

1. IDENTIFICATION
- 1.1 Digital-8-20-F-Bin
- 1.2 Four-Word Floating-Point Package
- 1.3 June 26, 1965

## 2. ABSTRACT

This program is almost identical to the 3-word Floating-Point Package (Digital-8-5-S) except that accuracy is carried to 35 bits, and 4 12-bit words are used for storage.

## 3. REQUIREMENTS

### 3.1 Storage

This program occupies registers 7; 40-61; 5600-7577 (octal).

## 4. USAGE

### 4.1 Loading

Binary Loader (Digital-8-2-U) or DECtape System.

### 4.2 Calling Sequence

Identical to Digital-8-5-S.

## 5. RESTRICTIONS

See Digital-8-5-S.

## 6. DESCRIPTION

The floating accumulator resides in memory locations 44, 45, 46, and 47. The instructions FGET, FPUT use 4-word arguments (11-bit exponent + sign; 35-bit mantissa + sign). The 4-word package contains all operations except for square root (0002) and square (0001).

## 7. METHODS

See Digital-8-5-S.

## 8. FORMAT (Not Applicable)

## 9. EXECUTION TIME

### 9.3 Average

Execution times are very difficult to estimate as they greatly depend upon the data on which the floating-point package is operating. Generally speaking:

FADD	=	382 $\mu$ sec + 42(N) where N is the number of shifts to align binary points.
FSUB	=	FADD time + 42 $\mu$ sec
FDIV	=	3.4 msec (approximately)

FMPY = 3.3 msec (approximately)  
 FGET = 156  $\mu$ sec  
 FPUT = 172  $\mu$ sec  
 FNOR =  $168 + N(42)$   $\mu$ sec where N is number of shifts;  
 +84  $\mu$ sec if argument <0.  
 FEXT = 140.5  $\mu$ sec

## 10. PROGRAM

## 10.4 Program Listing

/4 WORD FLOATING POINT  
 /ARITHMETIC INTERPRETER  
 /PAGE 1

\*40

0040 0000 EX1, 0  
 0041 0000 HIGH1, 0  
 0042 0000 MID1, 0  
 0043 0000 LOW1, 0  
 0044 0000 EXP, 0  
 0045 0000 HORDER, 0  
 0046 0000 MIDDLE, 0  
 0047 0000 LORDER, 0  
 0050 0000 OVER2, 0

0051 0000 OVER1, 0  
 \*61  
 0061 0000 FLAG, 0

/ARITHMETIC ERROR FLAG

\*5600

5600 0000 FPNT, 0  
 5601 7300 CLA CLL  
 5602 3051 DCA OVER1  
 5603 3050 DCA OVER2  
 5604 1600 TAD I FPNT /GET INSTRUCTION  
 5605 3257 DCA JUMP  
 5606 1257 TAD JUMP  
 5607 0265 AND PAGENO /PAGE 0??  
 5610 7650 SNA CLA  
 5611 5214 JMP .+3 /YES  
 5612 1267 TAD MASK5 /NO - GET PAGE BITS  
 5613 0200 AND FPNT  
 5614 3262 DCA ADDRS  
 5615 1270 TAD MASK7 /GET 7 BIT ADDRESS  
 5616 0257 AND JUMP  
 5617 1262 TAD ADDRS  
 5620 3262 DCA ADDRS

5621	1266	TAD INDRCT	/BIT3=1??
5622	0257	AND JUMP	
5623	7650	SNA CLA	
5624	5227	JMP LOOP01	
5625	1662	TAD I ADDRS	/YES - DEFER
5626	3262	DCA ADDRS	
5627	2200	LOOP01, ISZ FPNT	
5630	1662	TAD I ADDRS	
5631	3040	DCA EXI	/EXPONENT
5632	1262	TAD ADDRS	
5633	3263	DCA SAVE	
5634	2263	ISZ SAVE	
5635	1663	TAD I SAVE	/HIGH ORDER
5636	3041	DCA HIGH1	
5637	2263	ISZ SAVE	
5640	1663	TAD I SAVE	
5641	3042	DCA MIDI	/MIDDLE BITS
5642	2263	ISZ SAVE	
5643	1663	TAD I SAVE	
5644	3043	DCA LOW1	/LOWER BITS
5645	1257	TAD JUMP	
5646	7106	CLL RTL	
5647	7006	RTL	
5650	0264	AND MASK3	/LOOK-UP ON TABLE
5651	1271	TAD TABLE	
5652	3260	DCA JUMP2	
5653	1660	TAD I JUMP2	
5654	3260	DCA JUMP2	
5655	4660	JMS I JUMP2	/EXECUTE
5656	5201	JMP FPNT+1	/GET NEXT
5657	0000	JUMP, 0	
5660	0000	JUMP2, 0	
5661	0000	GO2, 0	
5662	0000	ADDRS, 0	
5663	0000	SAVE, 0	
5664	0017	MASK3, 0017	
5665	0200	PAGENO, 0200	
5666	0400	INDRCT, 0400	
5667	7600	MASK5, 7600	
5670	0177	MASK7, 0177	
5671	5672	TABLE, .+1	
5672	5714	EXIT	
5673	6000	FLAD	
5674	6026	FLSU	
5675	6367	FLMY	
5676	6600	FLDV	
5677	5702	FLGT	
5700	5733	FLPT	
5701	6200	FNORM	

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/FLOATING GET=5000
5702 0000 FLGT, 0
5703 1040 TAD EX1
5704 3044 DCA EXP
5705 1041 TAD HIGH1
5706 3045 DCA HORDER
5707 1042 TAD MIDI
5710 3046 DCA MIDDLE
5711 1043 TAD LOW1
5712 3047 DCA LORDER
5713 5201 JMP FPNT+1

/FLOATING EXIT OR SUBROUTINE=00XX
EXIT, 0
5714 0000 TAD JUMP
5715 1257 AND MASK3
5716 0264 SNA /BITS 8-11=0??
5717 7450 JMP I FPNT /YES:FEXT
5720 5600 TAD TABLE6 /NO:LOOKUP BITS 8-11
5721 1350 DCA JUMP2 /ON SUBROUTINE TABLE
5722 3260 TAD I JUMP2
5723 1660 DCA JUMP2
5724 3260 TAD FPNT /SAVE PSEUDO PC
5725 1200 DCA G02
5726 3261 JMS I JUMP2
5727 4660 TAD G02 /RESTORE PSEUDO PC
5730 1261 DCA FPNT
5731 3200 JMP FPNT+1 /RETURN
5732 5201

/FLOATING PUT=6000
FLPT, 0
5733 0000 TAD EXP
5734 1044 DCA I ADDRS
5735 3662 TAD HORDER
5736 1045 ISZ ADDRS
5737 2262 DCA I ADDRS
5740 3662 TAD MIDDLE
5741 1046 ISZ ADDRS
5742 2262 DCA I ADDRS
5743 3662 TAD LORDER
5744 1047 ISZ ADDRS
5745 2262 DCA I ADDRS
5746 3662 JMP FPNT+1
5747 5201

5750 5750 TABLE6, . /SUBROUTINE TABLE
5751 5770 EXIT6 /ABSOLUTE ADDRESSES
5752 5770 EXIT6 /OF SUBROUTINES
5753 5770 EXIT6
5754 5770 EXIT6
5755 5770 EXIT6 /EXIT6=DUMMY OR NOP
5756 5770 EXIT6

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