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 μsec + 42(N) where N is the number of shifts to align binary points. |
| FSUB | = | FADD time + 42 μsec |
| FDIV | = | 3.4 msec (approximately) |

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

## 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      MIDDL,      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 LOOPØ1
5625  1662            TAD I ADDRS         /YES - DEFER
5626  3262            DCA ADDRS
5627  2200  LOOPØ1,    ISZ FPNT
5630  1662            TAD I ADDRS
5631  3040            DCA EX1             /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 MID1            /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,      Ø
5660  0000  JUMP2,     Ø
5661  0000  GO2,       Ø
5662  0000  ADDRS,     Ø
5663  0000  SAVE,      Ø
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
```

```
                /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 MID1
5710    3046              DCA MIDDL
5711    1043              TAD LOW1
5712    3047              DCA LORDER
5713    5201              JMP FPNT+1
                /FLOATING EXIT OR SUBROUTINE=00XX
5714    0000    EXIT,     0
5715    1257              TAD JUMP
5716    0264              AND MASK3
5717    7450              SNA                     /BITS 8-11=0??
5720    5600              JMP I FPNT              /YES:FEXT
5721    1350              TAD TABLE6              /NO:LOOKUP BITS 8-11
5722    3260              DCA JUMP2               /ON SUBROUTINE TABLE
5723    1660              TAD I JUMP2
5724    3260              DCA JUMP2
5725    1200              TAD FPNT                /SAVE PSEUDO PC
5726    3261              DCA GO2
5727    4660              JMS I JUMP2
5730    1261              TAD GO2                 /RESTORE PSEUDO PC
5731    3200              DCA FPNT
5732    5201              JMP FPNT+1              /RETURN
                /FLOATING PUT=6000
5733    0000    FLPT,     0
5734    1044              TAD EXP
5735    3662              DCA I ADDRS
5736    1045              TAD HORDER
5737    2262              ISZ ADDRS
5740    3662              DCA I ADDRS
5741    1046              TAD MIDDL
5742    2262              ISZ ADDRS
5743    3662              DCA I ADDRS
5744    1047              TAD LORDER
5745    2262              ISZ ADDRS
5746    3662              DCA I ADDRS
5747    5201              JMP FPNT+1

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
```