARACTER
06417 5645 JMP I BDENDP /FIELD FILLED, EXIT
06420 2004 ISZ FNEGSW
06421 5206 JMP BACK /CONTINUE
06422 1022 TAD PER /DECIMAL POINT
06423 4512 PRINTC
06424 5206 JMP BACK
06425 7040 DIG, CMA
06426 1156 TAD T1 /DECREMENT DECIMAL EXPONENT
06427 3156 DCA T1
06430 2157 ISZ T2 /CHECK SIG DIGIT COUNT
06431 5235 JMP .+4 /SOME LEFT
06432 7040 CMA /ALL USED UP
06433 3157 DCA T2
06434 5216 JMP IN /PRINT A 0
06435 1412 TAD I XRT2 /PRINT A SIG DIGIT
06436 5216 JMP IN

/DIGIT PRINT ROUTINE FOR BD CONV
06437 0000 OUTA, 0
06440 1036 TAD C260 /CONVERT TO ASCII
06441 4512 PRINTC
06442 2164 ISZ DECNUM /FIELD FILLED?
06443 2237 ISZ OUTA /NO, GO TO SECOND RETURN
06444 5637 JMP I OUTA
06445 6145 BDENDP, BDEND

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/ "OPTION" PROCESSOR
06446 4521 OPTION, SPNOR /GET OPTION LETTER
06447 4512 SORTJ
06450 2377 OPTLST-1
06451 7574 OPTTBL-OPTLST
06452 4526 ERROR /ILLEGAL OPTION NAME
/////
06453 7240 OPTR, CLA CMA /SWAP INPUT TO HIGH SPEED READER
06454 3037 DCA HINBUF
06455 6014 RFC /START READER
06456 1317 TAD RESTR /POINT TO "HREAD"
06457 1161 OPTK, TAD PTCH /SWAP TO KEYBOARD IF CALLED HERE
06460 3113 DCA 113
/////
06461 4565 OPTRET, TSTERM /MOVE TO ,/CR
06462 5261 JMP .-1
06463 5665 JMP I .+2 /END OF OPTIONS
06464 5246 JMP OPTION /CONTINUE PROCESSING OPTIONS
06465 6616 PROC
/////
/HIGH SPEED INPUT ROUTINE
06466 0000 HREAD, 0
06467 1067 TAD M5 /SET UP READ TIMER
06470 3156 DCA T1
06471 3157 DCA T2
06472 6001 HREAD2, ION /((SWAP) - FOR 2-USER
06473 1037 TAD HINBUF /WAIT FOR INPUT
06474 7700 SMA CLA
06475 5306 JMP HSGO /CHARACTER READY
06476 2157 ISZ T2 /NOT YET, CHECK TIMER
06477 5272 JMP HREAD2
06500 2156 ISZ T1
06501 5272 JMP HREAD2
06502 1161 TAD PTCH /TIME'S UP, OUT OF TAPE
06503 3113 DCA 113 /SWAP TO KEYBOARD INPUT
06504 1054 TAD P337 /RETURN A B.A. TO KILL UNENDED LINE
06505 5315 JMP RESTR-2 /OR SPURIOUS CHARACTER
/////
HSGO, CMA /FOUND CHARACTER
06506 7040 DCA HINBUF /SET TO READ NEXT
06507 3037 RRB RFC
06510 6016 AND P177 /IGNORE PARITY AND BLANK
06511 0026 SNA
06512 7450 JMP HREAD+1
06513 5267 TAD C200
06514 1015 DCA CHAR
06515 3142 JMP I HREAD
06516 5666
/////
06517 4003 RESTR, HREAD-CHIN

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6600 PAGE

/FLOATING POINT PACKAGE

/ARITHMETIC INTERPRETER

FPNT, 4

06600	0000		
06601	7300	CLA CLL	
06602	1600	TAD I FPNT	/FLOATING INSTRUCTION
06603	7450	SNA	
06604	5600	JMP I FPNT	/FEXT
06605	0015	AND C200	/GET PAGE BIT
06606	7640	SZA CLA	
06607	1200	TAD FPNT	/CURRENT PAGE
06610	0024	AND P7600	
06611	3231	DCA FLADDR	/START ADDRESS OF ADDRESSED PAGE
06612	1600	TAD I FPNT	/GET ADDRESS BITS
06613	0026	AND P177	
06614	1231	TAD FLADDR	
06615	3231	DCA FLADDR	/FULL 12-BIT ADDRESS
06616	1600	TAD I FPNT	
06617	2200	ISZ FPNT	
06620	7106	CLL RTL	/OP BITS =>AC9-11
06621	7006	RTL	/INDIRECT BIT =>LINK
06622	0031	AND P17	
06623	1235	TAD DRECTR	/SET UP OP POINTER
06624	3235	DCA DIRECT	
06625	1631	TAD I FLADDR	/INDIRECT?
06626	7430	SZL	
06627	3231	DCA FLADDR	/YES
06630	4504	PUSHF	/NO, GET OPERAND
06631	0000	FLADDR, 0	
06632	4505	POPF	
06633	0040	FLOP	
06634	3043	DCA FLOP3	/CLEAR LOW ORDER OPERAND
06635	5637	DIRECT, JMP I .+2	/OP DIRECT INSTRUCTION
06636	5637	DRECTR, JMP I .+1	/OP TABLE
06637	7406	FLPOW	
06640	6720	FLADD	
06641	6717	FLSUB	
06642	7077	FLMUL	
06643	7171	FLDIV	
06644	6647	FLGET	
06645	6653	FLPUT	
06646	6762	FLNOR	

06647	4504	FLGET,	PUSHF	/OP 5: GET FLAC FROM STORAGE
06650	0040		FLOP	
06651	1254		TAD .+3	/SET UP POINTER TO FLAC
06652	5256		JMP .+4	
06653	4504	FLPUT,	PUSHF	/OP 6: PUT FLAC IN STORAGE
06654	0044		FLAC	
06655	1231		TAD FLADDR	/SET UP POINTER TO STORAGE
06656	3260		DCA .+2	
06657	4505		POPF	
06660	0000		0	/ADDRESS OF STORAGE LOCATION
06661	5201		JMP FPNT+1	
06662	0000	NEGOP,	0	/ROUTINE TO NEGATE FLOP
06663	1042		TAD FLOP2	
06664	7141		CLL CIA	
06665	3042		DCA FLOP2	
06666	7024		CML RAL	
06667	1041		TAD FLOP1	
06670	7041		CIA	
06671	3041		DCA FLOP1	
06672	1004		TAD FNEGSW	/FNEGSW IS COMPLEMENTED WHEN
06673	7140		CLL CMA	/FLOP OR FLAC IS NEGATED
06674	3004		DCA FNEGSW	
06675	5662		JMP I NEGOP	
06676	0000	NEGAC,	0	/ROUTINE TO NEGATE FLAC - "NEGATE"
06677	7300		CLA CLL	/TRIPLE PRECISION
06700	1047		TAD FLAC3	
06701	7041		CIA	
06702	3047		DCA FLAC3	
06703	7024		CML RAL	
06704	1046		TAD FLAC2	
06705	7041		CIA	
06706	3046		DCA FLAC2	
06707	7024		CML RAL	
06710	1045		TAD FLAC1	
06711	7041		CIA	
06712	3045		DCA FLAC1	
06713	1004		TAD FNEGSW	
06714	7140		CLL CMA	
06715	3004		DCA FNEGSW	
06716	5676		JMP I NEGAC	

/ARITHMETIC OPERATIONS

/BOTH FLAC AND FLOP MUST BE NORMALIZED FOR

/+**/^ (FAD,FSU,FMY,FDV,FXP)

06717	4262	FLSUB,	JMS NEGOP	/OP 2: SUBTRACT OP (NEGATE AND ADD)
06720	1045	FLADD,	TAD FLAC1	/OP 1: ADD OP
06721	7650		SNA CLA	
06722	5247		JMP FLGET	/RESULT=OPERAND IF FLAC=0
06723	1041		TAD FLOP1	
06724	7650		SNA CLA	
06725	5201		JMP FPNT+1	/RESULT=FLAC IF FLOP=0
06726	1040		TAD FLOP0	/COMPARE EXPONENTS
06727	7041		CIA	
06730	1044		TAD FLAC0	
06731	7450		SNA	
06732	5357		JMP CMBINE	/EQUAL, GO ADD TOGETHER
06733	7500		SMA	/NOT EQUAL, NEED SHIFTING
06734	5340		JMP SHFLOP	/FLAC>FLOP, SHIFT FLOP
06735	1365		TAD P27	/FLAC<FLOP, SHIFT FLAC
06736	7510		SPA	
06737	5247		JMP FLGET	/TOO FAR TO SHIFT, TREAT AS IF FLAC=0
06740	1364		TAD M27	
06741	3235		DCA DIRECT	/NUMBER OF PLACES TO SHIFT
06742	4767		JMS I RARAC1	/SHIFT FLAC 1 TO RIGHT
06743	2235		ISZ DIRECT	
06744	5342		JMP .-2	
06745	5357		JMP CMBINE	/NUMBERS NOW ALIGNED
06746	7041	SHFLOP,	CIA	/ROUTINE TO SHIFT FLOP
06747	1365		TAD P27	
06750	7510		SPA	
06751	5201		JMP FPNT+1	/FLOP TOO SMALL. TREAT AS 0
06752	1364		TAD M27	
06753	3235		DCA DIRECT	
06754	4766		JMS I RAROP1	/SHIFT FLOP 1 TO RIGHT
06755	2235		ISZ DIRECT	
06756	5354		JMP .-2	
06757	4767	CMBINE,	JMS I RARAC1	/NOW SHIFT BOTH TO PREVENT OVERFLOW
06760	4766		JMS I RAROP1	
06761	4770		JMS I FLAD3	/ADD TRIPLE PRECISION
06762	4771	FLNOP,	JMS I NORF	/OP 7: NORMALIZE FLAC
06763	5201		JMP FPNT+1	
06764	7751	M27,	-27	
06765	0027	P27,	27	
06766	7271	RAROP1,	RAROP	
06767	7251	RARAC1,	RARAC	
06770	5713	FLAD3,	TRPLAD	
06771	7000	NORF,	FNORM	

		/DIRECTORY FOR INTERPRETIVE INPUT	
06772	3347	ASKLS2, INTERM	/CR, TERMINATOR
06773	3347	INTERM	/FF, TERMINATOR
06774	3330	INBARR	/BA, RESTART INPUT
06775	3347	INTERM	/COMMA, TERMINATOR
06776	3347	INTERM	/USER-SPECIFIED TERMINATOR
06777	3345	INGT	/LF, IGNORE

07000	0000	MULPLR=.	
07001	0000	FNORM, 0	/ROUTINE TO NORMALIZE FLAC
07002	7340	CLL CLA CMA	/INITIALIZE SIGN SWITCH
07003	3004	DCA FNEGSW	
07004	1045	TAD FLAC1	/TEST FOR ZERO
07005	7450	SNA	
07006	1046	TAD FLAC2	
07007	7450	SNA	
07008	1047	TAD FLAC3	
07009	7650	SNA CLA	
07010	5232	JMP NOREND	/ZERO, NO NEED TO NORMALIZE
07011	1045	TAD FLAC1	
07012	7710	SPA CLA	
07013	4450	NEGATE	/SIGN IS NEGATIVE
07014	3255	DCA NORC	/SHIFT COUNTER
07015	1045	NRLOOP, TAD FLAC1	/SHIFT NEEDED?
07016	7104	CLL RAL	
07017	7710	SPA CLA	
07018	5225	JMP NMEXIT	/NO, BIT 1=1
07019	4237	JMS RALAC	
07020	2255	ISZ NORC	/RECORD A SHIFT
07021	5216	JMP NRLOOP	
07022	2004	NEXIT, ISZ FNEGSW	/RESTORE SIGN
07023	4450	NEGATE	
07024	1255	TAD NORC	/CORRECT EXPONENT
07025	7041	CIA	
07026	1044	TAD FLAC0	
07027	3044	NOREND, DCA FLAC0	
07028	3047	DCA FLAC3	/NORMALIZED # IS 3 WORDS
07029	5600	JMP I FNORM	
07030	6601	FLTPT, FPNT+1	
07031	6602	NEGOP1, NEGOP	
07032	7037	PROD1=.	
07033	0000	RALAC, 0	/ROUTINE TO ROTATE FLAC 1 TO LEFT
07034	1047	TAD FLAC3	
07035	7104	CLL RAL	
07036	3047	DCA FLAC3	
07037	4245	JMS DRAL	/CALL DOUBLE RAL
07038	5637	JMP I RALAC	
07039	0000	DRAL, 0	/ROTATE FLAC 1 LEFT, DOUBLE PRECISION
07040	1046	TAD FLAC2	
07041	7004	RAL	
07042	3046	DCA FLAC2	
07043	1045	TAD FLAC1	
07044	7004	RAL	
07045	3045	DCA FLAC1	
07046	5645	JMP I DRAL	
07047	7055	NORC=.	

```

/ROUTINE TO TEST SIGNS OF FLAC AND FLOP,
/PLACE FLAC IN TEMP, FOR FLMUL AND FLOIV
FIXSGN, 0
07055 0000
07056 7340 CLL CLA CMA
07057 3004 DCA FNEGSW
07060 1045 TAD FLAC1 /TEST FLAC
07061 7450 SNA
07062 5635 JMP I FLTPT /ZERO, NO OPERATION NEEDED
07063 7710 SPACLA, SPA CLA
07064 4450 NEGATE /TAKE ABS VAL OF FLAC
07065 1045 TAD FLAC1 /TRANSFER TO TEMP
07066 3102 DCA TEMP1
07067 1046 TAD FLAC2
07070 3103 DCA TEMP2
07071 1041 TAD FLOP1
07072 7710 SGNSWT, SPA CLA /SPA CLA FOR *, SMA CLA FOR /
07073 4036 JMS I NEGOP1 /TAKE ABS VAL OF FLOP
07074 1004 TAD FNEGSW
07075 3157 DCA T2 /STORE SIGN OF RESULT
07076 5655 JMP I FIXSGN

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07077	1263	FLOUL,	TAD SPACLA
07100	3272		DCA SGNSWT
07101	4255		JMS FIXSGN
07102	1042		TAD FLOP2
07103	4333		JMS SDMULT
07104	7301		CLA CLL IAC
07105	1044		TAD FLAC0
07106	1040		TAD FLOP0
07107	3044		DCA FLAC0
07110	1272		TAD PROD2
07111	3047		DCA FLAC3
07112	1237		TAD PROD1
07113	3046		DCA FLAC2
07114	1041		TAD FLOP1
07115	4333		JMS SDMULT
07116	1047		TAD FLAC3
07117	3047		DCA FLAC3
07120	7004		RAL
07121	1272		TAD PROD2
07122	1046		TAD FLAC2
07123	3046		DCA FLAC2
07124	7004		RAL
07125	1237		TAD PROD1
07126	3045		DCA FLAC1
07127	4200		JMS FNORM
07130	2157		ISZ T2
07131	4450		NEGATE
07132	5635		JMP I FLTPT

/OP 3: MULTIPLY BY OPERAND
/WANT POSITIVE OPERAND HERE

/MULTIPLY (TEMP1 TEMP2) BY FLOP2
/IGNORE LOW ORDER RESULT
/ADD EXPONENTS

/SAVE PARTIAL RESULTS

/MULTIPLY (TEMP1 TEMP2) BY FLOP1

/COMBINE RESULTS OF MULTIPLICATIONS

/NORMALIZE RESULTS
/CHECK SIGN OF RESULT

07133	0000	SDMULT, 0	/UNSIGNED MULTIPLY ROUTINE
07134	3200	DCA MULPLR	/24 BY 12 BITS
07135	3237	DCA PROD1	
07136	3272	DCA PROD2	
07137	1372	TAD M14	
07140	3255	DCA FIXSGN	/SET TO COUNT 12 MULTIPLICATIONS
07141	7100	CLL	
07142	1200	SDLOOP, TAD MULPLR	/NEW MULTIPLIER BIT INTO LINK
07143	7010	RAR	
07144	3200	DCA MULPLR	/MULPLR ALSO ACCUMULATES LOW-ORDER
07145	7420	SNL	/RESULTS
07146	5355	JMP SDSHIFT	
07147	7100	CLL	/ADD MULTIPLIER IF BIT=1
07150	1163	TAD TEMP2	
07151	1272	TAD PROD2	
07152	3272	DCA PROD2	
07153	7004	RAL	
07154	1162	TAD TEMP1	
07155	1237	SDSHIFT, TAD PROD1	/SHIFT PRODUCT ONE TO RIGHT
07156	7010	RAR	
07157	3237	DCA PROD1	
07160	1272	TAD PROD2	
07161	7010	RAR	
07162	3272	DCA PROD2	
07163	2255	ISZ FIXSGN	
07164	5342	JMP SDLOOP	
07165	1200	TAD MULPLR	/DONE, EXIT WITH LOW ORDER IN AC
07166	7010	RAR	
07167	5733	JMP I SDMULT	
	7472	PROD2=SGNSWT	
07170	7764	M14, -14	


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07171 1041 FLDIV, TAD FLOP1
07172 7650 SNA CLA
07173 4526 ERROR
07174 1062 TAD P7700
07175 3272 DCA SGNSWT
07176 4255 JMS FIXSGN
07177 1040 TAD FLOP0
07200 7041 CIA
07201 1044 TAD FLAC0
07202 7001 IAC
07203 3044 DCA FLAC0
07204 3045 DCA FLAC1
07205 3046 DCA FLAC2
07206 1314 TAD M30
07207 3271 DCA DIVCNT
07210 5226 JMP OVLOOP
07211 7420 OVSETQ, SNL
07212 5216 JMP ZERQUO
07213 3162 DCA TEMP1
07214 1164 TAD TEMP3
07215 3163 DCA TEMP2
07216 7200 ZERQUO, CLA
07217 4647 JMS I DRALP
07220 1163 TAD TEMP2
07221 7004 RAL
07222 3163 DCA TEMP2
07223 1162 TAD TEMP1
07224 7004 RAL
07225 3162 DCA TEMP1
07226 7100 OVLOOP, CLL
07227 1042 TAD FLOP2
07230 1163 TAD TEMP2
07231 3164 DCA TEMP3
07232 7004 RAL
07233 1041 TAD FLOP1
07234 1162 TAD TEMP1
07235 2271 ISZ DIVCNT
07236 5211 JMP OVSETQ
07237 7210 CLA RAR
07240 3047 DCA FLAC3
07241 4650 JMS I NOR2
07242 2157 ISZ T2
07243 5646 JMP I FLOT1
07244 4450 NEGATE
07245 5646 JMP I FLOT1
07246 6601 FLOT1, FPNT+1
07247 7045 DRALP, DRAL
07250 7000 NOR2, FNORM

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/OP 4: DIVIDE BY OPERAND

/TRIED TO DIVIDE BY 0
/*SMA CLA

/SUBTRACT EXPONENTS

/ZERO FLAC FOR QUOTIENT

/SET COUNTER

/LINK IS QUOTIENT BIT

/RESTORE LOW ORDER RESULT

/SHIFT RESULT BIT INTO QUOTIENT
/ROTATE LEFT DOUBLE PRECISION
/SHIFT DIVIDEND

/SUBTRACT DIVISOR FROM DIVIDEND

/DONE, USE RESULT OF LAST SUBTRACTION
/AS EXTRA PRECISION

/RESTORE SIGN

07251	0000	RARAC,	0	/ROUTINE TO ROTATE FLAC 1 RIGHT
07252	7300		CLA CLL	
07253	1045		TAD FLAC1	
07254	7510		SPA	
07255	7020		CML	/PROPOGATE SIGN BIT
07256	7010		RAR	/SHIFT
07257	3045		DCA FLAC1	
07260	1046		TAD FLAC2	
07261	7010		RAR	
07262	3040		DCA FLAC2	
07263	1047		TAD FLAC3	
07264	7010		RAR	
07265	3047		DCA FLAC3	
07266	2044		ISZ FLAC0	/ADJUST EXPONENT
07267	5651		JMP I RARAC	
07270	5651		JMP I RARAC	
	7271	EXPCNT=		
07271	0000	RAROP,	0	/ROUTINE TO SHIFT FLOP 1 RIGHT
07272	7300		CLA CLL	
07273	1041		TAD FLOP1	
07274	7510		SPA	
07275	7020		CML	
07276	7010		RAR	
07277	3041		DCA FLOP1	
07300	1042		TAD FLOP2	
07301	7010		RAR	
07302	3042		DCA FLOP2	
07303	1043		TAD FLOP3	
07304	7010		RAR	
07305	3043		DCA FLOP3	
07306	2040		ISZ FLOP0	
07307	5671		JMP I RAROP	
07310	5671		JMP I RAROP	

/ROUTINE TO FIX FLAG = "FIX"

/REMOVE FRACTIONAL PART BUT LEAVE FLOATING

/FIXED NUMBER IN AC ON EXIT

07311	0000	XFIX, 0	
07312	7300	CLA CLL	
07313	1044	TAD FLAG	/TEST EXPONENT
07314	7750	SPA SNA CLA	/IF -1<#<1, CLEAR ENTIRELY
07315	3044	DCA FLAG	/EXCEPT FOR SIGN BIT
07316	1044	TAD FLAG	
07317	1331	TAD FIXC	
07320	3271	DCA DIVCNT	
07321	7430	SZL	
07322	5711	JMP I XFIX	/TOO BIG TO FIX
07323	4251	JMS RARAC	/FIX BY ROTATING FRACTIONAL BITS
07324	2271	ISZ DIVCNT	/OUT OF FLAG
07325	5323	JMP .-2	
07326	3047	DCA FLAG+3	/CLEAR FRACTIONAL PART
07327	1046	TAD FLAG+2	
07330	5711	JMP I XFIX	
07331	7751	FIXC, -27	

/ROUTINE TO FLOAT C(AC) AS FLOATING PT. INTEGER

/- "FLOAT"

07332	0000	XFLOAT, 0	
07333	3045	DCA FLAG1	/SAVE NUMBER
07334	3046	DCA FLAG2	
07335	3047	DCA FLAG3	
07336	1005	TAD P13	/INTEGER EXPONENT
07337	3044	DCA FLAG0	
07340	4251	JMS RARAC	/IN CASE NUMBER WAS 4000
07341	4650	JMS I NOR2	/NORMALIZE
07342	5732	JMP I XFLOAT	

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07343 7037 RFLAC, RALAC
07344 5713 TFLAD, TRPLAD
07345 7774 M4, -4
07346 4421 RANDOM, 4421 /CURRENT RANDOM NUMBER
07347 3040 3040
07350 0001 0001

/STATISTICAL RANDOM NUMBER GENERATOR
/EASED ON DECUS 5-25, POWER RESIDUE METHOD
/NEW R=R*(2^17+3) MOD 36 BITS
FRAN, FENT
07351 4407 FGT RANDOM /R=OLD RANDOM NUMBER
07352 5346 FEXT /ALREADY SHIFTED LEFT 12 BITS
07353 0000 PUSHF
07354 4504 RANDOM
07355 7340 POPF
07356 4505 FLOP1
07357 0041 TAD M4 /SHIFT 4 MORE TO GET R*2^16
07360 1345 DCA T1
07361 3156 JMS I RFLAC
07362 4743 ISZ T1
07363 2156 JMP ,+2
07364 5362 JMS I TFLAD /+R = R*(2^16+1)
07365 4744 JMS I RFLAC /*2 = R*(2^17+2)
07366 4743 JMS I TFLAD /+R = R*(2^17+3)
07367 4744 PUSHF
07370 4504 FLAC1
07371 0045 POPF
07372 4505 RANDOM
07373 7346 /SAVE NEW RANDOM NUMBER
07374 3047 DCA FLAC3
07375 3044 DCA FLAC0 /MAKE IT A 2-WORD FRACTION
07376 1045 TAD FLAC1 /CHECK SIGN
07377 7700 SMA CLA
07400 5500 RETURN
07401 2046 ISZ FLAC2 /POSITIVE
07402 7410 SKP /NEGATIVE, TAKE 1'S COMPLEMENT
07403 2045 ISZ FLAC1
07404 4450 NEGATE
07405 5500 RETURN

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07406 1407 FLPOW, TAD I 7 /OP 0: RAISE FLAC TO POWER
07407 4503        PUSHB  /SAVE FLOATING POINTER
07410 4504        PUSHF  /SAVE FLAC
07411 0044        FLAC
07412 4505        POPF
07413 7545        FLTEMP
07414 4504        PUSHF  /GET FLOP
07415 0040        FLOP
07416 4505        POPF
07417 0044        FLAC
07420 4452        FIX    /FIX OPERAND
07421 7710        SPA CLA
07422 7001        IAC
07423 1045        TAD FLAC1
07424 7640        SZA CLA
07425 4520        ERROR  /RAISING TO TOO HIGH A POWER
07426 1040        TAD FLAC2
07427 3350        DCA XFL
07430 4407        FENT   /PUT 1. IN FLAC
07431 5661        FGT I ONEP
07432 0000        FEXT
07433 1350        TAD XFL
07434 7450        SNA
07435 5255        JMP FLXEND      /X=0=1, DO NOT MULTIPLY
07436 7501        SMA
07437 5240        JMP RAISTP     /RAISE TO + POWER
07440 4407        FENT         /RAISE TO - POWER
07441 4345        FDV FLTEMP
07442 6345        FPT FLTEMP
07443 5661        FGT I ONEP
07444 0000        FEXT
07445 5250        JMP .+3
07446 7041 RAISTP, CIA
07447 3350        DCA XFL      /SET COUNTER
07450 4407        FENT         /DO MULTIPLICATIONS
07451 3345        FMY FLTEMP
07452 0000        FEXT
07453 2350        ISZ XFL
07454 5250        JMP .-4
07455 1413 FLXEND, POPA      /RESTORE FLOATING POINTER
07456 3407        DCA I 7
07457 5660        JMP I .+1
07460 6601        FPNT+1
07461 1573 ONEP,  FLTONE

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/FLOATING SQUARE ROOT FUNCTION

07462	1045	FSRT,	TAD FLAC1	/TEST SIGN
07463	7510		SPA	
07464	4526		ERROR	/SQUARE ROOT OF NEG NUMBER
07465	7650		SNA CLA	
07466	5500		RETURN	/ZERO, RESULT IS ZERO
07467	1044		TAD FLAC0	/CONSTRUCT INITIAL APPROXIMATION
07470	7510		SPA	/BY HALVING EXPONENT
07471	7020		CML	
07472	7010		RAR	
07473	3044		DCA FLAC0	
07474	1334		TAD SQCON	
07475	3045		DCA FLAC1	
07476	4407	SQLOOP,	FENT	/MAKE NEW APPROXIMATION
07477	6345		FPT FLTEMP	/NEW X=(N/X+X)/2
07500	5500		FGT I FLARGP	/ORIGINAL ARG
07501	4345		FDV FLTEMP	
07502	1345		FAD FLTEMP	
07503	0000		FEXT	
07504	7040		CMA	
07505	1044		TAD FLAC0	
07506	3044		DCA FLAC0	
07507	1044		TAD FLAC0	/COMPARE OLD AND NEW APPROXIMATIONS
07510	7041		CIA	
07511	1345		TAD FLTEMP	
07512	7640		SZA CLA	
07513	5276		JMP SQLOOP	/EXPONENTS NOT EQUAL
07514	1045		TAD FLAC1	
07515	7041		CIA	
07516	1340		TAD FLTEMP+1	
07517	7640		SZA CLA	
07520	5276		JMP SQLOOP	/HIGH ORDER NOT EQUAL
07521	1040		TAD FLAC2	
07522	7041		CIA	
07523	1347		TAD FLTEMP+2	
07524	7450		SNA	/COMPARE LOW ORDERS TO
07525	5500		RETURN	/WITHIN PLUS OR MINUS ONE BIT
07526	7500		SMA	
07527	7041		CIA	
07530	7001		IAC	
07531	7650		SNA CLA	
07532	5500		RETURN	
07533	5276		JMP SQLOOP	
07534	3015	SQCON,	3015	

/FUNCTION TO EVALUATE SIGN PART OF FLAC
/RESULTS: -1 FOR NEGATIVE, 0 FOR ZERO, +1 FOR POSITIVE

07535	1045	FSGN,	TAD FLAC1	
07536	7450		SNA	
07537	5343		JMP .+4	/ZERO, SET RESULT TO 0
07540	7710		SPA CLA	
07541	1034		TAD M2	/NEGATIVE (-1)
07542	7001		IAC	/POSITIVE (+1)
07543	4430		FLOAT	/FLOAT C(AC) = -1,0,1
07544	5500		RETURN	
	7545	DIGBUF=.		/OUTPUT DIGIT BUFFER (8 WORDS)
07545	0000	FLTEMP, 0		/TEMPORARY REGISTERS
07546	0000			
07547	0000			
	7550	ASKBUF=.		/"ASK" INPUT BUFFER (TO END OF PAGE)
	7612	ASKEND=7612		/END+12 OF "ASK" INPUT BUFFER
07550	0000	XFL, 0		

ADD	0135	C43	5763	ERROR4	4526	FLTONE	1573
ALIST	1133	C7760	0367	ERROR5	2735	FLTPT	7035
ARGNXT	1723	DBCONV	5600	ERR2	2736	FLT XR	0014
ASK	1206	DBLOOP	5656	ERV	2235	FLTZER	1575
ASKBND	7612	DBTERM	5653	ERVX	2240	FLXEND	7455
ASKBUF	7550	DCONT	0462	ETERM	1641	FNEGSW	0004
ASKEND	3317	DCOUNT	6225	ETERMN	1636	FNORM	7000
ASKLST	5776	DERGSW	0151	ETERM1	1615	FNTABF	0571
ASKLS2	6772	DECEXP	5764	ETERM2	1647	FNTABL	2210
ATLIST	1501	DECINT	6010	EVAL	1601	FOR	1024
ATSW	0131	DECIN1	5757	EVLN	0370	FOUTPU	0072
AXIN	0010	DECNUM	0164	EXIT	2644	FPNT	6600
AXOUT	0017	DECP	0133	EXITJ	2657	FPRNT	6364
BACK	6406	DECR	6240	EXTR	2334	FP10P	0415
BDCONV	6170	DELETE	2111	FCONT	1064	FRAN	7351
BDC0	6252	DGRP	0423	FEND	1126	FRST	3420
BDC1	6256	DGRP1	0432	FEND3	2310	FRSTX	3430
BDC2	6301	DIG	6425	FINDLN	4516	FSGN	7535
BDEND	6145	DIGBUF	7545	FINDN	2271	FSQT	7462
BDENOP	6445	DIGIT	0163	FINPUT	0073	FTXR	1125
BDSAL	6203	DIGITS	0006	FIX	4452	FTXS	1124
BEGIN	3432	DIRECT	6635	FIXC	7331	F10P	0414
BOTTOM	0027	DIVCNT	7271	FIXSGN	7055	GEG	0356
BUFBEG	3432	DMP SW	0152	FLAC	0044	GEND	2355
BUFBOT	3353	DO	0416	FLAC0	0044	GETARG	1404
BUFR	0134	DOK	2130	FLAC1	0045	GETC	4506
BUFST	6235	DONE	2146	FLAC2	0046	GETLN	4515
BUFTOP	3364	DOONE	0454	FLAC3	0047	GETVAR	1411
CCR	0000	DRAL	7045	FLADD	6720	GET1	2351
CFNR	5766	DRALP	7247	FLADDR	6631	GET3	2366
CFRS	0075	DRECTR	6636	FLAD3	6770	GEXIT	0332
CFRSX	0227	DVLOOP	7226	FLARG	2034	GFND1	1512
CHAR	0142	DVSETQ	7211	FLARGP	0160	GINC	0144
CHIN	2403	ECHO	2471	FLDIG	6131	GLIST	1141
CLF	0057	ECHOLS	1612	FLDIV	7171	GONE	0233
CMBINE	6757	ECHP	3255	FLGET	6647	GOTO	0610
CNTR	0132	EFOP	0131	FLINST	5767	GRPTST	2451
COL	1233	EFUN	1742	FLMUL	7077	GS1	1443
CCLP	3251	EFUN2	1764	FLNOR	6762	GS2	1467
COMBOT	0226	EFUN3	2056	FLOAT	4430	GS3	1447
COMBUF	0074	EFUN3I	0100	FLOP	0040	GS4	1464
COMELA	2527	EINPUT	5701	FLOPR	1674	GS5	1520
COMGO	1104	ELPAR	1753	FLOP0	0040	GTEM	0021
COMLST	0756	END	0076	FLOP1	0041	GTESTA	0347
COMMEN	0620	ENDLN	4517	FLOP2	0042	HELLO	3274
COMOUT	2600	ENDT	0077	FLOP3	0043	HINBUF	0037
COUTPT	3373	ENUM	1732	FLOT1	7246	HP	3301
CPRINT	3247	EPAR	1710	FLOUT	6122	HPT	2037
CTSF	3220	EPAR2	1755	FLOUTP	6236	HREAD	6466
C100	0000	ERASE	2226	FLPOW	7406	HREAD2	6472
C200	0015	ERG	2252	FLPTEN	5773	HSGO	6506
C240	0033	ERL	2250	FLPUT	6653	IBAR	0212
C253	0115	ERROR	4526	FLSUB	6717	IF	0776
C260	2036	ERROR2	4526	FLTEMP	7545	IGNOR	0217
C305	0146	ERROR3	4526	FLTEN	5770	IN	6416

INBARR	3330	M2	0034	OPTXIT	3241	P337	0054
INBUF	2664	M20	0025	OUT	2477	P4000	0225
INDEV	0140	M240	0063	OUTA	6437	P7600	0024
INGT	3345	M27	6764	OUTCR	2510	P77	0071
INLIST	0504	M3	0066	OUTDEV	0137	P7700	0062
INPINT	0366	M30	7314	OUTP	6150	RAISTP	7446
INPUTX	0274	M4	7345	OUTPT	3365	RALAC	7037
INSIG	5765	M40	2376	OUTS	1240	RANDOM	7346
INTABL	004	M5	0067	OUTX	2507	RARAC	7251
INTASK	3330	M77	0023	OVCHK	5633	RARAC1	6767
INTDO	0005	NAGSW	0141	OWAIT	3225	RAROP	7271
INTERK	3347	NEGAC	6676	PACBUF	3023	RAROP1	6766
INTERP	1220	NEGATE	4450	PACKC	4507	READC	4513
INTG	1272	NEGOP	6662	PACKST	0153	RECOVR	2745
INTNEG	0067	NEGOP1	7036	PACLST	3056	REMAIN	0162
INTOUT	0042	NEGSN	6167	PACLS2	1204	RESTR	6517
INTPTR	0114	NEWDIG	5614	PC	0145	RET	6351
INTRPT	2603	NMEXIT	7025	PCHK	0510	RETRN	1554
INTSUB	0060	NORC	7055	PCK1	3042	RETURN	5500
IOBUF	3400	NOREND	7032	PC1	0620	RFLAC	7343
IOSW	3305	NORF	6771	PDLXR	0013	RND2	6227
IOVRL	5761	NOR2	7250	PD2	0532	ROT	3060
IRARAC	5761	NOTDIG	5650	PD3	0550	ROTRAC	5762
IRETN	0231	NRLDOP	7016	PER	0022	RTL6	4520
LASTLN	0150	NTEXIT	1550	PERIOD	5612	RUB1	3065
LASTOP	0130	NTST1	1552	PGOTO	1022	RUB2	3077
LASTV	0155	NTST2	1553	PINC	1122	RUB3	3110
LIBRAP	2735	ONEINC	1117	PKZERO	3122	R6	6340
LINEND	0143	ONEP	7461	PLPR	1023	SAVAC	2600
LISTGD	1402	OPNEXT	1610	POPA	1413	SAVLK	2601
LIST3	0060	OPTABL	1731	POPF	4505	SBAR	1321
LIST6	0054	OPTABS	2026	POPJ	5502	SCALED	6244
LNERR	0361	OPTC	3302	PQUES	3040	SCHAR	1312
LPRTST	2077	OPTCOL	3244	PRCP	1103	SCONT	1307
MEREAK	2002	OPTC1	3250	PRINTC	4512	SDLOOP	7142
MCR	0065	OPTDOP	2734	PRNTLN	4514	SDMULT	7133
MDIG	6147	OPTF	3252	PROC	0616	SDOWN	6220
MDIGIT	6226	OPTI	3303	PROCES	0615	SDSHIF	7155
MF	0007	OPTION	6446	PROD1	7037	SET	1024
MFLT	0066	OPTK	6457	PROD2	7072	SEX	1357
MINUSA	0003	OPTLST	2400	PSWIT	5660	SEXC	0752
MODIFY	1273	OPTM	3271	PTCH	0161	SFINAL	1060
MPER	0064	OPTN	3253	PTENPT	6232	SFOUND	1325
MULPLR	7040	OPTP	3234	PT1	0154	SGNSWT	7072
MULT1V	5742	OPTR	6453	PT2	1132	SGNTST	5755
MULT2	5734	OPTRET	6461	PUSHA	4503	SGOT	1331
MULT2I	5756	OPTRI	2663	PUSHF	4504	SHFLOP	6746
MULT2P	6233	OPTRO	2662	PUSHJ	4501	SIGOUT	6100
MULT10P	6234	OPTRO	2661	P0	1523	SIN	2706
M10V	0062	OPTS	3256	P13	0005	SKIPNP	3014
M11	0070	OPTT	3237	P17	0031	SKPNP	2732
M12	6230	OPTTBL	2174	P177	0026	SNLIST	6115
M13	1120	OPTTDO	3203	P2	0035	SORTB	1333
M137	2377	OPTTL	3221	P27	6765	SORTC	4511
M14	7170	OPTX	3243	P277	0032	SORTCN	0127

SORTJ	4510	T1	0156
SPACLA	7463	T2	0157
SPLAT	3124	USERT	6002
SPNCR	4521	USERTP	3270
SGCON	7534	UTE	2317
SQLDOP	7476	UTO	2326
SKWLST	1376	UTRA	2315
START	4177	UTX	2337
STARTV	4134	VAL	2463
STRING	3323	WAITP	2733
SUBS	1524	WALL	0671
TAB	1362	WEXIT	0703
TABCTR	4153	WRITE	0641
TASK	1214	WTESTG	0674
TASKCL	1222	WTEST2	0660
TASK4	1252	WTXR	0712
TCLLF	1254	WTXS	0711
TCLLF2	1254	WX	0676
TDEND	3170	XABS	2053
TDLOOP	3131	XADC	2414
TDOUTP	3174	XCT	0020
TDTEXT	3175	XCTIN	0136
TDUMP	3125	XDXS	1153
TELSA	2660	XDYS	1145
TEMP1	4162	XENDLN	2417
TEMP2	4163	XFIND	2265
TEMP3	4164	XFIX	7311
TENPT	4231	XFL	7550
TERMS	2066	XFLOAT	7332
TESTC	4525	XGETLN	0312
TESTN	4522	XINT	1156
TEXTP	2017	XI33	2665
TFLAQ	7344	XOUTL	2675
TGRP2	4473	XPOPJ	1556
THISLN	4146	XPRNTL	6151
THISOP	4147	XPUSHA	0501
TINT	2625	XPUSHJ	0523
TINTR	1260	XRT	0011
TLIST	1142	XRTL6	0305
TLIST2	1405	XRT2	0012
TLIST3	1162	XRT3	0016
TOIDIG	0051	XSORTC	0733
TQUOT	1241	XSPNOR	1524
TRPLAD	5713	XTESTC	0713
TTERM	4565	XTESTN	1533
TSTGRP	4524	XTSTER	2514
TSTLPR	4523	XXX	6117
TSTSGN	6030	XXXP	6237
TSWP	3233	X0	1161
TTXTR	1237	ZERQUO	7216
TTXTS	1236		
TXTRES	2443		
TXTSAV	2435		
TYPE	1237		
TYPE2	1227		

```

1      /EXTENDED FUNCTION PACKAGE FOR FOCAL 5/69
2      /E.A.TAFT, 6/10/69
3      /
4      /FSIN: SIN(X)
5      /FCOS: COS(X)
6      /FATN: ARC TAN(X)
7      /FEXP: EXP(X)
8      /FLOG: LN(X)
9      /////
10     /DEFINITIONS
11     1000 FIXMRI FAD=1000
12     2000 FIXMRI FSB=2000
13     3000 FIXMRI FMY=3000
14     4000 FIXMRI FDV=4000
15     5000 FIXMRI FGT=5000
16     6000 FIXMRI FPT=6000
17     7000 FNR=7000
18     4407 FENT=4407
19     0000 FEXT=0
20
21     FIXTAB
22     /////
23     4450 NEGATE= 4450
24     1045 GETSGN= 1045
25     5500 RETURN= 5500
26     0010 SN= 10
27     4452 FIX= 4452
28     4503 PUSHA= 4503
29     1413 POPA= 1413
30     0044 FLAC= 44
31     7545 FLTEMP= 7545
32     1573 FLTONE= 1573
33     0013 POLXR= 13
34     4526 ERROR= 4526
35     4430 FLOAT= 4430
36     0571 FNTABF= 571
37     0027 BOTTOM= 27
38     1164 COMGO= 1164
39     4510 SORTJ= 4510
40     0067 M5= 67
41     0132 CNTR= 132
42     0010 AXIN= 10
43     4565 TSTERM= 4565
44     0616 PROC= 616
45     2735 ERROR5= 2735
46     5600 DBCONV= 5600

```

X IN RADIANS
X IN RADIANS
RESULT IN RADIANS


```

46      0027  *BOTTOM
47      00027 5112      FCOS-1      /TOP OF TEXT
48      0600  *FNTABF+7
49      00600 5335      FATN      /POINTERS TO EXTENDED FUNCTIONS
50      00601 5202      FEXP
51      00602 5454      FLOG
52      00603 5117      FSIN
53      00604 5113      FCOS
54      //
55      /ENABLE A "LIBRARY DELETE" COMMAND
56      /WHICH WILL DELETE THE EXTENDED FUNCTIONS AND
57      /FREE MORE FOR USER AREA.
58      1174  *COMGO+10
59      01174 6556      LIBRARY
60      6555  *6555
61      06555 0304      LIBLST, "D
62      //
63      06556 4510      LIBRARY, SORTJ      /"LIBRARY" = EXPANDABLE COMMAND
64      06557 6554      LIBLST-1
65      06560 0022      LIBGO-LIBLST
66      06561 4526      ERROR      /ILLEGAL LIBRARY COMMAND
67      //
68      06562 1067      LIBD,      TAD M5      /DELETE THE EXTENDED FUNCTIONS
69      06563 3132      DCA CNTR
70      06564 1375      TAD EXTAB
71      06565 3010      DCA AXIN
72      06566 1175      TAD PERROR
73      06567 3410      DCA I AXIN      /SET ERROR5 POINTERS
74      06570 2132      ISZ CNTR
75      06571 5366      JMP .-3
76      06572 1376      TAD DTOP
77      06573 3027      DCA BOTTOM      /MOVE TOP POINTER UP
78      06574 5261      JMP 6461      /OPTRET (TO REACH END OF COMMAND)
79      //
80      06575 0577      EXTAB,      FNTABF+6
81      06576 5577      DTOP,      DBCONV-1
82      06577 6562      LIBGO,      LIBD
83      0175  *175
84      00175 2735      PERROR,      ERROR5

```

85			/FOCAL EXTENDED FUNCTIONS	
86		5113	*5113	
87			/	
88	05113	4450	FCOS,	COSINE
89	05114	4407		NEGATE
90	05115	1772		FENT
91	05116	0000		FAD I PI2
92				FEXT
93			/////	
94	05117	1045	/	SINE
95	05120	7450	FSIN,	GETSGN
96	05121	5500		SNA
97	05122	7710		RETURN
98	05123	4771		SPA CLA
99	05124	3010		JMS I NEG2
100	05125	4407		DCA SN
101	05126	4374		FENT
102	05127	6773		FDV TWOPI
103	05130	0000		FPT I X2
104	05131	4452		FEXT
105	05132	4450		FIX
106	05133	4407		NEGATE
107	05134	7000		FENT
108	05135	1773		FNR
109	05136	3374		FAD I X2
110	05137	6773		FMY TWOPI
111	05140	2377		FPT I X2
112	05141	0000		FSB PI
113	05142	1045		FEXT
114	05143	7710		GETSGN
115	05144	5353		SPA CLA
116	05145	4407		JMP PCHECK
117	05146	6773		FENT
118	05147	0000		FPT I X2
119	05150	1010		FEXT
120	05151	7040		TAD SN
121	05152	3010		CMA
122	05153	4407	PCHECK,	DCA SN
123	05154	5773		FENT
124	05155	2772		FGT I X2
125	05156	0000		FSB I PI2
126	05157	1045		FEXT
127	05160	7710		GETSGN
128	05161	5367		SPA CLA
129	05162	4407		JMP PALGO
130	05163	5377		FENT
131	05164	2773		FGT PI
132	05165	6773		FSB I X2
133	05166	0000		FPT I X2
134	05167	5770	PALGO,	FEXT
135	05170	5540		JMP I .+1
				PALG

/COS(X)=SIN(PI/2-X)

/SIN(0)=0

/SIN(-X)=-SIN(X)

/REDUCE MODULO 2 PI

/X<PI?

/YES

/NO, SIN(X-PI)=-SIN(X)

/X<PI/2?

/YES

/NO, SIN(X)=SIN(PI-X)

/PERFORM POWER SERIES EXPANSION

136				
137	05171	5321	NEG2,	FNEG
138	05172	5413	PI2,	PIOT
139	05173	5325	X2,	X
140	05174	0003	TWOPI,	0003
141	05175	3110		3110
142	05176	3761		3761
143	05177	0002	PI,	0002
144	05200	3110		3110
145	05201	3761		3761
146			/	EXPONENTIAL
147	05202	1045	FEXP,	GETSGN
148	05203	7710		SPA CLA
149	05204	4321		JMS FNEG
150	05205	3010		DCA SN
151	05206	4407		FENT
152	05207	3272		FMY LG2E
153	05210	6325		FPT X
154	05211	0000		FEXT
155	05212	4452		FIX
156	05213	4503		PUSHA
157	05214	4450		NEGATE
158	05215	4407		FENT
159	05216	7000		FNR
160	05217	1325		FAD X
161	05220	6325		FPT X
162	05221	3325		FMY X
163	05222	6330		FPT XSQR
164	05223	1267		FAD DF
165	05224	6733		FPT I TP
166	05225	5264		FGT CF
167	05226	4733		FDV I TP
168	05227	2325		FSB X
169	05230	1256		FAD AF
170	05231	6733		FPT I TP
171	05232	5261		FGT BF
172	05233	3330		FMY XSQR
173	05234	1733		FAD I TP
174	05235	6733		FPT I TP
175	05236	5325		FGT X
176	05237	4733		FDV I TP
177	05240	3275		FMY TWO
178	05241	1734		FAD I ONEPT
179	05242	0000		FEXT
180	05243	1413		POPA
181	05244	1044		TAD FLAC
182	05245	3044		DCA FLAC
183	05246	2010		ISZ SN
184	05247	5500		RETURN
185	05250	4407		FENT
186	05251	6325		FPT X
187	05252	5734		FGT I ONEPT
188	05253	4325		FDV X
189	05254	0000		FEXT
190	05255	5500		RETURN

/TAKE ABSOLUTE VALUE

/SAVE INTEGER PART

/RETAIN FRACTIONAL PART

/EXP(-X)=1/EXP(X)


```

191                                     /EXP AND ARCTANGENT CONSTANTS
192 05256 0404 AF, 0004
193 05257 2372 2372
194 05260 1402 1402
195 05261 7774 BF, 7774
196 05262 2157 2157
197 05263 5157 5157
198 05264 0012 CF, 0012
199 05265 5454 5454
200 05266 0343 0343
201 05267 0007 DF, 0007
202 05270 2566 2566
203 05271 5341 5341
204 05272 0001 LG2E, 0001
205 05273 2705 2705
206 05274 2435 2435
207 05275 0002 TWO, 0002
208 05276 2000 2000
209 05277 0000 BET1, 0000
210 05300 2427 2427
211 05301 2323 2323
212 05302 7775 BET2, 7775
213 05303 3427 3427
214 05304 7052 7052
215 05305 0000 BETZ, 0000
216 05306 2437 2437
217 05307 1646 1646
218 05310 7773 ALF2, 7773
219 05311 3306 3306
220 05312 5454 5454
221 05313 7777 ALF1, 7777
222 05314 3304 3304
223 05315 4434 4434
224 05316 0000 ALFZ, 0000
225 05317 2437 2437
226 05320 1643 1643
227 //////////////////////////////////
228 /ROUTINE TO NEGATE FLAG AND RETURN WITH AC=7777
229 05321 0000 FNEG, 0
230 05322 4450 NEGATE
231 05323 7040 CMA
232 05324 5721 JMP I FNEG
233 /VARIABLES
234 05325 0000 X, 0
235 05326 0000 0
236 05327 0000 0
237 05330 0000 XSQR, 0
238 05331 0000 0
239 05332 0000 0
240 /POINTERS
241 05333 7545 TP, FLTEMP
242 05334 1573 ONEPT, FLTONE

```


243		/	ARC TANGENT	
244	05335	1045	FATN,	GETSGN /TAKE ABSOLUTE VALUE
245	05336	7710		SPA CLA
246	05337	4321		JMS FNEG
247	05340	3710		DCA SN
248	05341	4407		FENT
249	05342	6325		FPT X
250	05343	5325		FGT X
251	05344	2734		FSB I ONEPT
252	05345	0000		FEXT
253	05346	1045		GETSGN
254	05347	7710		SPA CLA
255	05350	5357		JMP GO
256	05351	4407		FENT
257	05352	5734		FGT I ONEPT
258	05353	4325		FDV X
259	05354	6325		FPT X
260	05355	0000		FEXT
261	05356	7040		CMA
262	05357	4503	GO,	PUSHA /SIGN FLAG
263	05360	4407		FENT
264	05361	5325		FGT X
265	05362	3325		FMV X
266	05363	6330		FPT XSQR
267	05364	3302		FMV BET2
268	05365	1277		FAD BET1
269	05366	3330		FMV XSQR
270	05367	1305		FAD BETZ
271	05370	0733		FPT I TP
272	05371	5310		FGT ALF2
273	05372	3330		FMV XSQR
274	05373	1313		FAD ALF1
275	05374	3330		FMV XSQR
276	05375	1316		FAD ALFZ
277	05376	3325		FMV X
278	05377	4733		FDV I TP
279	05400	0000		FEXT
280	05401	2413		ISZ I PDLXR /CHECK SIGN FLAG
281	05402	5207		JMP EXIT2
282	05403	4450		NEGATE /SUBTRACT FROM PI/2
283	05404	4407		FENT
284	05405	1213		FAD PIOT
285	05406	0000		FEXT
286	05407	2010	EXIT2,	ISZ SN /ARC TAN(-X)=-ARC TAN(X)
287	05410	5500		RETURN
288	05411	4450		NEGATE
289	05412	5500		RETURN

290			/ARCTANGENT AND LOG CONSTANTS AND POINTERS
291	05413	0001	PIOT, 0001
292	05414	3110	3110
293	05415	3761	3761
294	05416	7771	L8, 7771
295	05417	4544	4544
296	05420	1735	1735
297	05421	7774	L7, 7774
298	05422	2236	2236
299	05423	4304	4304
300	05424	7775	L6, 7775
301	05425	4746	4746
302	05426	0771	0771
303	05427	7776	L5, 7776
304	05430	2535	2535
305	05431	3301	3301
306	05432	7776	L4, 7776
307	05433	4113	4113
308	05434	7211	7211
309	05435	7777	L3, 7777
310	05436	2517	2517
311	05437	0307	0307
312	05440	7777	L2, 7777
313	05441	4000	4000
314	05442	4100	4100
315	05443	0000	L1, 0000
316	05444	3777	3777
317	05445	7742	7742
318	05446	0000	LOGE2, 0000
319	05447	2613	2613
320	05450	4414	4414
321	05451	7545	TP1, FLTEMP
322	05452	1573	ONEP2, FLTONE
323	05453	5325	X1, X

324		/	LOGARITHM	
325	05454	1045	FLOG,	GETSGN
326	05455	7550		SPA SNA
327	05456	4526		ERROR
328	05457	4407		FENT
329	05460	6651		FPT I TP1
330	05461	2652		FSB I ONEP2
331	05462	0000		FEXT
332	05463	1045		GETSGN
333	05464	7450		SNA
334	05465	5336		JMP ZERGO
335	05466	7700		SMA CLA
336	05467	5276		JMP STARTL
337	05470	4407		FENT
338	05471	5652		FGT I ONEP2
339	05472	4651		FDV I TP1
340	05473	6651		FPT I TP1
341	05474	0000		FEXT
342	05475	7040		CMA
343	05476	3010	STARTL,	DCA SN
344	05477	7040		CMA
345	05500	1651		TAD I TP1
346	05501	4430		FLOAT
347	05502	4407		FENT
348	05503	3246		FMY LOGE2
349	05504	6653		FPT I X1
350	05505	0000		FEXT
351	05506	7001		IAC
352	05507	3651		DCA I TP1
353	05510	4407		FENT
354	05511	5651		FGT I TP1
355	05512	2652		FSB I ONEP2
356	05513	6651		FPT I TP1
357	05514	3216		FMY L8
358	05515	1221		FAD L7
359	05516	3651		FMY I TP1
360	05517	1224		FAD L6
361	05520	3651		FMY I TP1
362	05521	1227		FAD L5
363	05522	3651		FMY I TP1
364	05523	1232		FAD L4
365	05524	3651		FMY I TP1
366	05525	1235		FAD L3
367	05526	3651		FMY I TP1
368	05527	1240		FAD L2
369	05530	3651		FMY I TP1
370	05531	1243		FAD L1
371	05532	3651		FMY I TP1
372	05533	1653		FAD I X1
373	05534	0000		FEXT
374	05535	5207		JMP EXIT2
375	05536	4430	ZERGO,	FLOAT
376	05537	5500		RETURN

/ZERO OR NEGATIVE ARGUMENT

/LOG(1)=0

/LOG(X)=-LOG(1/X)

```

377
378 05540 4407 /CONTINUATION OF SINE ROUTINE
379 05541 5653 PALG, FENT
380 05542 4213 FGT I X1
381 05543 6653 FDV PIOT
382 05544 3653 FPT I X1
383 05545 6651 FMY I X1
384 05546 3361 FPT I TP1
385 05547 1364 FMY C9
386 05550 3651 FAD C7
387 05551 1367 FMY I TP1
388 05552 3651 FAD C5
389 05553 1372 FMY I TP1
390 05554 3651 FAD C3
391 05555 1213 FMY I TP1
392 05556 3653 FAD PIOT
393 05557 0000 FMY I X1
394 05560 5207 FEXT
395 JMP EXIT2
396 05561 7764 /SINE CONSTANTS
397 05562 2366 C9, 7764
398 05563 5735 2366
399 05564 7771 C7, 5735
400 05565 5466 7771
401 05566 6317 5466
402 05567 7775 C5, 6317
403 05570 2431 7775
404 05571 5053 2431
405 05572 0000 C3, 5053
406 05573 5325 0000
407 05574 0420 5325
408 0420 0420

```


AF	5256	ONEPT	5334
ALFZ	5316	ONEP2	5452
ALF1	5313	PALG	5540
ALF2	5310	PALGO	5167
AXIN	0010	PCHECK	5153
BETZ	5305	PDLXR	0013
BET1	5277	PERROR	0175
BET2	5302	PI	5177
BF	5261	PIOT	5413
BOTTOM	0027	PI2	5172
CF	5264	PCPA	1413
CNTR	0132	PROC	0616
COMGO	1164	PUSHA	4503
C3	5572	RETURN	5500
C5	5567	SN	0010
C7	5564	SORTJ	4513
C9	5561	STARTL	5476
DBCQNV	5600	TP	5333
DF	5267	TP1	5451
DTOP	6576	TSTERM	4565
ERROR	4526	TWO	5275
ERROR5	2735	TWOPI	5174
EXIT2	5407	X	5325
EXTAR	6575	XSQR	5330
FATN	5335	X1	5453
FCOS	5113	X2	5173
FEXP	5202	ZERGO	5536
FIX	4452		
FLAC	0044		
FLOAT	4430		
FLOG	5454		
FLTEMP	7545		
FLTONE	1573		
FNEG	5321		
FNTABF	0571		
FSIN	5117		
GETSGN	1045		
GO	5357		
LG2E	5272		
LIBD	6562		
LIBGO	6577		
LIBLST	6555		
LIBRAR	6556		
LOGE2	5446		
L1	5443		
L2	5440		
L3	5435		
L4	5432		
L5	5427		
L6	5424		
L7	5421		
L8	5416		
M5	0067		
NEGATE	4450		
NEG2	5171		

ERRORS DETECTED: 0
409
LINKS GENERATED: 0
410

AF	169	192#							
ALFZ	224#	276							
ALF1	221#	274							
ALF2	218#	272							
AXIN	41#	71	73						
BETZ	215#	270							
BET1	209#	268							
BET2	212#	267							
oF	171	195#							
BOTTOM	36#	46	77						
CF	166	198#							
CNTR	40#	69	74						
COMGO	37#	58							
C3	389	405#							
C5	387	402#							
C7	385	399#							
C9	384	396#							
DBCONV	45#	81							
DF	164	201#							
DTOP	76	81#							
ERROR	33#	66	327						
ERROR5	44#	84							
EXIT2	281	286#	374	394					
EXTAB	70	80#							
FATN	49	244#							
FCUS	47	53	88#						
FEXP	50	147#							
FIX	26#	104	155						
FLAC	29#	181	182						
FLOAT	34#	346	375						
FLOG	51	325#							
FLTEMP	30#	241	321						
FLTONE	31#	242	322						
FNEG	137	149	229#	232	246				
FNTABF	35#	48	80						
FSIN	52	94#							
GETSGN	23#	94	113	126	147	244	253	325	332
GO	255	262#							
LG2E	152	204#							
LIBD	68#	82							
LIBGO	65	82#							
LIBLST	61#	64	65						
LIBRAR	59	63#							
LOGE2	318#	348							
L1	315#	370							
L2	312#	368							
L3	309#	366							
L4	306#	364							
L5	303#	362							
L6	300#	360							
L7	297#	358							
L8	294#	357							
M5	39#	68							
NEGATE	22#	88	105	157	230	282	288		
NEG2	95	137#							


```

1      /2-USER PATCH FOR FOCAL, 5/69
2      /EDWARD TAFT      6/10/69
3      /
4      /LOAD FOCAL, 5/69      INTO FIELD 0, THEN THIS PATCH.
5      /IT COPIES FOCAL INTO FIELD 1 AND PERFORMS
6      /THE NECESSARY MODIFICATIONS FOR 2-USER FOCAL.
7      /
8      0176      *176
9      00176      3600      STRT
10     3600      *3600
11     03600      7300      STRT,      CLA CLL
12     03601      1234      TAD BEGNP
13     03602      3176      DCA 176
14     03603      1635      FD,      TAD I FFP
15     03604      6211      CDF 10
16     03605      3635      DCA I FFP
17     03606      6201      CDF 00
18     03607      2235      ISZ FFP
19     03610      2236      ISZ FCNTR
20     03611      5203      JMP FD
21     03612      1237      TAD PTCHP
22     03613      3416      DCA 16
23     03614      1416      PTCH1, TAD I 16
24     03615      7450      SNA
25     03616      5225      JMP PTCH0
26     03617      3235      DCA FFP
27     03620      1416      TAD I 16
28     03621      6211      CDF 10
29     03622      3635      DCA I FFP
30     03623      6201      CDF 00
31     03624      5214      JMP PTCH1
32     03625      1416      PTCH0, TAD I 16
33     03626      7450      SNA
34     03627      5570      JMP I 176
35     03630      3235      DCA FFP
36     03631      1416      TAD I 16
37     03632      3635      DCA I FFP
38     03633      5225      JMP PTCH0
39     /////
40     03634      3432      BEGNP, 3432      /BEGIN
41     03635      0000      FFP,      0
42     03636      0200      FCNTR, -7600
43     03637      3637      PTCHP, .

```

/POINT TO "BEGIN"

/TRANSFER C(LOCS. 0-7577) FROM
/FIELD 0 TO FIELD 1

/SET UP TO PATCH FOR 2-USER

/PATCH FIELD 1

/GET ADDRESS

/0 ADDR = END OF FIELD 1 PATCH

/GET PATCH

/PATCH FIELD 0

/START 2-USER FOCAL

			/FIELD 1 PATCHES
			/ALTERNATE ADDRESS. PATCH
44			
45			
46	03640	0166	0166;5537
47	03641	6537	
48	03642	0167	0167;3453
49	03643	3453	
50	03644	0170	0170;7410
51	03645	7410	
52	03646	0754	0754;4566
53	03647	4566	
54	03650	1360	1360;4566
55	03651	4566	
56	03652	2707	2707;4566
57	03653	4566	
58	03654	3226	3226;4566
59	03655	4566	
60	03656	6472	6472;4566
61	03657	4566	
62	03660	6601	6601;4566
63	03661	4566	
64	03662	2606	2606;6401
65	03663	6401	
66	03664	2610	2610;6406
67	03665	6406	
68	03666	2625	2625;6411
69	03667	6411	
70	03670	2627	2627;6412
71	03671	6412	
72	03672	2634	2634;6414
73	03673	6414	
74	03674	2717	2717;6416
75	03675	6416	
76	03676	2771	2771;6416
77	03677	6416	
78	03700	3204	3204;1220
79	03701	1220	
80	03702	3220	3220;6411
81	03703	6411	
82	03704	3235	3235;1170
83	03705	1170	
84	03706	3271	3271;4526
85	03707	4526	
86	03710	2617	2617;5246
87	03711	5246	
88	03712	2644	2644;5645
89	03713	5645	
90	03714	2645	2645;6520
91	03715	6520	
92	03716	2646	2646;5234
93	03717	5234	
94	03720	2647	2647;7640
95	03721	7640	
96	03722	2650	2650;5345
97	03723	5345	
98	03724	2651	2651;1254

99	03725	1254	
100	03726	2652	2652;3167
101	03727	3167	
102	03730	2653	2653;5225
103	03731	5225	
104	03732	2654	2654;2745
105	03733	2745	
106	03734	2655	2655;6552
107	03735	6552	
108	03736	2670	2670;5655
109	03737	5655	
110	03740	2712	2712;5307
111	03741	5307	
112	03742	6520	6520;7604
113	03743	7604	
114	03744	6521	6521;7710
115	03745	7710	
116	03746	6522	6522;6011
117	03747	6011	
118	03750	6523	6523;5326
119	03751	5326	
120	03752	6524	6524;6012
121	03753	6012	
122	03754	6525	6525;3037
123	03755	3037	
124	03756	6526	6526;6201
125	03757	6201	
126	03760	6527	6527;1735
127	03761	1735	
128	03762	6530	6530;7104
129	03763	7104	
130	03764	6531	6531;1736
131	03765	1736	
132	03766	6532	6532;6244
133	03767	6244	
134	03770	6533	6533;6001
135	03771	6001	
136	03772	6534	6534;5400
137	03773	5400	
138	03774	6535	6535;2601
139	03775	2601	
140	03776	6536	6536;2600
141	03777	2600	
142	04000	6540	6540;7300
143	04001	7300	
144	04002	6541	6541;6002
145	04003	6002	
146	04004	6542	6542;1337
147	04005	1337	
148	04006	6543	6543;3167
149	04007	3167	
150	04010	6544	6544;6203
151	04011	6203	
152	04012	6545	6545;5746
153	04013	5746	

154	04014	6546	6546;6544
155	04015	6544	
156	04016	6547	6547;7340
157	04017	7300	
158	04020	6550	6550;6001
159	04021	6001	
160	04022	6551	6551;5567
161	04023	5567	
162	04024	6552	6552;4566
163	04025	4566	
164	04026	6553	6553;5754
165	04027	5754	
166	04030	6554	6554;2666
167	04031	2666	
168	04032	3454	3454;6416
169	04033	6416	
170	04034	0000	0 /END OF FIELD 1 PATCHES
171			/////
172			/FIELD 0 PATCHES
173	04035	0166	0166;6534
174	04036	6534	
175	04037	0167	0167;0200
176	04040	0200	
177	04041	0754	0754;4566
178	04042	4566	
179	04043	1360	1360;4566
180	04044	4566	
181	04045	2707	2707;4566
182	04046	4566	
183	04047	3226	3226;4566
184	04050	4566	
185	04051	6472	6472;4566
186	04052	4566	
187	04053	6601	6601;4566
188	04054	4566	
189	04055	2617	2617;5246
190	04056	5246	
191	04057	2644	2644;5645
192	04060	5645	
193	04061	2645	2645;6520
194	04062	6520	
195	04063	2646	2646;6234
196	04064	6234	
197	04065	2647	2647;7650
198	04066	7650	
199	04067	2650	2650;5345
200	04070	5345	
201	04071	2651	2651;1254
202	04072	1254	
203	04073	2652	2652;3167
204	04074	3167	
205	04075	2653	2653;5225
206	04076	5225	
207	04077	2654	2654;2745
208	04100	2745	

209	04101	2655	2655;6547
210	04102	6547	
211	04103	2670	2670;5655
212	04104	5655	
213	04105	2712	2712;5307
214	04106	5307	
215	04107	6520	6520;7604
216	04110	7604	
217	04111	6521	6521;7700
218	04112	7700	
219	04113	6522	6522;6011
220	04114	6011	
221	04115	6523	6523;5326
222	04116	5326	
223	04117	6524	6524;6012
224	04120	6012	
225	04121	6525	6525;3037
226	04122	3037	
227	04123	6526	6526;1000
228	04124	1000	
229	04125	6527	6527;6213
230	04126	6213	
231	04127	6530	6530;3733
232	04130	3733	
233	04131	6531	6531;5732
234	04132	5732	
235	04133	6532	6532;2606
236	04134	2606	
237	04135	6533	6533;0000
238	04136	0000	
239	04137	6535	6535;7300
240	04140	7300	
241	04141	6536	6536;6002
242	04142	6002	
243	04143	6537	6537;1334
244	04144	1334	
245	04145	6540	6540;3167
246	04146	3167	
247	04147	6541	6541;6213
248	04150	6213	
249	04151	6542	6542;5743
250	04152	5743	
251	04153	6543	6543;6547
252	04154	6547	
253	04155	6544	6544;7300
254	04156	7300	
255	04157	6545	6545;6001
256	04160	6001	
257	04161	6546	6546;5567
258	04162	5567	
259	04163	6547	6547;4566
260	04164	4566	
261	04165	6550	6550;5751
262	04166	5751	
263	04167	6551	6551;2666

264 04170 2666

265 04171 0400 ENDP, 0

266 \$

/END OF PATCHES

BEGNP	3634
ENDP	4171
PCNTR	3636
FC	3603
FFP	3635
PTCHP	3637
PTCH0	3625
PTCH1	3614
STRT	3600
267	

