

DECIMAL ASCII CODES

FOR FIN<> AND FOUT<>

CODE CHARACTER	CODE CHARACTER	CODE CHARACTER
128 CTRL/SHIFT/P (LEADER)	160 SPACE	193 A
129 CTRL/A	161 !	194 B
130 CTRL/B	162 "	195 C
131 CTRL/C	163 #	196 D
132 CTRL/D	164 \$	197 E
133 CTRL/E	165 %	198 F
134 CTRL/F	166 &	199 G
135 CTRL/G (BELL)	167 '	200 H
136 CTRL/H	168 (	201 I
137 CTRL/I	169 )	202 J
138 LINE FEED	170 *	203 K
139 CTRL/K	171 +	204 L
140 CTRL/L	172 ,	205 M
141 CARRIAGE RETURN	173 -	206 N
142 CTRL/N	174 .	207 O
143 CTRL/O	175 /	208 P
144 CTRL/P	176 0	209 Q
145 CTRL/R	177 1	210 R
146 CTRL/S	178 2	211 S
147 CTRL/T	179 3	212 T
148 CTRL/U	180 4	213 U
149 CTRL/V	181 5	214 V
150 CTRL/W	182 6	215 W
151 CTRL/X	183 7	216 X
152 CTRL/Y	184 8	217 Y
153 CTRL/Z	185 9	218 Z
154 CTRL/SHIFT/K	186 :	219 [
155 CTRL/SHIFT/L	187 ;	220 \
156 CTRL/SHIFT/M	188 <	221 ]
157 CTRL/SHIFT/N	189 =	222 ^
158 CTRL/SHIFT/O	190 ?	223 _
159 CTRL/SHIFT/P	191 ?	253 ALT MODE
	192 @	255 RUBOUT

FOUT(141) WILL OUTPUT A RETURN/LINE FEED; FOUT(13) WILL OUTPUT A CARRIAGE RETURN ONLY. CODE 144 (CTRL/P) IS PS/8 FOCAL'S BREAK CHARACTER. 224 THROUGH 250 ARE LOWER-CASE LETTERS ON SOME TERMINALS. MANY TERMINALS USE SHIFT/K, /L, AND /M FOR '[', '\', AND ']'.

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PS/8 FOCAL, 1971 ERROR CODES

ERROR CODES VALID ONLY FOR 6/1/71 VERSION OF PS/8 FOCAL

CODE EXPLANATION

700 00	MANUAL START FROM CONSOLE
701 00	BREAK FROM KEYBOARD VIA 'CTRL/P'
701 40	BAD LINE NUMBER
701 91	GROUP NUMBER LARGER THAN 31
701 :3	ZERO IS ILLEGAL LINE NUMBER
702 32	'DO' REFERENCED NON-EXISTENT GROUP
702 52	'DO' REFERENCED NON-EXISTENT LINE
703 05	NON-EXISTENT LINE AFTER 'GOTO' OR 'IF'
703 28	ILLEGAL COMMAND
704 39	BAD VARIABLE IN 'FOR' OR 'SET' COMMAND
704 52	EXCESS RIGHT TERMINATORS
704 60	ILLEGAL TERMINATOR IN 'FOR' OR 'SET' COMMAND
704 :3	MISSING ARGUMENT IN DISPLAY FUNCTION
705 48	BAD ARGUMENT IN 'MODIFY' COMMAND
706 06	ILLEGAL USE OF A FUNCTION OR NUMBER
706 54	TOO MANY VARIABLES
707 38	NO OPERATOR BEFORE PARENTHESIS
707 :9	FUNCTION ARGUMENT MISSING
707 :6	ILLEGAL FUNCTION OR DOUBLE OPERATORS
708 47	ENCLOSURES DO NOT MATCH
709 11	BAD ARGUMENT IN 'ERASE' COMMAND
710 :5	STORAGE FILLED BY TEXT
711 35	INPUT BUFFER OVERFLOW
715 28	BAD RESTORE COMMAND
715 :1	ATTEMPT TO WRITE PAST END-OF-FILE
720 34	LOGARITHM OF ZERO REQUESTED
722 23	NO OUTPUT FILE TO RESTORE
722 51	BAD FILES 'OPEN' COMMAND
723 05	DATA FILE NOT FOUND
723 15	NO INPUT FILE TO RESTORE
723 36	TOO MANY DIGITS IN NUMBER
723 39	PUSHDOWN OVERFLOW; PROGRAM TOO LONG
724 60	TWO PERIODS IN FILE NAME OR NO NAME
725 37	BAD DEVICE OR 2 PAGE HANDLER
726 18	BAD LIBRARY COMMAND
726 58	NO PROGRAM NAMED BY 'SAVE' COMMAND
726 99	EXPONENT TOO LARGE OR NEGATIVE
727 10	PROGRAM NOT FOUND
727 14	'LIBRARY CALL' FROM NON-DIRECTORY DEVICE
728 06	'LIBRARY LIST' OF NON-DIRECTORY DEVICE
728 :7	DIVISION BY ZERO
729 53	FILE ALREADY DELETED
729 68	DEVICE ERROR: WRITE LOCK OR PARITY
729 91	CANNOT OPEN OUTPUT FILE
730 05	IMAGINARY SQUARE ROOTS REQUIRED
731 <7	UNAVAILABLE COMMAND OR FUNCTION
?	ATTEMPT TO READ PAST END-OF-FILE (INPUT IS SWITCHED TO TERMINAL AND PROGRAM CONTINUES)

TYPESET ON **CENTRONICS-101** MATRIX PRINTER

ADDITIONAL COPIES OF SUMMARY CARD AVAILABLE FROM:

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**PS/8 FOCAL**

**SUMMARY CARD**

**ELEMENTARY COMMANDS**

\*ASK <X> ..... ACCEPT VALUE OF X FROM INPUT DEVICE  
 \*COMMENT ..... IGNORE REST OF LINE  
 \*DO [LINE OR GROUP NUMBER] ..... SUBROUTINE CALL  
 \*ERASE ..... ZERO VARIABLES  
 \*ERASE <LINE OR GROUP NUMBER> ..... DELETE LINE OR GROUP  
 \*ERASE ALL ..... DELETE ENTIRE INDIRECT PROGRAM  
 \*FOR X=E1, E2, E3, COMMAND REPEATED (E3-E1)/E2+1 TIMES  
 \*GO [L1] ..... START PROGRAM EXECUTION AT LINE L1  
 \*IF (E1)L1, L2, L3 ..... BRANCH ON SIGN OF E1  
 \*MODIFY <L1> ..... EDIT LINE L1  
 \*QUIT ..... STOP EXECUTION  
 \*RETURN ..... TERMINATE 'DO' OR 'GOSUB' SUBROUTINE  
 \*SET X=<E1> ..... ASSIGN VALUE E1 TO VARIABLE  
 \*TYPE [NUMBERS, E1, "TEXT", !, #, : \$ OR X] ..... OUTPUT  
 \*WRITE [LINE OR GROUP NUMBER] ..... LIST PROGRAM

**LIBRARY AND FILE COMMANDS**

\*LIBRARY CALL [DEVICE:]PROGRAM ..... LOAD PROGRAM  
 \*LIBRARY DELETE [DEVICE:]PROGRAM ..... UNSAVE PROGRAM  
 \*LIBRARY GOSUB [DEVICE:]PROGRAM [G1] SUBROUTINE CALL  
 \*LIBRARY LIST [DEVICE:]FIRST LISTED FILE ..... CATALOG  
 \*LIBRARY RUN [DEVICE:]PROGRAM [L1] ..... CHAIN  
 \*LIBRARY SAVE [DEVICE:]PROGRAM ..... SAVE PROGRAM  
 \*LIBRARY EXIT ..... RETURN TO PS/8 MONITOR

\*OPEN INPUT [DEVICE:]FILE[, ECHO] ..... PREPARE TO READ  
 \*OPEN OUTPUT [DEVICE:]FILE[, ECHO] ..... PREPARE TO WRITE  
 \*OPEN RESTORE INPUT[, ECHO] ..... RESUME INPUT FROM FILE  
 \*OPEN RESTORE OUTPUT[, ECHO] ..... RESUME OUTPUT TO FILE  
 \*OUTPUT CLOSE ..... OUTPUTS BUFFER; CLOSSES OUTPUT FILE

---INPUT---, ECHO ..... ECHO INPUT ONTO OUTPUT DEVICE  
 ---OUTPUT---, ECHO ..... ECHO OUTPUT ONTO TERMINAL  
 .FC & .FD ARE THE PROGRAM & DATA FILE NAME EXTENSIONS.

<> ENCLOSE REQUIRED TERMS. [ ] ENCLOSE OPTIONAL TERMS.  
 ONE LETTER ABBREVIATIONS MAY BE USED AS COMMAND WORDS.  
 X REPRESENTS A VARIABLE. E1, E2 AND E3 ARE ARITHMETIC EXPRESSIONS. L1, L2 AND L3 ARE LINE NUMBERS. G1 IS A LINE OR GROUP NUMBER. L1-L3 AND G1 CAN BE REPLACED BY ARITHMETIC EXPRESSIONS WHICH DO NOT BEGIN WITH AN 'A'.

## SYMBOLS AND CHARACTERS

\* / + ... EXPONENT, MULTIPLY, DIVIDE, ADD, SUBTRACT  
 ( ) [ ] < ... ENCLOSURES FOR ARITHMETIC EXPRESSIONS  
 ! ... TYPE '!' OR 'ASK !' OUTPUTS A RETURN/LINE FEED  
 # ... TYPE '#' OR 'ASK #' OUTPUTS A RETURN ONLY  
 " ... TYPE "STRING" OR 'ASK "STRING"' OUTPUTS "STRING"  
 : ... TYPE ':6,\*' TABS TO LOCATION 26 AND TYPES '\*'  
 \$ ... TYPE '\$' OUTPUTS SYMBOL TABLE  
 % ... TYPE '%.02' FORMATS OUTPUT (5 DIGITS; XXX.YY)  
 ? ... GO ? TRACES PROGRAM UNTIL NEXT '?'  
 E ... POWERS-OF-TEN NOTATION (5.3E+06 EQUALS 5300000.)  
 ' ... SEPARATES EXPRESSIONS IN 'TYPE' AND 'ASK' COMMANDS  
 ; ... INSERTED BETWEEN COMMANDS; E.G. 'DO X:TYPE Y/7.2'  
 CTRL/Z ... END-OF-FILE CHARACTER  
 COMMA, SPACE OR RETURN ... ENDS NUMBER BEING 'ASKED'  
 ALT MODE ... IN RESPONSE TO 'ASK X' LEAVES OLD VALUE OF X  
 CTRL/O ... CHANGES SEARCH CHARACTER IN 'MODIFY'  
 CTRL/L ... SKIPS TO NEXT OCCURRENCE OF SEARCH CHARACTER  
 LINE FEED ... RETAINS REST OF LINE IN 'MODIFY'  
 RETURN ... KILLS REST OF LINE IN 'MODIFY'  
 RUBOUT ... DELETES PRECEDING CHARACTER IN LINE  
 ← ... KILLS PROGRAM LINE BEING ENTERED  
 ← ... KILLS NUMBER BEING ENTERED IN RESPONSE TO 'ASK'  
 CTRL/P ... PS/8 FOCAL'S BREAK CHARACTER

## PS/8 DEVICE NAMES

SYS: SYSTEM DEVICE (DISK OR DECTAPE DRIVE #0)  
 DSK: DISK OR DECTAPE DRIVE #0; HOWEVER, DECTAPE  
 INSTALLATIONS SHOULD 'ASSIGN DTA1: DSK:'.  
 'DSK:' IS THE DEVICE IF NONE IS SPECIFIED.  
 DTA0: - DTA7: DECTAPE DRIVES  
 LTA0: - LTA7: LINCTAPE DRIVES  
 MTA0: - MTA7: MAGTAPE DRIVES  
 PTR: HIGH SPEED READER  
 PTP: HIGH SPEED PUNCH  
 LPT: LINE PRINTER  
 TTY: TERMINAL

## PROTECTED VARIABLES

'!', '\$' AND '#' CANNOT BE 'TYPED', 'ASKED' OR 'ERASED'  
 BUT ARE OTHERWISE NORMAL VARIABLES. '#' IS THE SYSTEM  
 STATUS VARIABLE AND IS 'SET' TO THE PRODUCT OF CODES  
 REPRESENTING FEATURES CHOSEN IN THE INITIAL DIALOGUE.

FEATURE	CODE
'0' NO OPTIONAL FEATURES	1
'1' FSIN AND FCOS FUNCTIONS	2
'2' FSIN, FCOS, FLOG, FEXP AND FATN	6
'3' EXTENDED PRECISION (40 DIGITS)	5
'4' FILE COMMANDS	7
'5' LEADING SPACE IN 'TYPE'	11
'6' '=' AUTOMATICALLY PRINTED BY 'TYPE'	13
'7' '=' AUTOMATICALLY PRINTED BY 'ASK'	17
'8' 'E' IN POWERS-OF-TEN NOTATION	-1
'9' FEATURES 2,3,4	210
'YES' STANDARD FEATURES 2,3,4,5	2310

## FUNCTIONS

FSIN(A) SINE (RADIANS)      FITR(A) INTEGER PART  
 FCOS(A) COSINE (RADIANS)    FSN(A) SIGN PART (-1, 0, +1)  
 FATN(A) ARCTAN (RADIANS)    FDIS(X,Y) 34D SCOPE DISPLAY  
 FEXP(A) EXPONENTIAL        FADC(A) ANALOG TO DIGITAL  
 FLOG(A) LOG (BASE E)        FRAN(A) PSEUDO-RANDOM NUMBER  
 FSQT(A) SQUARE ROOT        FIN(A) CHARACTER INPUT  
 FABS(A) ABSOLUTE VALUE      FOUT(A) CHARACTER OUTPUT

## DISPLAY & JOYSTICK FUNCTIONS FOR THE TEKTRONIX T-4002 GRAPHIC COMPUTER TERMINAL

### FDIS<I, X, Y> --- DISPLAY

COORDINATES: 0 ≤ X < 1024      0 ≤ Y < 1024

I=-1 PLOT A POINT AT (X,Y)  
 I=0 DRAW A DARK VECTOR TO (X,Y)  
 I=+1 IF IN GRAPHICS MODE, DRAW A BRIGHT VECTOR TO  
 (X,Y); OTHERWISE ENTER GRAPHICS MODE AND DRAW  
 A DARK VECTOR TO (X,Y).

### FJOY<I> ----- JOYSTICK

FJOY(I) SETS VARIABLES XJ AND YJ EQUAL TO THE X AND Y  
 LOCATIONAL ADDRESSES IN THE INTERACTIVE GRAPHICS UNIT.

I=-1 SETS XJ AND YJ EQUAL TO LOCATIONAL ADDRESSES.  
 I=0 TURNS ON JOYSTICK. WAITS FOR KEYBOARD  
 INPUT BEFORE READING CURSOR COORDINATES.  
 I=+1 ASSUMES JOYSTICK PREVIOUSLY TURNED ON BY  
 A FOUT(17); READS CURSOR IMMEDIATELY.

### GRAPHICS FOUT<> CODES:

1 .. HOME  
 17 .. TURNS ON JOYSTICK FOR FJOY(1) APPLICATION  
 24 .. ERASE SCREEN (REQUIRES .5 SECOND DELAY)  
 30 .. ENTER INCREMENTAL PLOT MODE  
 31 .. LEAVE GRAPHICS MODE

### FOUT<> CODES FOR INCREMENTAL PLOT MODE:

DIRECTION	N	NE	E	SE	S	SW	W	NW
BRIGHT POINT	32	33	34	35	36	37	38	39
DARK POINT	40	41	42	43	44	45	46	47

### PROGRAM: 'SKETCH'

FOLLOWS JOYSTICK ON DISPLAY

```

01.10 SET I=0; FOR K=0, 2.FOUT(24);C ERASE AND PRUSE
01.20 SET DUMMY=FJOY(0);C WAITS FOR A KEY TO BE HIT
01.30 SET DUMMY=FDIS(0,XHOLD,YHOLD)+FDIS(I,XJ,YJ)
01.40 SET XHOLD=XJ;SET YHOLD=YJ;SET I=1;GOTO 1.2
  
```

## PROGRAMMING EXAMPLES

### INPUT PROGRAM TAPE:

- 1) TYPE 'OPEN INPUT PTR:' (WAIT FOR '^' ON TERMINAL)
- 2) HIT SPACE BAR WHEN READY TO READ TAPE
- 3) WAIT FOR OUTPUT OF '?' ON TERMINAL; HIT 'CTRL/P'

### TO INPUT PROGRAMS FROM THE TERMINAL'S LOW SPEED READER:

- 1) TYPE 'OPEN INPUT TTY:' (TURNS ECHO OFF)
- 2) READ IN TAPE
- 3) TYPE 'OPEN INPUT TTY:;ECHO' (TURNS ECHO ON)

### INPUT DATA FROM READER:

- 10.60 OPEN INPUT PTR:  
(WAIT FOR '^' ON TERMINAL; HIT SPACE BAR)
- 10.65 FOR X=1,10;ASK A(X)
- 10.70 OPEN INPUT TTY:;ECHO;COMMENT RESTORES TERMINAL

### OUTPUT PROGRAM TAPE:

- 1) TYPE 'OPEN INPUT TTY:;OPEN OUTPUT PTP:;WRITE ALL'  
(WAIT FOR PUNCH TO STOP)
- 2) TYPE 'OUTPUT CLOSE;OPEN INPUT TTY:;ECHO'

### OUTPUT DATA TO PUNCH:

- 10.80 OPEN OUTPUT PTP:
- 10.85 FOR X=1,10;TYPE A(X)
- 10.90 OUTPUT CLOSE

### LIST PROGRAM ON LINE PRINTER:

- 1) TYPE 'OPEN INPUT TTY:;OPEN OUTPUT LPT:;WRITE ALL'
- 2) 'OUTPUT CLOSE;OPEN INPUT TTY:;ECHO'

### CHARACTERS AND FILES:

GROUP 1 SETS UP THE 'WORDS' FILE. GROUP 2 SCANS IT,  
 ECHOING ONLY WORDS STARTING WITH THE SEARCH LETTER.

```

01.10 OPEN OUTPUT DTA2;WORDS;OPEN OUTPUT TTY:;ERASE
01.20 TYPE "!"ENTER WORDS, FOLLOW EACH WITH A SPACE:"!
01.30 TYPE "<"ENTER A SPACE BY ITSELF TO CLOSE FILE"!!
01.40 TYPE "5?" "OPEN RESTORE OUTPUT,ECHO
01.50 IF (-FABS(FIN(-160))>1.5;OPEN OUTPUT TTY:
01.60 TYPE "MORE?" "OPEN RESTORE OUTPUT,ECHO
01.70 IF (-FABS(FIN(-160))>1.5;OUTPUT CLOSE;GOTO 2.7

02.10 TYPE "!"ENTER SEARCH LETTER: " ;SET L=F(IN);T !!!
02.20 TYPE "WORDS STARTING WITH " ;S 0=FOUT(L);T " :!! ;S
02.30 OPEN INPUT DTA2;WORDS;SET S=160;SET P=2,6
02.40 SET C=F(IN);IF (FABS(C-S)>2.7);1 (-FABS(L-C))>2.6
02.50 OPEN RESTORE INPUT,ECHO;T !! ;S;SET DUMMY=FOUT(C)
02.60 IF (-FABS(FIN(-S))>P);OPEN RESTORE INPUT;G 2,4
02.70 OPEN INPUT TTY:;ECHO;TYPE "!"DONE. "!! ;QUIT
  
```