FP11

DIVIDE EXERCISER

MD-11-DCFPU-D

EP-DCFPU-D-DL-A

OCT 1976

FICHE 1 OF 1

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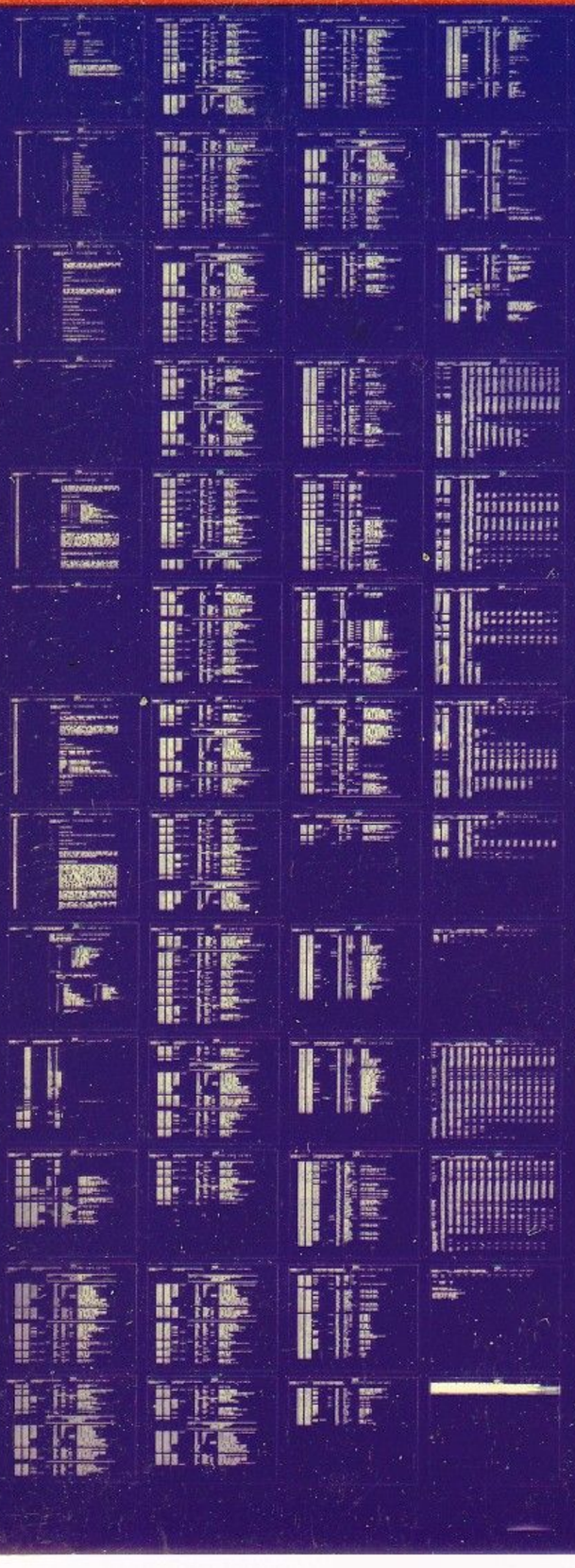

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IDENTIFICATION

PRODUCT CODE: MAINDEC-11-DCFPU-D-D
PRODUCT NAME: FP11 DIVIDE EXERCISER
DATE CREATED: 1-NOV-72
MAINTAINER: DIAGNOSTIC GROUP
AUTHOR: KEN CHAPMAN

CONTENTS

DESCRIPTION

1. ABSTRACT

THIS PROGRAM EXERCISES THE FP11 FLOATING POINT DIVIDE INSTRUCTIONS (DIVF AND DIVD) WITH RANDOM NUMBER PATTERNS. THE ANSWERS ARE CHECKED AGAINST RESULTS OBTAINED USING THE CORRESPONDING FORTRAN SOFTWARE ROUTINES.

2. REQUIREMENTS

2.1 EQUIPMENT

PDP11/45 STANDARD COMPUTER WITH FP11 OPTION

2.2 STORAGE

THE ROUTINES USE MEMORY LOCATIONS 0 - 17500. THE MAP AT THE END OF THE LISTINGS SHOWS THE ABSOLUTE LOCATIONS OF THE FORTRAN MATH ROUTINES WHICH WERE ASSEMBLED SEPERATELY AND LINKED TO THE MAIN PROGRAM VIA LNKX11 ON A DECSYSTEM-10.

2.3 PRELIMINARY PROGRAMS

DCFPA THRU DCFPL

3. LOADING PROCEDURE

USE STANDARD PROCEDURE FOR ABS TAPES.

4. STARTING PROCEDURE

4.1 CONTROL SWITCH SETTINGS

SEE 5.1.1 (ALL DOWN FOR WORST CASE TESTING)

4.2 STARTING ADDRESS

THE PROGRAM SHOULD ALWAYS BE STARTED AT 200.

4.3 PROGRAM AND/OR OPERATOR ACTION

1) LOAD PROGRAM INTO MEMORY USING ABS LOADER.
2) LOAD ADDRESS 200.

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                        3) SET SWITCHES (SEE 5.1.1) ALL DOWN FOR WORST CASE.
                        4) PRESS START.
```

5) THE PROGRAM WILL LOOP AND BELL WILL RING ONCE EVERY PASS.
6) THE DISPLAY ON THE 11/45 WILL SHOW THE ITERATION COUNT IN THE LEFT BYTE AND TEST NUMBER IN THE RIGHT. TO USE, SET THE DATA DISPLAY SWITCH TO THE DISPLAY POSITION.

5. OPERATING PROCEDURE

5.1 OPERATIONAL SWITCH SETTINGS

```
SW<15> =  1 ......  HALT ON ERROR
SW<14> =  1 ......  SCOPE LOOP
SW<13> =  1 ......  INHIBIT PRINTOUT
SW<12> =  1 ......  INHIBIT TRACE TRAPPING
SW<11> =  1 ......  INHIBIT ITERATIONS OF SUBTEST
SW<10> =  1 ......  BELL ON ERROR
          0 ......  BELL ON PASS COMPLETE
SW<09> =  1 ......  CORE IMAGE TYPE-OUT (16 BIT WORDS)
          0 ......  FLOATING POINT TYPE-OUT (SIGN, EXPONENT,
                    MANTISSA)
SW<08> =  1 ......  LOOP ON TEST IN SW<7:0>
          0 ......  LOAD SW<7:0> INTO US REGISTER
```

5.2 SUBROUTINE ABSTRACTS

5.2.1 SCOPE

THIS SUBROUTINE CALL IS PLACED BETWEEN EACH SUBTEST IN THE TEST SECTION. IT RECORDS THE STARTING ADDRESS OF EACH SUBTEST AS IT IS BEING ENTERED IN LOCATION "LAD". IF A SCOPE LOOP IS REQUESTED, THE CURRENT SUBTEST WILL BE LOOPED UPON. SW<11> ON A 1 INHIBITS ITERATION OF SUBTESTS. THE CONTENTS OF LAD MAY BE USED TO DETERMINE THE LAST SUBTEST SUCCESSFULLY COMPLETED. LAD IS UPDATED INSIDE EACH SUBTEST AFTER THE FORTRAN ANSWER IS CALCULATED, SO THAT THE ITERATIONS WILL INCLUDE ONLY THE FP11 PORTION OF THE TEST.

5.2.2 HLT

THIS ROUTINE PRINTS OUT AN ERROR MESSAGE (SEE 6.1). TO INHIBIT TYPEOUTS, PUT SW<13> ON A 1.

5.2.3 TRTRAP

IF SW<12> IS ON A 0, THE T BIT WILL BE SET ON ALTERNATE PASSES. WHEN SET, IT CAUSES A TRAP AFTER EACH INSTRUCTION. THE FIRST INSTRUCTION EXECUTED UPON TRAPPING IS AN "RTT" WHICH RETURNS TO THE INTERRUPTED SEQUENCE OF INSTRUCTIONS. THIS SEQUENCE IS CONTINUED UNTIL THE END OF THE PROGRAM IS

199 REACHED.

5.2.4 TRAPCATCHER

A ".+2" - "HALT" SEQUENCE IS REPEATED FROM 0 - 776 TO CATCH ANY UNEXPECTED TRAPS. THUS ANY UNEXPECTED TRAPS OR INTERUPTS WILL HALT AT THE VECTOR + 2.

5.2.5 FLOATING POINT TRAP (TO 244)

SINCE SOME OF THE SUBTESTS HAVE INTERRUPTS ENABLED, THE FLOATING POINT TRAP (FLTERR) CHECKS TO SEE IF FORTRAN ALSO GOT AN ERROR CONDITION. IF FORTRAN DIDN'T INDICATE AN ERROR, OR INTERRUPTS WERE DISABLED AN ERROR HLT OCCURS (SEE 5.2.2). IF AN INTERRUPT WAS ANTICIPATED, BUT DIDN'T OCCUR, THE SUBTEST WILL DETECT THE ERROR.

6. ERRORS

6.1 ERROR PRINTOUT

THE FORMAT IS AS FOLLOWS:

ADDRESS, OPERAND, OPERATOR, OPERAND, EQUALS
FPP: ANSWER, FPS, FEC, FEA
FORTRAN: ANSWER, FPS, FEC, FEA

WHERE:

ADDRESS = ADDRESS OF ERROR HLT
OPERAND = RANDOM FLOATING POINT NUMBER INPUTS
OPERATOR = ARITHMETIC OPERATOR (+ OR -)
EQUALS = (=)
ANSWER = FLOATING POINT ANSWER
FPS = FLOATING POINT STATUS
FEC = FLOATING EXCEPTION CODES (ERROR CODES)
FEA = FLOATING EXCEPTION ADDRESS (ERROR ADDRESS)

TO FIND THE FAILING TEST, LOOK AT THE LISTING ABOVE THE ADDRESS TYPED.

6.2 ERROR RECOVERY

RESTART AT 200

7. RESTRICTIONS

NONE

8. MISCELLANEOUS

8.1 EXECUTION TIME

A BELL WILL RING WITHIN 15 SECONDS WITH ALL SWITCHES DOWN.

8.2 STACK POINTER

STACK IS INITALLY SET TO 600

8.3 POWER FAIL

EACH TEST CAN BE POWER FAILED WITH NO ERRORS EXCEPT ON THE FEC AND FEA. TO USE, START THE TEST AS USUAL AND POWER DOWN THEN UP AT ANY TIME. THE PROGRAM SHOULD TYPE "POWER" AND CONTINUE TO RUN WITH NO OTHER TYPEOUTS.

9. PROGRAM DESCRIPTION

THIS PROGRAM TESTS THE DIVIDE INSTRUCTIONS ON THE FP11 IN ROUND AND TRUNCATE MODES AND WITH INTERUPTS ON AND OFF. EACH PROGRAM HAS MANY SUBTESTS (THE CODE BETWEEN 2 SCOPE STATEMENTS) WHICH ARE RUN 256 TIMES BEFORE CONTINUING TO THE NEXT. SW<11> ON A 1 CAUSES EACH SUBTEST TO BE RUN ONLY ONCE. THE ADDRESS ICNT (LOC 1000) AND DISPLAY REGISTER ON THE 11/45 EACH CONTAIN THE ITERATION COUNT IN THE LEFT BYTE AND THE TEST NUMBER IN THE RIGHT BYTE. ALL THE SUBTESTS SHOULD BE RUN SEQUENTIALLY BY STARTING AT 200 NOT BY STARTING AT THE BEGINNING OF THE SUBTEST. TO LOOP ON A PARTICULAR SUBTEST, PUT THE TEST NUMBER (SEE LISTING) IN THE RIGHT BYTE OF THE SWITCH REGISTER AND SW<8> ON A 1. THIS TEST WILL BE LOOPED UPON UNTIL SW<8> IS PUT ON A 0 OR THE RIGHT BYTE IS CHANGED. IF THE TEST IS NON-EXISTANT, THE PROGRAM WILL BE RUN AS USUAL.

THE FORTRAN MATH ROUTINES WERE TAKEN UNMODIFIED FROM THE PDP-11 FORTRAN PACKAGE AND ASSEMBLED AS SEPERATE MODULES. THEY WERE LINKED TO THE MAIN PROGRAMS VIA LNKX11 ON A DECSYSTEM-10 WHICH PRODUCES A BINARY TAPE IN THE NORMAL ABSOLUTE FORMAT. THUS, THE PROGRAMS LOAD AND RUN JUST LIKE ANY OTHER DIAGNOSTIC PROGRAM.

NOTE: SINCE THE FP11 LOAD, STORE, AND COMPARE INSTRUCTIONS (LDF, LDD, STF, STD, CMPF, AND CMPD) ARE ALSO USED IN THIS PROGRAM, IT IS POSSIBLE THAT THEY AND NOT THE DIVIDE INSTRUCTIONS COULD CAUSE ERRORS.

.ENDR

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                                .TITLE  MAINDEC-11-DCFPU-D      FLOATING POINT DIVIDE EXERCISER
000000                          .ASECT
                                .GLOBL  $DVR,$DVD,$ERRA
                                ;COPYRIGHT 1972, DIGITAL EQUIPMENT CORP., MAYNARD, MASS
                                ;PROGRAM BY KEN CHAPMAN

                                ;       SWITCH          USE
                                ;       ------          --------------------
                                ;          8            0 - LOAD UB REGISTER WITH SW<7:0>
                                ;                       1 - LOOP ON TEST IN SW<7:0>
                                ;          9            TTY OUTPUT FORMAT:
                                ;                       0 - SIGN, EXPONENT, MANTISSA
                                ;                       1 - CORE IMAGE (16 BIT WORDS)
                                ;          10           0 - BELL ON PASS COMPLETE
                                ;                       1 - BELL ON ERROR
                                ;          11           INHIBIT ITERATIONS
                                ;          12           INHIBIT TRACE TRAP
                                ;          13           INHIBIT ERROR TYPEOUTS
                                ;          14           LOOP ON TEST
                                ;          15           HALT ON ERROR

                                ;OUTPUT FORM:
                                ;       ADDRESS, OPERAND, OPERATOR, OPERAND, EQUALS
                                ;       FPP:            ANSWER, FPS, FEC, FEA
                                ;       FORTRAN:            "     "    "    "

                                ;           FPS                             FEC
                                ;       BIT     REASON                  CODE    ERROR
                                ;       ---     ------                  ----    -----
                                ;        0      CARRY                     0      ADDRESS ERROR
                                ;        1      OVERFLOW                  2      OPCODE ERROR
                                ;        2      ZERO                      4      DIVIDE BY ZERO
                                ;        3      NEGATIVE                  6      CONVERSION ERROR
                                ;        4      MAINTAINANCE MODE        10      OVERFLOW
                                ;        5      TRUNCATE MODE            12      UNDERFLOW
                                ;        6      LONG INTEGER MODE        14      UNDEFINED VARIABLE (-D)
                                ;        7      DOUBLE PRECISION MODE    16      UBREAK TRAP
                                ;        8      INTERUPT ON CONVERSION ERROR
                                ;        9      INTERUPT ON OVERFLOW
                                ;       10      INTERUPT ON UNDERFLOW
                                ;       11      INTERUPT ON UNDEFINED VARIABLE
                                ;       12
                                ;       13
                                ;       14      INTERUPT ENABLE
                                ;       15      ERROR FLAG
```

```
000000                  R0=     %0
000001                  R1=     %1
000002                  R2=     %2
000003                  R3=     %3
000004                  R4=     %4
000005                  R5=     %5
000005                  TTY=    %5
000006                  SP=     %6
000007                  PC=     %7
000000                  AC0=    %0
000001                  AC1=    %1
000002                  AC2=    %2
000003                  AC3=    %3
000004                  AC4=    %4
000005                  AC5=    %5
000400                  SW08=   000400
001000                  SW09=   001000
002000                  SW10=   002000
004000                  SW11=   004000
010000                  SW12=   010000
020000                  SW13=   020000
040000                  SW14=   040000
100000                  SW15=   100000
177570                  SWR=    177570
177776                  PS=     177776
177570                  DISPLAY=SWR
000000                  DUMMY=  HALT
000240                  NOP=    240
104400                  SCOPE=  TRAP
104000                  HLT=    EMT
000004                  TYPE=   IOT
000207                  BELL=   207

        000000          .=      0                       ;TRAP CATCHER FROM 0 - 776

        000200          .=      200

000200  000167  000652            JMP     BEG

        001000          . =     1000
001000  000000          ICNT:   0
001002  000000          LONUM:  DUMMY
001004  000000                  DUMMY
001006  000000                  DUMMY
001010  000000                  DUMMY

001012  000000          HINUM:  DUMMY
001014  000000                  DUMMY
001016  000000                  DUMMY
001020  000000                  DUMMY
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001022  000000                  ANS1:   DUMMY
001024  000000                          DUMMY
001026  000000                          DUMMY
001030  000000                          DUMMY

001032  000000                  ANS2:   DUMMY
001034  000000                          DUMMY
001036  000000                          DUMMY
001040  000000                          DUMMY

001042  000000                  FPS:    0                       ;FLOATING POINT STATUS
001044  000000                  FEC:    0                       ;FLOATING EXCEPTION CODES
001046  000000                  FPC:    0                       ;FLOATING PC
001050  000000                  $FPS:   0                       ;FORTRAN FLOATING POINT STATUS
001052  000000                  $FEC:   0                       ;FORTRAN FLOATING EXCEPTION CODES
001054  000000                  $FPC:   0                       ;FORTRAN FLOATING PC

001056  012706  000600          BEG:    MOV     #600,SP         ;** STACK AT 600 **
001062  012737  001104  000004          MOV     #M1120,@#4      ;FIND OUT WHICH MACHINE THIS IS
001070  005737  177772                  TST     @#177772        ;IS PIRQ THERE?
001074  012767  000006  005034          MOV     #6,YESRT        ;FUDGE IN RTT IF 11/45
001102  000403                          BR      BEGIN

001104  016737  010050  000010  M1120:  MOV     FPTADR,@#10     ;LOAD THE ILLEGAL INSTRUCTION VECTOR
                                                                ; WITH THE ADDRESS OF THE FPU.
                                                                ; THE FPU WILL HANDLE THE BAD OPCODES
001112  012737  000006  000004  BEGIN:  MOV     #6,@#4          ;RESET 4
001120  012706  000600                  MOV     #600,SP
001124  012737  006136  000014          MOV     #YESRT,@#14     ;SET TRACE TRAP VECTOR
001132  012777  010606  010026          MOV     #POWDWN,@DWNVEC
001140  012777  000340  010022          MOV     #340,@DWNVEC+2
001146  012737  011006  000020          MOV     #.IOT,@#20      ;SET UP VECTOR 20
001154  012700  000030                  MOV     #30,R0          ;SET R0 TO VECTOR 30
001160  012720  007542                  MOV     #.TRP,(0)+      ;SET EMT VECTOR
001164  012720  000340                  MOV     #340,(0)+
001170  012720  006140                  MOV     #.EMT,(0)+      ;SET TRAP VECTOR
001174  012710  000340                  MOV     #340,(0)
001200  012777  007210  007754          MOV     #FLTERR,@FPVECT ;LOAD INTERUPT VECTOR
001206  012777  000340  007750          MOV     #340,@FPVECT+2  ;LOCK UP PROCESSOR
001214  005067  177560                  CLR     ICNT
001220  005067  007756                  CLR     LAD
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                        ;*****************************************************************
                        ;TEST 1:        EXERCISE DIVF (DIVIDE FLOATING)
                        ;                       ALL INTERUPTS ON
                        ;                       ROUNDING MODE
                        ;*****************************************************************

001224  104400                          SCOPE
001226  012767  007400  177514          MOV     #007400,$FPS    ;SET IE BITS IN FORTRAN ANSWER
001234  005067  177612                  CLR     $FEC            ;CLR FORTRAN FEC
001240  005067  177610                  CLR     $FPC            ;CLR FORTRAN FPC
001244  005067  177572                  CLR     FPS             ;CLR FPU FPS BUFFER
001250  005067  177570                  CLR     FEC             ;CLR FPU FEC BUFFER
001254  005067  177566                  CLR     FPC             ;CLR FPU FPC BUFFER
001260  004767  005762                  JSR     PC,     RANDM2  ;GET RANDOM INPUT DATA
001264  004467  005010                  JSR     R4,     $POLSH  ;ENTER POLISH MODE
001270  006312                          $P.2A                   ;PUSH 2 WORDS ON STACK (LONUM)
001272  006334                          $P.2B                   ;PUSH 2 WORDS ON STACK (HINUM)
001274  000000G                         $DVR                    ;ADDRESS OF FORTRAN DIVIDE
001276  006402                          $TST                    ;DETERMINE THE CONDITION CODES
001300  006346                          $POP2X                  ;POP 2 WORDS AND EXIT POLISH MODE

001302  016700  177542                  MOV     $FPS,   R0      ;DISPLAY FLOATING POINT STATUS
001306  170127  040000                  LDFPS   #040000         ;SET INTERUPT DISABLE
001312  172467  177464                  LDF     LONUM,  AC0     ;LOAD AC0 WITH A RANDOM NUMBER
001316  172567  177470                  LDF     HINUM,  AC1     ;LOAD AC1 WITH A RANDOM NUMBER
001322  172767  177504                  LDF     ANS2,   AC3     ;LOAD AC3 WITH THE SUM
001326  170127  007400                  LDFPS   #007400         ;TURN INTERUPTS ON
001332  012767  001340  007642          MOV     #.+6,   LAD     ;RESET LOOP ADDRESS

                        ;*****************************************************************

001340  172600                  LDF     AC0,    AC2     ;LOAD AC0 INTO AC2
001342  174601          RET1:   DIVF    AC1,    AC2     ;DIVIDE AC1 INTO AC2
001344  005767  177500          TST     $FPS            ;CHECK FOR FORTRAN FPS ERROR FLAG
001350  100412                  BMI     ERR1            ;BRANCH IF ERROR FLAG SET
001352  170267  177464          STFPS   FPS             ;STORE FLOATING POINT STATUS
001356  026767  177460  177464  CMP     FPS,    $FPS    ;CHECK FPS
001364  001427                  BEQ     TST1            ;BRANCH IF OK
001366  174267  177430          STF     AC2,    ANS1    ;SAVE FPU ANSWER
001372  104001                  HLT+1                   ;FPS ERROR
001374  000444                  BR      END1            ;SKIP COMPARE

001376  170000          ERR1:   CFCC                    ;WAIT FOR FPU TO FINISH
001400  026767  177436  177442  CMP     FPS,$FPS        ;CHECK THE FLOATING POINT STATUS
001406  001402                  BEQ     .+6             ;BRANCH IF OK
001410  104377                  HLT+377                 ;FPS ERROR
001412  000435                  BR      END1            ;SKIP TO END

001414  026767  177424  177430  CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
001422  001402                  BEQ     .+6             ;BRANCH IF OK
001424  104377                  HLT+377                 ;FEC IS WRONG
001426  000427                  BR      END1            ;SKIP TO END

001430  026767  177412  177416  CMP     FPC,$FPC        ;CHECK FLOATING PC
001436  001402                  BEQ     TST1            ;BRANCH IF OK
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001440  104377                          HLT+377                 ;WRONG ADDRESS IN FPC
001442  000421                          BR      END1            ;SKIP TO END

001444  173702                  TST1:   CMPF    AC2,    AC3     ;COMPARE FPU ANSWER TO FORTRAN ANSWER
001446  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
001450  001416                          BEQ     END1            ;ANSWERS CHECK
                                        ;COMPENSATE FOR FORTRAN INACCURACIES.
001452  174267  177344                  STF     AC2,    ANS1    ;SAVE FPU ANSWER
001456  162767  000001  177340          SUB     #1,     ANS1+2  ;DECREMENT FPU ANSWER
001464  005667  177332                  SBC     ANS1
001470  173767  177326                  CMPF    ANS1,   AC3     ;CHECK ANSWERS AGAIN
001474  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
001476  001403                          BEQ     END1            ;BRANCH IF OK
001500  174267  177316                  STF     AC2,    ANS1    ;SAVE FPU ANSWER
001504  104000                          HLT                     ;FPU AND FORTRAN DISAGREE

001506  005067  177330          END1:   CLR     FPS             ;CLR FPU FPS BUFFER
001512  104400                          SCOPE

                        ;*****************************************************************
                        ;TEST 2:        EXERCISE DIVD (DIVIDE DOUBLE PRECISION)
                        ;                       ALL INTERUPTS ON
                        ;                       ROUNDING MODE
                        ;*****************************************************************

001514  012767  007600  177326            MOV     #007600,$FPS    ;SET IE BITS IN FORTRAN ANSWER
001522  005067  177324                    CLR     $FEC            ;CLR FORTRAN FEC
001526  005067  177322                    CLR     $FPC            ;CLR FORTRAN FPC
001532  005067  177304                    CLR     FPS             ;CLR FPU FPS BUFFER
001536  005067  177302                    CLR     FEC             ;CLR FPU FEC BUFFER
001542  005067  177300                    CLR     FPC             ;CLR FPU FPC BUFFER
001546  004767  005632                    JSR     PC,     RANDM4  ;GET RANDOM INPUT DATA
001552  004467  004522                    JSR     R4,     $POLSH  ;ENTER POLISH MODE
001556  006302                            $P.4A                   ;PUSH 4 WORDS ON STACK (LONUM)
001560  006324                            $P.4B                   ;PUSH 4 WORDS ON STACK (HINUM)
001562  000000G                           $DVD                    ;ADDRESS OF FORTRAN DIVIDE
001564  006402                            $TST                    ;DETERMINE THE CONDITION CODES
001566  006360                            $POP4X                  ;POP 4 WORDS AND EXIT POLISH MODE

001570  016700  177254                    MOV     $FPS,   R0      ;DISPLAY FLOATING POINT STATUS
001574  170127  040200                    LDFPS   #040200         ;SET FID AND FD
001600  172467  177176                    LDD     LONUM,  AC0     ;LOAD AC0 WITH A RANDOM NUMBER
001604  172567  177202                    LDD     HINUM,  AC1     ;LOAD AC1 WITH A RANDOM NUMBER
001610  172767  177216                    LDD     ANS2,   AC3     ;LOAD AC3 WITH THE SUM
001614  170127  007600                    LDFPS   #007600         ;TURN INTERUPTS ON
001620  012767  001626  007354            MOV     #.+6,   LAD     ;RESET LOOP ADDRESS

                        ;*****************************************************************

001626  172600                  RET2:   LDD     AC0,    AC2     ;LOAD AC0 INTO AC2
001630  174601                          DIVD    AC1,    AC2     ;DIVIDE AC1 INTO AC2
001632  005767  177212                  TST     $FPS            ;CHECK FOR FORTRAN FPS ERROR FLAG
001636  100412                          BMI     ERR2            ;BRANCH IF ERROR FLAG SET
001640  170267  177176                  STFPS   FPS             ;STORE FLOATING POINT STATUS
001644  026767  177172  177176          CMP     FPS,    $FPS    ;CHECK FPS
001652  001427                          BEQ     TST2            ;BRANCH IF OK
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001654  174267  177142                 STD     AC2,    ANS1    ;SAVE FPU ANSWER
001660  104001                          HLT+1                   ;FPS ERROR
001662  000450                          BR      END2            ;SKIP TO END

001664  170000                  ERR2:   CFCC                    ;WAIT FOR FPU TO FINISH
001666  026767  177150  177154        CMP     FPS,$FPS        ;CHECK THE FLOATING POINT STATUS
001674  001402                          BEQ     .+6             ;BRANCH IF OK
001676  104377                          HLT+377                 ;FPS ERROR
001700  000441                          BR      END2            ;SKIP TO END

001702  026767  177136  177142        CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
001710  001402                          BEQ     .+6             ;BRANCH IF OK
001712  104377                          HLT+377                 ;FEC IS WRONG
001714  000433                          BR      END2            ;SKIP TO END

001716  026767  177124  177130        CMP     FPC,$FPC        ;CHECK FLOATING PC
001724  001402                          BEQ     TST2            ;BRANCH IF OK
001726  104377                          HLT+377                 ;WRONG ADDRESS IN FPC
001730  000425                          BR      END2            ;SKIP TO END

001732  173702                  TST2:   CMPD    AC2,    AC3     ;COMPARE FPU ANSWER TO FORTRAN ANSWER
001734  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
001736  001422                          BEQ     END2            ;ANSWERS CHECK
                                        ;COMPENSATE FOR FORTRAN INACCURACIES.
001740  174267  177056                 STD     AC2,    ANS1    ;SAVE FPU ANSWER
001744  162767  000001  177056        SUB     #1,     ANS1+6  ;DECREMENT FPU ANSWER
001752  005667  177050                 SBC     ANS1+4
001756  005667  177042                 SBC     ANS1+2
001762  005667  177034                 SBC     ANS1
001766  173767  177030                 CMPD    ANS1,   AC3     ;CHECK ANSWERS AGAIN
001772  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
001774  001403                          BEQ     END2            ;BRANCH IF OK
001776  174267  177020                 STD     AC2,    ANS1    ;SAVE FPU ANSWER
002002  104000                          HLT                     ;FPU AND FORTRAN DISAGREE

002004  005067  177032          END2:   CLR     FPS             ;CLR FPU FPS BUFFER
002010  104400                          SCOPE

                                ;*****************************************************************
                                ;TEST 3:        EXERCISE DIVF (DIVIDE FLOATING)
                                ;                       OVERFLOW AND UNDERFLOW INTERUPTS OFF.
                                ;                       ROUNDING MODE
                                ;*****************************************************************

002012  012767  004400  177030          MOV     #004400,$FPS    ;SET IE BITS IN FORTRAN ANSWER
002020  005067  177026                  CLR     $FEC            ;CLR FORTRAN FEC
002024  005067  177024                  CLR     $FPC            ;CLR FORTRAN FPC
002030  005067  177006                  CLR     FPS             ;CLR FPU FPS BUFFER
002034  005067  177004                  CLR     FEC             ;CLR FPU FEC BUFFER
002040  005067  177002                  CLR     FPC             ;CLR FPU FPC BUFFER
002044  004767  005176                  JSR     PC,     RANDM2  ;GET RANDOM INPUT DATA
002050  004467  004224                  JSR     R4,     $POLSH  ;ENTER POLISH MODE
002054  006312                          $P.2A                   ;PUSH 2 WORDS ON STACK (LONUM)
002056  006334                          $P.2B                   ;PUSH 2 WORDS ON STACK (HINUM)
002060  0000006                         $DVF                    ;ADDRESS OF FORTRAN DIVIDE
002062  006402                          $TST                    ;DETERMINE THE CONDITION CODES
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002064  006346                          $POP2X                  ;POP 2 WORDS AND EXIT POLISH MODE

002066  016700  176756                  MOV     $FPS,   R0      ;DISPLAY FLOATING POINT STATUS
002072  170127  040000                  LDFPS   #040000         ;SET FID
002076  172467  176700                  LDF     LONUM,  AC0     ;LOAD AC0 WITH A RANDOM NUMBER
002102  172567  176704                  LDF     HINUM,  AC1     ;LOAD AC1 WITH A RANDOM NUMBER
002106  172767  176720                  LDF     ANS2,   AC3     ;LOAD AC3 WITH THE SUM
002112  170127  004400                  LDFPS   #004400         ;TURN INTERUPTS ON, EXCEPT OVERFLOW AND UNDERFLOW
002116  012767  002124  007056          MOV     #.+6,   LAD     ;RESET LOOP ADDRESS

                        ;*****************************************************************************

002124  172600                  RET3:   LDF     AC0,    AC2     ;LOAD AC0 INTO AC2
002126  174601                          DIVF    AC1,    AC2     ;DIVIDE AC1 INTO AC2
002130  005767  176714                  TST     $FPS            ;CHECK FOR FORTRAN FPS ERROR FLAG
002134  100412                          BMI     ERR3            ;BRANCH IF ERROR FLAG SET
002136  170267  176700                  STFPS   FPS             ;STORE FLOATING POINT STATUS
002142  026767  176674  176700          CMP     FPS,    $FPS    ;CHECK FPS
002150  001427                          BEQ     TST3            ;BRANCH IF OK
002152  174267  176644                  STF     AC2,    ANS1    ;SAVE FPU ANSWER
002156  104001                          HLT+1                   ;FPS ERROR
002160  000450                          BR      END3            ;SKIP COMPARE

002162  170000                  ERR3:   CFCC                    ;WAIT FOR FPU TO FINISH
002164  026767  176652  176656          CMP     FPS,$FPS        ;CHECK THE FLOATING POINT STATUS
002172  001402                          BEQ     .+6             ;BRANCH IF OK
002174  104377                          HLT+377                 ;FPS ERROR
002176  000441                          BR      END3            ;SKIP TO END

002200  026767  176640  176644          CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
002206  001402                          BEQ     .+6             ;BRANCH IF OK
002210  104377                          HLT+377                 ;FEC IS WRONG
002212  000433                          BR      END3            ;SKIP TO END

002214  026767  176626  176632          CMP     FPC,$FPC        ;CHECK FLOATING PC
002222  001402                          BEQ     TST3            ;BRANCH IF OK
002224  104377                          HLT+377                 ;WRONG ADDRESS IN FPC
002226  000425                          BR      END3            ;SKIP TO END

002230  032767  000002  176612  TST3:   BIT     #2,     $FPS    ;CHECK FOR OVERFLOW
002236  001021                          BNE     END3            ;BRANCH IF OVERFLOW
002240  173702                          CMPF    AC2,    AC3     ;COMPARE FPU ANSWER TO FORTRAN ANSWER
002242  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
002244  001416                          BEQ     END3            ;ANSWERS CHECK
                                        ;COMPENSATE FOR FORTRAN INACCURACIES.
002246  174267  176550                  STF     AC2,    ANS1    ;SAVE FPU ANSWER
002252  162767  000001  176544          SUB     #1,     ANS1+2  ;DECREMENT FPU ANSWER
002260  005667  176536                  SBC     ANS1
002264  173767  176532                  CMPF    ANS1,   AC3     ;CHECK ANSWERS AGAIN
002270  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
002272  001403                          BEQ     END3            ;BRANCH IF OK
002274  174267  176522                  STF     AC2,    ANS1    ;SAVE FPU ANSWER
002300  104000                          HLT                     ;FPU AND FORTRAN DISAGREE

002302  005067  176534          END3:   CLR     FPS             ;CLR FPU FPS BUFFER
002306  104400                          SCOPE
```

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                        ;*****************************************************************************
                        ;TEST 4:        EXERCISE DIVD (DIVIDE DOUBLE PRECISION)
                        ;                       OVERFLOW AND UNDERFLOW INTERUPTS OFF
                        ;                       ROUNDING MODE
                        ;*****************************************************************************

002310  012767  004600  176532          MOV     #004600,$FPS    ;SET IE BITS IN FORTRAN ANSWER
002316  005067  176530                  CLR     $FEC            ;CLR FORTRAN FEC
002322  005067  176526                  CLR     $FPC            ;CLR FORTRAN FPC
002326  005067  176510                  CLR     FPS             ;CLR FPU FPS BUFFER
002332  005067  176506                  CLR     FEC             ;CLR FPU FEC BUFFER
002336  005067  176504                  CLR     FPC             ;CLR FPU FPC BUFFER
002342  004767  005036                  JSR     PC,     RANDM4  ;GET RANDOM INPUT DATA
002346  004467  003726                  JSR     R4,     $POLSH  ;ENTER POLISH MODE
002352  006302                          $P.4A                   ;PUSH 4 WORDS ON STACK (LONUM)
002354  006324                          $P.4B                   ;PUSH 4 WORDS ON STACK (HINUM)
002356  000000G                         $DVD                    ;ADDRESS OF FORTRAN DIVIDE
002360  006402                          $TST                    ;DETERMINE THE CONDITION CODES
002362  006360                          $POP4X                  ;POP 4 WORDS AND EXIT POLISH MODE

002364  016700  176460                  MOV     $FPS,   R0      ;DISPLAY FLOATING POINT STATUS
002370  170127  040200                  LDFPS   #040200         ;SET FID AND FD
002374  172467  176402                  LDD     LONUM,  AC0     ;LOAD AC0 WITH A RANDOM NUMBER
002400  172567  176406                  LDD     HINUM,  AC1     ;LOAD AC1 WITH A RANDOM NUMBER
002404  172767  176422                  LDD     ANS2,   AC3     ;LOAD AC3 WITH THE SUM
002410  170127  004600                  LDFPS   #004600         ;TURN INTERUPTS ON, EXCEPT OVER AND UNDERFLOW
002414  012767  002422  006560          MOV     #.+6,   LAD     ;RESET LOOP ADDRESS

                        ;*****************************************************************************

002422  172600                  RET4:   LDD     AC0,    AC2     ;LOAD AC0 INTO AC2
002424  174601                          DIVD    AC1,    AC2     ;DIVIDE AC1 INTO AC2
002426  005767  176416                  TST     $FPS            ;CHECK FOR FORTRAN FPS ERROR FLAG
002432  100412                          BMI     ERR4            ;BRANCH IF ERROR FLAG SET
002434  170267  176402                  STFPS   FPS             ;STORE FLOATING POINT STATUS
002440  026767  176376  176402          CMP     FPS,    $FPS    ;CHECK FPS
002446  001427                          BEQ     TST4            ;BRANCH IF OK
002450  174267  176346                  STD     AC2,    ANS1    ;SAVE FPU ANSWER
002454  104001                          HLT+1                   ;FPS ERROR
002456  000454                          BR      END4            ;SKIP COMPARE

002460  170000                  ERR4:   CFCC                    ;WAIT FOR FPU TO FINISH
002462  026767  176354  176360          CMP     FPS,$FPS        ;CHECK THE FLOATING POINT STATUS
002470  001402                          BEQ     .+6             ;BRANCH IF OK
002472  104377                          HLT+377                 ;FPS ERROR
002474  000445                          BR      END4            ;SKIP TO END

002476  026767  176342  176346          CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
002504  001402                          BEQ     .+6             ;BRANCH IF OK
002506  104377                          HLT+377                 ;FEC IS WRONG
002510  000437                          BR      END4            ;SKIP TO END

002512  026767  176330  176334          CMP     FPC,$FPC        ;CHECK FLOATING PC
002520  001402                          BEQ     TST4            ;BRANCH IF OK
002522  104377                          HLT+377                 ;WRONG ADDRESS IN FPC
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002524  000431                          BR      END4            ;SKIP TO END

002526  032767  000002  176314  TST4:   BIT     #2,     $FPS    ;CHECK FOR OVERFLOW
002534  001025                          BNE     END4            ;BRANCH IF OVERFLOW
002536  173702                          CMPD    AC2,    AC3     ;COMPARE FPU ANSWER TO FORTRAN ANSWER
002540  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
002542  001422                          BEQ     END4            ;ANSWERS CHECK
                                        ;COMPENSATE FOR FORTRAN INACCURACIES.
002544  174267  176252                  STD     AC2,    ANS1    ;SAVE FPU ANSWER
002550  162767  000001  176252          SUB     #1,     ANS1+6  ;DECREMENT FPU ANSWER
002556  005667  176244                  SBC     ANS1+4
002562  005667  176236                  SBC     ANS1+2
002566  005667  176230                  SBC     ANS1
002572  173767  176224                  CMPD    ANS1,   AC3     ;CHECK ANSWERS AGAIN
002576  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
002600  001403                          BEQ     END4            ;BRANCH IF OK
002602  174267  176214                  STD     AC2,    ANS1    ;SAVE FPU ANSWER
002606  104000                          HLT                     ;FPU AND FORTRAN DISAGREE

002610  005067  176226          END4:   CLR     FPS             ;CLR FPU FPS BUFFER
002614  104400                          SCOPE

                        ;*****************************************************************
                        ;TEST 5:        EXERCISE DIVF (DIVIDE FLOATING)
                        ;                       ALL INTERUPTS ON
                        ;                       TRUNCATE MODE
                        ;*****************************************************************

002616  012767  007440  176224          MOV     #007440,$FPS    ;SET IE BITS IN FORTRAN ANSWER
002624  005067  176222                  CLR     $FEC            ;CLR FORTRAN FEC
002630  005067  176220                  CLR     $FPC            ;CLR FORTRAN FPC
002634  005067  176202                  CLR     FPS             ;CLR FPU FPS BUFFER
002640  005067  176200                  CLR     FEC             ;CLR FPU FEC BUFFER
002644  005067  176176                  CLR     FPC             ;CLR FPU FPC BUFFER
002650  004767  004372                  JSR     PC,     RANDM2  ;GET RANDOM INPUT DATA
002654  004467  003420                  JSR     R4,     $POLSH  ;ENTER POLISH MODE
002660  006312                          $P.2A                   ;PUSH 2 WORDS ON STACK (LONUM)
002662  006334                          $P.2B                   ;PUSH 2 WORDS ON STACK (HINUM)
002664  0000006                         $DVR                    ;ADDRESS OF FORTRAN DIVIDE
002666  006402                          $TST                    ;DETERMINE THE CONDITION CODES
002670  006346                          $POP2X                  ;POP 2 WORDS AND EXIT POLISH MODE

002672  016700  176152                  MOV     $FPS,   R0      ;DISPLAY FLOATING POINT STATUS
002676  170127  040000                  LDFPS   #040000         ;SET FID
002702  172467  176074                  LDF     LONUM,  AC0     ;LOAD AC0 WITH A RANDOM NUMBER
002706  172567  176100                  LDF     HINUM,  AC1     ;LOAD AC1 WITH A RANDOM NUMBER
002712  172767  176114                  LDF     ANS2,   AC3     ;LOAD AC3 WITH THE SUM
002716  170127  007440                  LDFPS   #007440         ;TURN INTERUPTS ON
002722  012767  002730  006252          MOV     #.+6,   LAD     ;RESET LOOP ADDRESS

                        ;*****************************************************************

002730  172600                          LDF     AC0,    AC2     ;LOAD AC0 INTO AC2
002732  174601          RET5:   DIVF    AC1,    AC2     ;DIVIDE AC1 INTO AC2
002734  003767  176110                  TST     $FPS            ;CHECK FOR FORTRAN FPS ERROR FLAG
002740  100412                          BMI     ERR5            ;BRANCH IF ERROR FLAG SET
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002742  170267  176074                  STFPS   FPS             ;STORE FLOATING POINT STATUS
002746  026767  176070  176074          CMP     FPS,    $FPS    ;CHECK FPS
002754  001427                          BEQ     TST5            ;BRANCH IF OK
002756  174267  176040                  STF     AC2,    ANS1    ;SAVE FPU ANSWER
002762  104001                          HLT+1                   ;FPS ERROR
002764  000455                          BR      END5            ;SKIP COMPARE

002766  170000                  ERR5:   CFCC                    ;WAIT FOR FPU TO FINISH
002770  026767  176046  176052          CMP     FPS,$FPS        ;CHECK THE FLOATING POINT STATUS
002776  001402                          BEQ     .+6             ;BRANCH IF OK
003000  104377                          HLT+377                 ;FPS ERROR
003002  000446                          BR      END5            ;SKIP TO END

003004  026767  176034  176040          CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
003012  001402                          BEQ     .+6             ;BRANCH IF OK
003014  104377                          HLT+377                 ;FEC IS WRONG
003016  000440                          BR      END5            ;SKIP TO END

003020  026767  176022  176026          CMP     FPC,$FPC        ;CHECK FLOATING PC
003026  001402                          BEQ     TST5            ;BRANCH IF OK
003030  104377                          HLT+377                 ;WRONG ADDRESS IN FPC
003032  000432                          BR      END5            ;SKIP TO END

003034  173702                  TST5:   CMPF    AC2,    AC3     ;COMPARE FPU ANSWER TO FORTRAN ANSWER
003036  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
003040  001427                          BEQ     END5            ;ANSWERS CHECK
                                        ;COMPENSATE FOR FORTRAN INACCURACIES.
003042  174267  175754                  STF     AC2,    ANS1    ;SAVE FPU ANSWER
003046  062767  000001  175750          ADD     #1,     ANS1+2  ;INCREMENT FPU ANSWER
003054  005567  175742                  ADC     ANS1
003060  173767  175736                  CMPF    ANS1,   AC3     ;CHECK ANSWERS AGAIN
003064  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
003066  001414                          BEQ     END5            ;BRANCH IF OK
003070  162767  000002  175726          SUB     #2,     ANS1+2  ;DECREMENT FPU ANSWER
003076  005667  175720                  SBC     ANS1
003102  173767  175714                  CMPF    ANS1,   AC3     ;CHECK ANSWERS AGAIN
003106  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
003110  001403                          BEQ     END5            ;BRANCH IF OK
003112  174267  175704                  STF     AC2,    ANS1    ;SAVE FPU ANSWER
003116  104000                          HLT                     ;FPU AND FORTRAN DISAGREE

003120  005067  175716          END5:   CLR     FPS             ;CLR FPU FPS BUFFER
003124  104400                          SCOPE

                        ;*****************************************************************
                        ;TEST 6:        EXERCISE DIVD (DIVIDE DOUBLE PRECISION)
                        ;                       ALL INTERUPTS ON
                        ;                       TRUNCATE MODE
                        ;*****************************************************************

003126  012767  007640  175714          MOV     #007640,$FPS    ;SET IE BITS IN FORTRAN ANSWER
003134  005067  175712                  CLR     $FEC            ;CLR FORTRAN FEC
003140  005067  175710                  CLR     $FPC            ;CLR FORTRAN FPC
003144  005067  175672                  CLR     FPS             ;CLR FPU FPS BUFFER
003150  005067  175670                  CLR     FEC             ;CLR FPU FEC BUFFER
003154  005067  175666                  CLR     FPC             ;CLR FPU FPC BUFFER
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003160  004767  004220                  JSR     PC,     RANDM4  ;GET RANDOM INPUT DATA
003164  004467  003110                  JSR     R4,     $POLSH  ;ENTER POLISH MODE
003170  006302                          $P.4A                   ;PUSH 4 WORDS ON STACK (LONUM)
003172  006324                          $P.4B                   ;PUSH 4 WORDS ON STACK (HINUM)
003174  000000G                         $DVD                    ;ADDRESS OF FORTRAN DIVIDE
003176  006402                          $TST                    ;DETERMINE THE CONDITION CODES
003200  006360                          $POP4X                  ;POP 4 WORDS AND EXIT POLISH MODE

003202  016700  175642                  MOV     $FPS,   R0      ;DISPLAY FLOATING POINT STATUS
003206  170127  040200                  LDFPS   #040200         ;SET FID AND FD
003212  172467  175564                  LDD     LONUM,  AC0     ;LOAD AC0 WITH A RANDOM NUMBER
003216  172567  175570                  LDD     HINUM,  AC1     ;LOAD AC1 WITH A RANDOM NUMBER
003222  172767  175604                  LDD     ANS2,   AC3     ;LOAD AC3 WITH THE SUM
003226  170127  007640                  LDFPS   #007640         ;TURN INTERUPTS ON
003232  012767  003240  005742          MOV     #.+6,   LAD     ;RESET LOOP ADDRESS

                        ;*****************************************************************************

003240  172600                  RET6:   LDD     AC0,    AC2     ;LOAD AC0 INTO AC2
003242  174601                          DIVD    AC1,    AC2     ;DIVIDE AC1 INTO AC2
003244  005767  175600                  TST     $FPS            ;CHECK FOR FORTRAN FPS ERROR FLAG
003250  100412                          BMI     ERR6            ;BRANCH IF ERROR FLAG SET
003252  170267  175564                  STFPS   FPS             ;STORE FLOATING POINT STATUS
003256  026767  175560  175564          CMP     FPS,    $FPS    ;CHECK FPS
003264  001427                          BEQ     TST6            ;BRANCH IF OK
003266  174267  175530                  STD     AC2,    ANS1    ;SAVE FPU ANSWER
003272  104001                          HLT+1                   ;FPS ERROR
003274  000465                          BR      END6            ;SKIP TO END

003276  170000                  ERR6:   CFCC                    ;WAIT FOR FPU TO FINISH
003300  026767  175536  175542          CMP     FPS,$FPS        ;CHECK THE FLOATING POINT STATUS
003306  001402                          BEQ     .+6             ;BRANCH IF OK
003310  104377                          HLT+377                 ;FPS ERROR
003312  000456                          BR      END6            ;SKIP TO END

003314  026767  175524  175530          CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
003322  001402                          BEQ     .+6             ;BRANCH IF OK
003324  104377                          HLT+377                 ;FEC IS WRONG
003326  000450                          BR      END6            ;SKIP TO END

003330  026767  175512  175516          CMP     FPC,$FPC        ;CHECK FLOATING PC
003336  001402                          BEQ     TST6            ;BRANCH IF OK
003340  104377                          HLT+377                 ;WRONG ADDRESS IN FPC
003342  000442                          BR      END6            ;SKIP TO END

003344  173702                  TST6:   CMPD    AC2,    AC3     ;COMPARE FPU ANSWER TO FORTRAN ANSWER
003346  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
003350  001437                          BEQ     END6            ;ANSWERS CHECK
                                        ;COMPENSATE FOR FORTRAN INACCURACIES.
003352  174267  175444                  STD     AC2,    ANS1    ;SAVE FPU ANSWER
003356  062767  000001  175444          ADD     #1,     ANS1+6  ;INCREMENT FPU ANSWER
003364  005567  175436                  ADC     ANS1+4
003370  005567  175430                  ADC     ANS1+2
003374  005567  175422                  ADC     ANS1
003400  173767  175416                  CMPD    ANS1,   AC3     ;CHECK ANSWERS AGAIN
003404  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
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003406  001420                          BEQ     END6            ;BRANCH IF OK
003410  162767  000002  175412          SUB     #2,     ANS1+6  ;DECREMENT FPU ANSWER
003416  005667  175404                  SBC     ANS1+4
003422  005667  175376                  SBC     ANS1+2
003426  005667  175370                  SBC     ANS1
003432  173767  175364                  CMPD    ANS1,   AC3     ;CHECK ANSWERS AGAIN
003436  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
003440  001403                          BEQ     END6            ;BRANCH IF OK
003442  174267  175354                  STD     AC2,    ANS1    ;SAVE FPU ANSWER
003446  104000                          HLT                     ;FPU AND FORTRAN DISAGREE

003450  005067  175366          END6:   CLR     FPS             ;CLR FPU FPS BUFFER
003454  104400                          SCOPE

                        ;*****************************************************************
                        ;TEST 7:        EXERCISE DIVF (DIVIDE FLOATING)
                        ;               OVERFLOW AND UNDERFLOW INTERUPTS OFF.
                        ;               TRUNCATE MODE
                        ;*****************************************************************

003456  012767  004440  175364          MOV     #004440,$FPS    ;SET IE BITS IN FORTRAN ANSWER
003464  005067  175362                  CLR     $FEC            ;CLR FORTRAN FEC
003470  005067  175360                  CLR     $FPC            ;CLR FORTRAN FPC
003474  005067  175342                  CLR     FPS             ;CLR FPU FPS BUFFER
003500  005067  175340                  CLR     FEC             ;CLR FPU FEC BUFFER
003504  005067  175336                  CLR     FPC             ;CLR FPU FPC BUFFER
003510  004767  003532                  JSR     PC,     RANDM2  ;GET RANDOM INPUT DATA
003514  004467  002560                  JSR     R4,     $POLSH  ;ENTER POLISH MODE
003520  006312                          $P.2A                   ;PUSH 2 WORDS ON STACK (LONUM)
003522  006334                          $P.2B                   ;PUSH 2 WORDS ON STACK (HINUM)
003524  0000006                         $DVR                    ;ADDRESS OF FORTRAN DIVIDE
003526  006402                          $TST                    ;DETERMINE THE CONDITION CODES
003530  006346                          $POP2X                  ;POP 2 WORDS AND EXIT POLISH MODE

003532  016700  175312                  MOV     $FPS,   R0      ;DISPLAY FLOATING POINT STATUS
003536  170127  040000                  LDFPS   #040000         ;SET FID
003542  172467  175234                  LDF     LONUM,  AC0     ;LOAD AC0 WITH A RANDOM NUMBER
003546  172567  175240                  LDF     HINUM,  AC1     ;LOAD AC1 WITH A RANDOM NUMBER
003552  172767  175254                  LDF     ANS2,   AC3     ;LOAD AC3 WITH THE SUM
003556  170127  004440                  LDFPS   #004440         ;TURN INTERUPTS ON, EXCEPT OVERFLOW AND UNDERFLOW
003562  012767  003570  005412          MOV     #.+6,   LAD     ;RESET LOOP ADDRESS

                        ;*****************************************************************

003570  172600                  RET7:   LDF     AC0,    AC2     ;LOAD AC0 INTO AC2
003572  174601                          DIVF    AC1,    AC2     ;DIVIDE AC1 INTO AC2
003574  005767  175250                  TST     $FPS            ;CHECK FOR FORTRAN FPS ERROR FLAG
003600  100412                          BMI     ERR7            ;BRANCH IF ERROR FLAG SET
003602  170267  175234                  STFPS   FPS             ;STORE FLOATING POINT STATUS
003606  026767  175230  175234          CMP     FPS,    $FPS    ;CHECK FPS
003614  001427                          BEQ     TST7            ;BRANCH IF OK
003616  174267  175200                  STF     AC2,    ANS1    ;SAVE FPU ANSWER
003622  104001                          HLT+1                   ;FPS ERROR
003624  000461                          BR      END7            ;SKIP COMPARE

003626  170000                  ERR7:   CFCC                    ;WAIT FOR FPU TO FINISH
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003630  026767  175206  175212          CMP     FPS,$FPS        ;CHECK THE FLOATING POINT STATUS
003636  001402                          BEQ     .+6             ;BRANCH IF OK
003640  104377                          HLT+377                 ;FPS ERROR
003642  000452                          BR      END7            ;SKIP TO END

003644  026767  175174  175200          CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
003652  001402                          BEQ     .+6             ;BRANCH IF OK
003654  104377                          HLT+377                 ;FEC IS WRONG
003656  000444                          BR      END7            ;SKIP TO END

003660  026767  175162  175166          CMP     FPC,$FPC        ;CHECK FLOATING PC
003666  001402                          BEQ     TST7            ;BRANCH IF OK
003670  104377                          HLT+377                 ;WRONG ADDRESS IN FPC
003672  000436                          BR      END7            ;SKIP TO END

003674  032767  000002  175146  TST7:   BIT     #2,     $FPS    ;CHECK FOR OVERFLOW
003702  001032                          BNE     END7            ;BRANCH IF OVERFLOW
003704  173702                          CMPF    AC2,    AC3     ;COMPARE FPU ANSWER TO FORTRAN ANSWER
003706  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
003710  001427                          BEQ     END7            ;ANSWERS CHECK
                                        ;COMPENSATE FOR FORTRAN INACCURACIES.
003712  174267  175104                  STF     AC2,    ANS1    ;SAVE FPU ANSWER
003716  062767  000001  175100          ADD     #1,     ANS1+2  ;INCREMENT FPU ANSWER
003724  005567  175072                  ADC     ANS1
003730  173767  175066                  CMPF    ANS1,   AC3     ;CHECK ANSWERS AGAIN
003734  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
003736  001414                          BEQ     END7            ;BRANCH IF OK
003740  162767  000002  175056          SUB     #2,     ANS1+2  ;DECREMENT FPU ANSWER
003746  005667  175050                  SBC     ANS1
003752  173767  175044                  CMPF    ANS1,   AC3     ;CHECK ANSWERS AGAIN
003756  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
003760  001403                          BEQ     END7            ;BRANCH IF OK
003762  174267  175034                  STF     AC2,    ANS1    ;SAVE FPU ANSWER
003766  104000                          HLT                     ;FPU AND FORTRAN DISAGREE

003770  005067  175046  END7:   CLR     FPS                     ;CLR FPU FPS BUFFER
003774  104400                  SCOPE

                        ;*****************************************************************
                        ;TEST ID:       EXERCISE DIVD (DIVIDE DOUBLE PRECISION)
                        ;               OVERFLOW AND UNDERFLOW INTERUPTS OFF
                        ;               TRUNCATE MODE
                        ;*****************************************************************

003776  012767  004640  175044          MOV     #004640,$FPS    ;SET IE BITS IN FORTRAN ANSWER
004004  005067  175042                  CLR     $FEC            ;CLR FORTRAN FEC
004010  005067  175040                  CLR     $FPC            ;CLR FORTRAN FPC
004014  005067  175022                  CLR     FPS             ;CLR FPU FPS BUFFER
004020  005067  175020                  CLR     FEC             ;CLR FPU FEC BUFFER
004024  005067  175016                  CLR     FPC             ;CLR FPU FPC BUFFER
004030  004767  003350                  JSR     PC,     RANDM4  ;GET RANDOM INPUT DATA
004034  004467  002240                  JSR     R4,     $POLSH  ;ENTER POLISH MODE
004040  006302                          $P.4A                   ;PUSH 4 WORDS ON STACK (LONUM)
004042  006324                          $P.4B                   ;PUSH 4 WORDS ON STACK (HINUM)
004044  0000006                         $DVD                    ;ADDRESS OF FORTRAN DIVIDE
004046  006402                          $TST                    ;DETERMINE THE CONDITION CODES
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004050  006360                          $POP4X                  ;POP 4 WORDS AND EXIT POLISH MODE

004052  016700  174772                  MOV     $FPS,   R0      ;DISPLAY FLOATING POINT STATUS
004056  170127  040200                  LDFPS   #040200         ;SET FID AND FD
004062  172467  174714                  LDD     LONUM,  AC0     ;LOAD AC0 WITH A RANDOM NUMBER
004066  172567  174720                  LDD     HINUM,  AC1     ;LOAD AC1 WITH A RANDOM NUMBER
004072  172767  174734                  LDD     ANS2,   AC3     ;LOAD AC3 WITH THE SUM
004076  170127  004640                  LDFPS   #004640         ;TURN INTERUPTS ON, EXCEPT OVER AND UNDERFLOW
004102  012767  004110  005072          MOV     #.+6,   LAD     ;RESET LOOP ADDRESS$

                        ;*****************************************************************************

004110  172600                  RET10:  LDD     AC0,    AC2     ;LOAD AC0 INTO AC2
004112  174601                          DIVD    AC1,    AC2     ;DIVIDE AC1 INTO AC2
004114  005767  174730                  TST     $FPS            ;CHECK FOR FORTRAN FPS ERROR FLAG
004120  100412                          BMI     ERR10           ;BRANCH IF ERROR FLAG SET
004122  170267  174714                  STFPS   FPS             ;STORE FLOATING POINT STATUS
004126  026767  174710  174714          CMP     FPS,    $FPS    ;CHECK FPS
004134  001427                          BEQ     TST10           ;BRANCH IF OK
004136  174267  174660                  STD     AC2,    ANS1    ;SAVE FPU ANSWER
004142  104001                          HLT+1                   ;FPS ERROR
004144  000471                          BR      END10           ;SKIP COMPARE

004146  170000                  ERR10:  CFCC                    ;WAIT FOR FPU TO FINISH
004150  026767  174666  174672          CMP     FPS,$FPS        ;CHECK THE FLOATING POINT STATUS
004156  001402                          BEQ     .+6             ;BRANCH IF OK
004160  104377                          HLT+377                 ;FPS ERROR
004162  000462                          BR      END10           ;SKIP TO END

004164  026767  174654  174660          CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
004172  001402                          BEQ     .+6             ;BRANCH IF OK
004174  104377                          HLT+377                 ;FEC IS WRONG
004176  000454                          BR      END10           ;SKIP TO END

004200  026767  174642  174646          CMP     FPC,$FPC        ;CHECK FLOATING PC
004206  001450                          BEQ     END10           ;BRANCH IF OK
004210  104377                          HLT+377                 ;WRONG ADDRESS IN FPC
004212  000446                          BR      END10           ;SKIP TO END

004214  032767  000002  174626  TST10:  BIT     #2,     $FPS    ;CHECK FOR OVERFLOW
004222  001042                          BNE     END10           ;BRANCH IF OVERFLOW
004224  173702                          CMPD    AC2,    AC3     ;COMPARE FPU ANSWER TO FORTRAN ANSWER
004226  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
004230  001437                          BEQ     END10           ;ANSWERS CHECK
                                ;COMPENSATE FOR FORTRAN INACCURACIES.
004232  174267  174564                  STD     AC2,    ANS1    ;SAVE FPU ANSWER
004236  062767  000001  174564          ADD     #1,     ANS1+6  ;INCREMENT FPU ANSWER
004244  005567  174556                  ADC     ANS1+4
004250  005567  174550                  ADC     ANS1+2
004254  005567  174542                  ADC     ANS1
004260  173767  174536                  CMPD    ANS1,   AC3     ;CHECK ANSWERS AGAIN
004264  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
004266  001420                          BEQ     END10           ;BRANCH IF OK
004270  162767  000002  174532          SUB     #2,     ANS1+6  ;DECREMENT FPU ANSWER
004276  005667  174524                  SBC     ANS1+4
004302  005667  174516                  SBC     ANS1+2
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004306  005667  174510                  SBC     ANS1
004312  173767  174504                  CMPD    ANS1,   AC3     ;CHECK ANSWERS AGAIN
004316  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
004320  001403                          BEQ     END10           ;BRANCH IF OK
004322  174267  174474                  STD     AC2,    ANS1    ;SAVE FPU ANSWER
004326  104000                          HLT                     ;FPU AND FORTRAN DISAGREE

004330  005067  174506          END10:  CLR     FPS             ;CLR FPU FPS BUFFER
004334  104400                          SCOPE

                        ;*************************************************************************
                        ;TEST 11:       EXERCISE DIVF (DIVIDE FLOATING)
                        ;                       INTERUPT DISABLE SET
                        ;                       ROUNDING MODE
                        ;*************************************************************************

004336  012767  047400  174504           MOV     #047400,$FPS    ;SET IE BITS IN FORTRAN ANSWER
004344  005067  174502                   CLR     $FEC            ;CLR FORTRAN FEC
004350  005067  174500                   CLR     $FPC            ;CLR FORTRAN FPC
004354  005067  174462                   CLR     FPS             ;CLR FPU FPS BUFFER
004360  005067  174460                   CLR     FEC             ;CLR FPU FEC BUFFER
004364  005067  174456                   CLR     FPC             ;CLR FPU FPC BUFFER
004370  004767  002652                   JSR     PC,     RANDM2  ;GET RANDOM INPUT DATA
004374  004467  001700                   JSR     R4,     $POLSH  ;ENTER POLISH MODE
004400  006312                           $P.2A                   ;PUSH 2 WORDS ON STACK (LONUM)
004402  006334                           $P.2B                   ;PUSH 2 WORDS ON STACK (HINUM)
004404  000000G                          $DVR                    ;ADDRESS OF FORTRAN DIVIDE
004406  006402                           $TST                    ;DETERMINE THE CONDITION CODES
004410  006346                           $POP2X                  ;POP 2 WORDS AND EXIT POLISH MODE

004412  016700  174432                   MOV     $FPS,   R0      ;DISPLAY FLOATING POINT STATUS
004416  170127  040000                   LDFPS   #040000         ;SET FID
004422  172467  174354                   LDF     LONUM,  AC0     ;LOAD AC0 WITH A RANDOM NUMBER
004426  172567  174360                   LDF     HINUM,  AC1     ;LOAD AC1 WITH A RANDOM NUMBER
004432  172767  174374                   LDF     ANS2,   AC3     ;LOAD AC3 WITH THE SUM
004436  170127  047400                   LDFPS   #047400         ;SET INTERUPT DISABLE AND INTERUPT BITS
004442  012767  004450  004532           MOV     #.+6,   LAD     ;RESET LOOP ADDRESS

                        ;*************************************************************************

004450  172600                   LDF     AC0,    AC2     ;LOAD AC0 INTO AC2
004452  174601           RET11:  DIVF    AC1,    AC2     ;DIVIDE AC1 INTO AC2
004454  170267  174362           STFPS   FPS             ;STORE FLOATING POINT STATUS
004460  005767  174364           TST     $FPS            ;CHECK FOR ERROR FLAG
004464  100410                   BMI     ERR11           ;BRANCH IF ERROR FLAG SET
004466  026767  174350  174354   CMP     FPS,    $FPS    ;CHECK FPS
004474  001430                   BEQ     TST11           ;BRANCH IF OK
004476  174267  174320           STF     AC2,    ANS1    ;SAVE FPU ANSWER
004502  104001                   HLT+1                   ;FPS ERROR
004504  000451                   BR      END11           ;SKIP COMPARE

004506  170367  174332   ERR11:  STST    FEC             ;STORE FEC AND FPC
004512  026767  174324  174330   CMP     FPS,    $FPS    ;CHECK THE FLOATING POINT STATUS
004520  001402                   BEQ     .+6             ;BRANCH IF OK
004522  104377                   HLT+377                 ;FPS ERROR
004524  000441                   BR      END11           ;SKIP TO END
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004526  026767  174312  174316          CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
004534  001402                          BEQ     .+6             ;BRANCH IF OK
004536  104377                          HLT+377                 ;FEC IS WRONG
004540  000433                          BR      END11           ;SKIP TO END

004542  026767  174300  174304          CMP     FPC,$FPC        ;CHECK FLOATING PC
004550  001402                          BEQ     TST11           ;BRANCH IF OK
004552  104377                          HLT+377                 ;WRONG ADDRESS IN FPC
004554  000425                          BR      END11           ;SKIP TO END

004556  032767  000002  174264  TST11:  BIT     #2,     $FPS    ;CHECK FOR OVERFLOW
004564  001021                          BNE     END11           ;BRANCH IF OVERFLOW
004566  173702                          CMPF    AC2,    AC3     ;COMPARE FPU ANSWER TO FORTRAN ANSWER
004570  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
004572  001416                          BEQ     END11           ;ANSWERS CHECK
                                        ;COMPENSATE FOR FORTRAN INACCURACIES.
004574  174267  174222                  STF     AC2,    ANS1    ;SAVE FPU ANSWER
004600  162767  000001  174216          SUB     #1,     ANS1+2  ;DECREMENT FPU ANSWER
004606  005667  174210                  SBC     ANS1
004612  173767  174204                  CMPF    ANS1,   AC3     ;CHECK ANSWERS AGAIN
004616  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
004620  001403                          BEQ     END11           ;BRANCH IF OK
004622  174267  174174                  STF     AC2,    ANS1    ;SAVE FPU ANSWER
004626  104000                          HLT                     ;FPU AND FORTRAN DISAGREE

004630  005067  174206          END11:  CLR     FPS             ;CLR FPU FPS BUFFER
004634  104400                          SCOPE
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                        ;*****************************************************************
                        ;TEST 12:       EXERCISE DIVD (DIVIDE DOUBLE PRECISION)
                        ;                       INTERUPT DISABLE SET
                        ;                       ROUNDING MODE
                        ;*****************************************************************

004636  012767  047600  174204          MOV     #047600,$FPS    ;SET FID AND IE BITS IN FORTRAN ANSWER
004644  005067  174202                  CLR     $FEC            ;CLR FORTRAN FEC
004650  005067  174200                  CLR     $FPC            ;CLR FORTRAN FPC
004654  005067  174162                  CLR     FPS             ;CLR FPU FPS BUFFER
004660  005067  174160                  CLR     FEC             ;CLR FPU FEC BUFFER
004664  005067  174156                  CLR     FPC             ;CLR FPU FPC BUFFER
004670  004767  002510                  JSR     PC,     RANDM4  ;GET RANDOM INPUT DATA
004674  004467  001400                  JSR     R4,     $POLSH  ;ENTER POLISH MODE
004700  006302                          $P.4A                   ;PUSH 4 WORDS ON STACK (LONUM)
004702  006324                          $P.4B                   ;PUSH 4 WORDS ON STACK (HINUM)
004704  000000G                         $DVD                    ;ADDRESS OF FORTRAN DIVIDE
004706  006402                          $TST                    ;DETERMINE THE CONDITION CODES
004710  006360                          $POP4X                  ;POP 4 WORDS AND EXIT POLISH MODE

004712  016700  174132                  MOV     $FPS,   R0      ;DISPLAY FLOATING POINT STATUS
004716  170127  040200                  LDFPS   #040200         ;SET FID AND FD
004722  172467  174054                  LDD     LONUM,  AC0     ;LOAD AC0 WITH A RANDOM NUMBER
004726  172567  174060                  LDD     HINUM,  AC1     ;LOAD AC1 WITH A RANDOM NUMBER
004732  172767  174074                  LDD     ANS2,   AC3     ;LOAD AC3 WITH THE SUM
004736  170127  047600                  LDFPS   #047600         ;SET INTERUPT DISABLE AND INTERUPT BITS
004742  012767  004750  004232          MOV     #.+6,   LAD     ;RESET LOOP ADDRESS

                        ;*****************************************************************

004750  172600                  TST12:  LDD     AC0,    AC2     ;LOAD AC0 INTO AC2
004752  174601                  RET12:  DIVD    AC1,    AC2     ;DIVIDE AC1 INTO AC2
004754  170267  174062                  STFPS   FPS             ;STORE FLOATING POINT STATUS
004760  005767  174064                  TST     $FPS            ;CHECK FOR ERROR FLAG
004764  100410                          BMI     ERR12           ;BRANCH IF ERROR FLAG SET
004766  026767  174050  174054          CMP     FPS,    $FPS    ;CHECK FPS
004774  001430                          BEQ     TST12           ;BRANCH IF OK
004776  174267  174020                  STD     AC2,    ANS1    ;SAVE FPU ANSWER
005002  104001                          HLT+1                   ;FPS ERROR
005004  000455                          BR      END12           ;SKIP COMPARE

005006  170367  174032          ERR12:  STST    FEC             ;STORE FEC AND FPC
005012  026767  174024  174030          CMP     FPS,    $FPS    ;CHECK THE FLOATING POINT STATUS
005020  001402                          BEQ     .+6             ;BRANCH IF OK
005022  104377                          HLT+377                 ;FPS ERROR
005024  000445                          BR      END12           ;SKIP TO END

005026  026767  174012  174016          CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
005034  001402                          BEQ     .+6             ;BRANCH IF OK
005036  104377                          HLT+377                 ;FEC IS WRONG
005040  000437                          BR      END12           ;SKIP TO END

005042  026767  174000  174004          CMP     FPC,$FPC        ;CHECK FLOATING PC
005050  001402                          BEQ     TST12           ;BRANCH IF OK
005052  104377                          HLT+377                 ;WRONG ADDRESS IN FPC
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005054  000431                              BR      END12           ;SKIP TO END

005056  032767  000002  173764  TST12:      BIT     #2,     $FPS    ;CHECK FOR OVERFLOW
005064  001025                              BNE     END12           ;BRANCH IF OVERFLOW
005066  173702                              CMPD    AC2,    AC3     ;COMPARE FPU ANSWER TO FORTRAN ANSWER
005070  170000                              CFCC                    ;COPY FLOATING CONDITION CODES
005072  001422                              BEQ     END12           ;ANSWERS CHECK
                                            ;COMPENSATE FOR FORTRAN INACCURACIES.
005074  174267  173722                      STD     AC2,    ANS1    ;SAVE FPU ANSWER
005100  162767  000001  173722              SUB     #1,     ANS1+6  ;DECREMENT FPU ANSWER
005106  005667  173714                      SBC     ANS1+4
005112  005667  173706                      SBC     ANS1+2
005116  005667  173700                      SBC     ANS1
005122  173767  173674                      CMPD    ANS1,   AC3     ;CHECK ANSWERS AGAIN
005126  170000                              CFCC                    ;COPY FLOATING CONDITION CODES
005130  001403                              BEQ     END12           ;BRANCH IF OK
005132  174267  173664                      STD     AC2,    ANS1    ;SAVE FPU ANSWER
005136  104000                              HLT                     ;FPU AND FORTRAN DISAGREE

005140  005067  173676          END12:      CLR     FPS             ;CLR FPU FPS BUFFER
005144  104400                              SCOPE

                        ;*************************************************************************
                        ;TEST 13:       EXERCISE DIVF (DIVIDE FLOATING)
                        ;                       INTERUPT DISABLE SET
                        ;                       TRUNCATE MODE
                        ;*************************************************************************

005146  012767  047440  173674              MOV     #047440,$FPS    ;SET FID AND IE BITS IN FORTRAN ANSWER
005154  005067  173672                      CLR     $FEC            ;CLR FORTRAN FEC
005160  005067  173670                      CLR     $FPC            ;CLR FORTRAN FPC
005164  005067  173652                      CLR     FPS             ;CLR FPU FPS BUFFER
005170  005067  173650                      CLR     FEC             ;CLR FPU FEC BUFFER
005174  005067  173646                      CLR     FPC             ;CLR FPU FPC BUFFER
005200  004767  002042                      JSR     PC,     RANDM2  ;GET RANDOM INPUT DATA
005204  004467  001070                      JSR     R4,     $POLSH  ;ENTER POLISH MODE
005210  006312                              $P.2A                   ;PUSH 2 WORDS ON STACK (LONUM)
005212  006334                              $P.2B                   ;PUSH 2 WORDS ON STACK (HINUM)
005214  000000G                             $DVR                    ;ADDRESS OF FORTRAN DIVIDE
005216  006402                              $TST                    ;DETERMINE THE CONDITION CODES
005220  006346                              $POP2X                  ;POP 2 WORDS AND EXIT POLISH MODE

005222  016700  173622                      MOV     $FPS,   R0      ;DISPLAY FLOATING POINT STATUS
005226  170127  040000                      LDFPS   #040000         ;SET FID
005232  172467  173544                      LDF     LONUM,  AC0     ;LOAD AC0 WITH A RANDOM NUMBER
005236  172567  173550                      LDF     HINUM,  AC1     ;LOAD AC1 WITH A RANDOM NUMBER
005242  172767  173564                      LDF     ANS2,   AC3     ;LOAD AC3 WITH THE SUM
005246  170127  047440                      LDFPS   #047440         ;SET INTERUPT DISABLE AND INTERUPT BITS
005252  012767  005260  003722              MOV     #.+6,   LAD     ;RESET LOOP ADDRESS
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                                ;*************************************************************************

005260  172600                  RET13:  LDF     AC0,    AC2     ;LOAD AC0 INTO AC2
005262  174601                          DIVF    AC1,    AC2     ;DIVIDE AC1 INTO AC2
005264  170267  173552                  STFPS   FPS             ;STORE FLOATING POINT STATUS
005270  005767  173554                  TST     $FPS            ;CHECK FOR ERROR FLAG
005274  100410                          BMI     ERR13           ;BRANCH IF ERROR FLAG SET
005276  026767  173540  173544          CMP     FPS,    $FPS    ;CHECK FPS
005304  001430                          BEQ     TST13           ;BRANCH IF OK
005306  174267  173510                  STF     AC2,    ANS1    ;SAVE FPU ANSWER
005312  104001                          HLT+1                   ;FPS ERROR
005314  000462                          BR      END13           ;SKIP COMPARE

005316  170367  173522          ERR13:  STST    FEC             ;STORE FEC AND FPC
005322  026767  173514  173520          CMP     FPS,    $FPS    ;CHECK THE FLOATING POINT STATUS
005330  001402                          BEQ     .+6             ;BRANCH IF OK
005332  104377                          HLT+377                 ;FPS ERROR
005334  000452                          BR      END13           ;SKIP TO END

005336  026767  173502  173506          CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
005344  001402                          BEQ     .+6             ;BRANCH IF OK
005346  104377                          HLT+377                 ;FEC IS WRONG
005350  000444                          BR      END13           ;SKIP TO END

005352  026767  173470  173474          CMP     FPC,$FPC        ;CHECK FLOATING PC
005360  001402                          BEQ     TST13           ;BRANCH IF OK
005362  104377                          HLT+377                 ;WRONG ADDRESS IN FPC
005364  000436                          BR      END13           ;SKIP TO END

005366  032767  000002  173454  TST13:  BIT     #2,     $FPS    ;CHECK FOR OVERFLOW
005374  001032                          BNE     END13           ;BRANCH IF OVERFLOW
005376  173702                          CMPF    AC2,    AC3     ;COMPARE FPU ANSWER TO FORTRAN ANSWER
005400  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
005402  001427                          BEQ     END13           ;ANSWERS CHECK
                                ;COMPENSATE FOR FORTRAN INACCURACIES.
005404  174267  173412                  STF     AC2,    ANS1    ;SAVE FPU ANSWER
005410  062767  000001  173406          ADD     #1,     ANS1+2  ;INCREMENT FPU ANSWER
005416  005567  173400                  ADC     ANS1
005422  173767  173374                  CMPF    ANS1,   AC3     ;CHECK ANSWERS AGAIN
005426  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
005430  001414                          BEQ     END13           ;BRANCH IF OK
005432  162767  000002  173364          SUB     #2,     ANS1+2  ;DECREMENT FPU ANSWER
005440  005667  173356                  SBC     ANS1
005444  173767  173352                  CMPF    ANS1,   AC3     ;CHECK ANSWERS AGAIN
005450  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
005452  001403                          BEQ     END13           ;BRANCH IF OK
005454  174267  173342                  STF     AC2,    ANS1    ;SAVE FPU ANSWER
005460  104000                          HLT                     ;FPU AND FORTRAN DISAGREE

005462  005067  173354          END13:  CLR     FPS             ;CLR FPU FPS BUFFER
005466  104400                          SCOPE
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                                ;*****************************************************************
                                ;TEST 14:       EXERCISE DIVD (DIVIDE DOUBLE PRECISION)
                                ;                       INTERUPT DISABLE SET
                                ;                       TRUNCATE MODE
                                ;*****************************************************************

005470  012767  047640  173352           MOV     #047640,$FPS    ;SET FID AND IE BITS IN FORTRAN ANSWER
005476  005067  173350                   CLR     $FEC            ;CLR FORTRAN FEC
005502  005067  173346                   CLR     $FPC            ;CLR FORTRAN FPC
005506  005067  173330                   CLR     FPS             ;CLR FPU FPS BUFFER
005512  005067  173326                   CLR     FEC             ;CLR FPU FEC BUFFER
005516  005067  173324                   CLR     FPC             ;CLR FPU FPC BUFFER
005522  004767  001656                   JSR     PC,     RANDM4  ;GET RANDOM INPUT DATA
005526  004467  000546                   JSR     R4,     $POLSH  ;ENTER POLISH MODE
005532  006302                           $P.4A                   ;PUSH 4 WORDS ON STACK (LONUM)
005534  006324                           $P.4B                   ;PUSH 4 WORDS ON STACK (HINUM)
005536  000000G                          $DVD                    ;ADDRESS OF FORTRAN DIVIDE
005540  006402                           $TST                    ;DETERMINE THE CONDITION CODES
005542  006360                           $POP4X                  ;POP 4 WORDS AND EXIT POLISH MODE

005544  016700  173300                   MOV     $FPS,   R0      ;DISPLAY FLOATING POINT STATUS
005550  170127  040200                   LDFPS   #040200         ;SET FID AND FD
005554  172467  173222                   LDD     LONUM,  AC0     ;LOAD AC0 WITH A RANDOM NUMBER
005560  172567  173226                   LDD     HINUM,  AC1     ;LOAD AC1 WITH A RANDOM NUMBER
005564  172767  173242                   LDD     ANS2,   AC3     ;LOAD AC3 WITH THE SUM
005570  170127  047640                   LDFPS   #047640         ;SET INTERUPT DISABLE AND INTERUPT BITS
005574  012767  005602  003400           MOV     #.+6,   LAD     ;RESET LOOP ADDRESS

                                ;*****************************************************************

005602  172600                   RET14:  LDD     AC0,    AC2     ;LOAD AC0 INTO AC2
005604  174601                           DIVD    AC1,    AC2     ;DIVIDE AC1 INTO AC2
005606  170267  173230                   STFPS   FPS             ;STORE FLOATING POINT STATUS
005612  005767  173232                   TST     $FPS            ;CHECK FOR ERROR FLAG
005616  100410                           BMI     ERR14           ;BRANCH IF ERROR FLAG SET
005620  026767  173216  173222           CMP     FPS,    $FPS    ;CHECK FPS
005626  001430                           BEQ     TST14           ;BRANCH IF OK
005630  174267  173166                   STD     AC2,    ANS1    ;SAVE FPU ANSWER
005634  104001                           HLT+1                   ;FPS ERROR
005636  000472                           BR      END14           ;SKIP COMPARE

005640  170367  173200           ERR14:  STST    FEC             ;STORE FEC AND FPC
005644  026767  173172  173176           CMP     FPS,    $FPS    ;CHECK THE FLOATING POINT STATUS
005652  001402                           BEQ     .+6             ;BRANCH IF OK
005654  104377                           HLT+377                 ;FPS ERROR
005656  000462                           BR      END14           ;SKIP TO END

005660  026767  173160  173164           CMP     FEC,$FEC        ;CHECK THE FLOATING EXCEPTION CODES
005666  001402                           BEQ     .+6             ;BRANCH IF OK
005670  104377                           HLT+377                 ;FEC IS WRONG
005672  000454                           BR      END14           ;SKIP TO END

005674  026767  173146  173152           CMP     FPC,$FPC        ;CHECK FLOATING PC
005702  001402                           BEQ     TST14           ;BRANCH IF OK
005704  104377                           HLT+377                 ;WRONG ADDRESS IN FPC
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005706  000446                          BR      END14           ;SKIP TO END

005710  032767  000002  173132  TST14:  BIT     #2,     $FPS    ;CHECK FOR OVERFLOW
005716  001042                          BNE     END14           ;BRANCH IF OVERFLOW
005720  173702                          CMPD    AC2,    AC3     ;COMPARE FPU ANSWER TO FORTRAN ANSWER
005722  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
005724  001437                          BEQ     END14           ;ANSWERS CHECK
                                        ;COMPENSATE FOR FORTRAN INACCURACIES.
005726  174267  173070                  STD     AC2,    ANS1    ;SAVE FPU ANSWER
005732  062767  000001  173070          ADD     #1,     ANS1+6  ;INCREMENT FPU ANSWER
005740  005567  173062                  ADC     ANS1+4
005744  005567  173054                  ADC     ANS1+2
005750  005567  173046                  ADC     ANS1
005754  173767  173042                  CMPD    ANS1,   AC3     ;CHECK ANSWERS AGAIN
005760  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
005762  001420                          BEQ     END14           ;BRANCH IF OK
005764  162767  000002  173036          SUB     #2,     ANS1+6  ;DECREMENT FPU ANSWER
005772  005667  173030                  SBC     ANS1+4
005776  005667  173022                  SBC     ANS1+2
006002  005667  173014                  SBC     ANS1
006006  173767  173010                  CMPD    ANS1,   AC3     ;CHECK ANSWERS AGAIN
006012  170000                          CFCC                    ;COPY FLOATING CONDITION CODES
006014  001403                          BEQ     END14           ;BRANCH IF OK
006016  174267  173000                  STD     AC2,    ANS1    ;SAVE FPU ANSWER
006022  104000                          HLT                     ;FPU AND FORTRAN DISAGREE

006024  005067  173012          END14:  CLR     FPS             ;CLR FPU FPS BUFFER
006030  104400                          SCOPE
```

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006032  032737  002000  177570  DONE:   BIT     #SW10,@#SWR     ;RING THE BELL?
006040  001005                  BNE     1$              ;NO!
006042  012767  000207  003126          MOV     #BELL,,TYPE     ;TYPE A BELL
006050  000004  011176                  TYPE,   .TYPE
006054  005046          1$:     CLR     -(6)            ;CLEAR TRACE TRAP
006056  032737  010000  177570          BIT     #SW12,@#SWR     ;RUN WITH TRT?
006064  001010                  BNE     2$
006066  005167  003106          COM     TRPB
006072  100005                  BPL     2$
006074  052716  000020          BIS     #20,(6)         ;SET TRACE TRAP
006100  012746  006132          MOV     #3$,    -(6)    ;JUMP TO START OF TEST
006104  000002                  RTI
006106  012746  006114  2$:     MOV     #4$,    -(6)    ;JUMP TO START OF TEST
006112  000002                  RTI
006114  013700  000042  4$:     MOV     @#42,R0         ;GET MONITOR ADDRESS
006120  001404                  BEQ     3$              ;IF NONE
006122  004710                  JSR     7,(0)           ;GO TO MONITOR
006124  000240                  NOP
006126  000240                  NOP
006130  000240                  NOP
006132  000137  000200  3$:     JMP     @#200           ;JUMP TO START OF TEST
006136  000002          YESRT:  RTI                     ;RETURN TO PROGRAM FROM TRAP

006140  032737  000400  177570  .EMT:   BIT     #SW08,@#SWR     ;KILL LDUB OR LOOP ON SPEC. TEST
006146  001404                  BEQ     1$
006150  123767  177570  172622          CMPB    @#SWR,ICNT      ;ON RIGHT TEST?   *SW7-0*
006156  001437                  BEQ     OVER
006160  113703  177570          1$:     MOVB    @#SWR,R3        ;GET UB BITS
006164  170003                  LDUB
006166  032737  040000  177570          BIT     #SW14,@#SWR     ;LOOP ON TEST
006174  001026                  BNE     KIT
006176  032737  004000  177570          BIT     #SW11,@#SWR     ;KILL ITERATIONS
006204  001012                  BNE     SAVLAD
006206  105767  172567                  TSTB    ICNT+1
006212  001404                  BEQ     2$              ;BRANCH IF FIRST
006214  126767  002770  172557          CMPB    TIMES,ICNT+1    ;DONE?
006222  001013                  BNE     KIT             ;BRANCH IF NOT
006224  112767  000001  172547  2$:     MOVB    #1,ICNT+1       ;FIRST ITERATION
006232  105267  172542          SAVLAD: INCB    ICNT            ;COUNT TEST NUMBERS
006236  011667  002740                  MOV     (6),LAD         ;SAVE LOOP ADDRESS
006242  016737  172532  177570          MOV     ICNT,@#DISPLAY  ;DISPLAY TEST NO. AND ITERATION COUNT
006250  000002                  RTI                     ;RETURN

006252  105267  172523          KIT:    INCB    ICNT+1
006256  016737  172516  177570  OVER:   MOV     ICNT,@#DISPLAY  ;SET UP DISPLAY
006264  005767  002712                  TST     LAD             ;FIRST ONE?
006270  001760                  BEQ     SAVLAD
006272  016716  002704                  MOV     LAD,(6)         ;FUDGE RETURN ADDRESS
006276  000002                  RTI                     ;FIXES PS
```

```
006300  000134                  $POLSH: JMP     @(R4)+

006302  016746  172502          $P.4A:  MOV     LONUM+6,-(SP)
006306  016746  172474                  MOV     LONUM+4,-(SP)
006312  016746  172466          $P.2A:  MOV     LONUM+2,-(SP)
006316  016746  172460                  MOV     LONUM,  -(SP)
006322  000134                          JMP     @(R4)+

006324  016746  172470          $P.4B:  MOV     HINUM+6,-(SP)
006330  016746  172462                  MOV     HINUM+4,-(SP)
006334  016746  172454          $P.2B:  MOV     HINUM+2,-(SP)
006340  016746  172446                  MOV     HINUM,  -(SP)
006344  000134                          JMP     @(R4)+

006346  012667  172460          $POP2X: MOV     (SP)+,  ANS2
006352  012667  172456                  MOV     (SP)+,  ANS2+2
006356  000204                          RTS     R4              ;EXIT POLISH MODE

006360  012667  172446          $POP4X: MOV     (SP)+,  ANS2
006364  012667  172444                  MOV     (SP)+,  ANS2+2
006370  012667  172442                  MOV     (SP)+,  ANS2+4
006374  012667  172440                  MOV     (SP)+,  ANS2+6
006400  000204                          RTS     R4              ;EXIT POLISH MODE

006402  032767  100002  172440  $TST:   BIT     #100002,$FPS    ;CHECK FOR ERROR FLAG AND OVERFLOW
006410  100453                          BMI     $TER            ;BRANCH IF FLAG SET
006412  001061                          BNE     $TOV            ;BRANCH IF OVERFLOW
006414  032716  077600                  BIT     #077600,(6)     ;TEST THE EXPONENT
006420  001041                          BNE     $TST1           ;BRANCH IF NOT ZERO
006422  052767  000004  172420          BIS     #04,    $FPS    ;SET Z BIT
006430  032767  077600  172354          BIT     #077600,HINUM   ;CHECK DIVISOR FOR ZERO
006436  001032                          BNE     $TST1           ;BRANCH IF NON-ZERO
006440  052767  100000  172402          BIS     #100000,$FPS    ;SET THE ERROR FLAG
006446  012767  000004  172376          MOV     #04,    $FEC    ;DIVIDE BY ZERO EXCEPTION CODE
006454  116701  172320                  MOVB    ICNT,   R1      ;GET THE TEST NUMBER
006460  006301                          ASL     R1              ;*2
006462  016167  006572  172364          MOV     RETAD-2(R1),$FPC ;GET EXPECTED PC
006470  016716  172306                  MOV     LONUM,  (SP)    ;RESTORE DIVIDEND
006474  016766  172304  000002          MOV     LONUM+2,2(SP)   ;
006502  105767  172342                  TSTB    $FPS            ;CHECK FOR DOUBLE PRECISION
006506  100006                          BPL     $TST1           ;BRANCH IF NOT
006510  016766  172272  000004          MOV     LONUM+4,4(SP)   ;
006516  016766  172266  000006          MOV     LONUM+6,6(SP)   ;
006524  005716                  $TST1:  TST     (SP)            ;FIND THE SIGN
006526  100003                          BPL     $TST2           ;BRANCH IF PLUS
006530  052767  000010  172312          BIS     #10,    $FPS    ;SET N BIT
006536  000134                  $TST2:  JMP     @(R4)+

006540  116701  172234          $TER:   MOVB    ICNT,   R1      ;GET TEST NUMBER
006544  005301                          DEC     R1              ;SET POINTER
006546  006301                          ASL     R1              ;TEST # * 2
006550  016167  006574  172276          MOV     RETAD(1),$FPC   ;STORE FORTRAN FPC
006556  022626                  $TOV:   CMP     (SP)+,  (SP)+   ;"POP" 2 WORDS
006560  105767  172264                  TSTB    $FPS            ;CHECK FD BIT
006564  100001                          BPL     $TOV1           ;BRANCH IF FLOATING MODE
```

```
006566  022626                  CMP     (SP)+,  (SP)+   ;"POP" 2 MORE WORDS
006570  005724          $TOV1:  TST     (R4)+           ;SKIP "POPX" ROUTINE
006572  000204                  RTS     R4              ;EXIT POLISH MODE

006574  001342          RETAD:  RET1
006576  001630                  RET2
006600  002126                  RET3
006602  002424                  RET4
006604  002732                  RET5
006606  003242                  RET6
006610  003572                  RET7
006612  004112                  RET10
006614  004452                  RET11
006616  004750                  RET12
006620  005262                  RET13
006622  005604                  RET14

006624  020027  002405    $ERRA:  CMP     R0,     #2405   ;CHECK FOR UNDERFLOW, FD=0
006630  001420                  BEQ     $UNDR0          ;BRANCH IF UNDERFLOW
006632  020027  004005            CMP     R0,     #4005   ;CHECK FOR UNDERFLOW, FD=1
006636  001433                  BEQ     $UNDR1          ;BRANCH IF UNDERFLOW
006640  020027  003003            CMP     R0,     #3003   ;CHECK FOR OVERFLOW, FD=0
006644  001454                  BEQ     $OVER0          ;BRANCH IF OVERFLOW
006646  020027  002003            CMP     R0,     #2003   ;CHECK FOR OVERFLOW, FD=1
006652  001463                  BEQ     $OVER1          ;BRANCH IF OVERFLOW
006654  020027  004003            CMP     R0,     #4003   ;CHECK FOR DIVIDE BY ZERO, FD=0
006660  001531                  BEQ     $DVBZ0          ;BRANCH IF DIVIDE BY ZERO
006662  020027  001403            CMP     R0,     #1403   ;CHECK FOR DIVIDE BY ZERO, FD=1
006666  001534                  BEQ     $DVBZ1          ;BRANCH IF DIVIDE BY ZERO
006670  000000          $UNKER: HALT                    ;UNKNOWN ERROR!

006672  032767  003000  172150  $UNDR0: BIT     #003000,$FPS    ;CHECK FOR INTERUPTS ON OR OFF
006700  001476                  BEQ     $ERTS           ;BRANCH IF OFF
006702  004467  177372            JSR     R4,     $POLSH  ;ENTER POLISH MODE
006706  006312                  $P.2A                   ;PUSH 2 WORDS ON STACK (LONUM)
006710  006334                  $P.2B                   ;PUSH 2 WORDS ON STACK (HINUM)
006712  007100                  $SB200                  ;SUBTRACT 200 FROM THE EXPONENT OF THE DIVISOR
006714  0000006                 $DVR                    ;ADDRESS OF FORTRAN DIVIDE
006716  007122                  $200SB                  ;SUBTRACT 200 FROM THE EXPONENT OF ANS
006720  006402                  $TST                    ;DETERMINE CONDITION CODES
006722  006346                  $POP2X                  ;POP 2 WORDS AND EXIT POLISH MODE
006724  000415                  BR      $UNDRA

006726  032767  003000  172114  $UNDR1: BIT     #003000,$FPS    ;CHECK FOR INTERUPTS ON OR OFF
006734  001460                  BEQ     $ERTS           ;BRANCH IF OFF
006736  004467  177336            JSR     R4,     $POLSH  ;ENTER POLISH MODE
006742  006302                  $P.4A                   ;PUSH 2 WORDS ON STACK (LONUM)
006744  006324                  $P.4B                   ;PUSH 2 WORDS ON STACK (HINUM)
006746  007100                  $SB200                  ;SUBTRACT 200 FROM THE EXPONENT OF THE DIVISOR
006750  0000006                 $DVD                    ;ADDRESS OF FORTRAN DIVIDE
006752  007122                  $200SB                  ;SUBTRACT 200 FROM THE EXPONENT OF ANS
006754  006402                  $TST                    ;DETERMINE CONDITION CODES
006756  006360                  $POP4X                  ;POP 4 WORDS AND EXIT POLISH MODE
006760  052767  100000  172062  $UNDRA: BIS     #100000,$FPS    ;SET FPS ERROR FLAG
006766  012767  000012  172056          MOV     #12.    $FEC    ;SET UNDERFLOW EXCEPTION CODE
006774  000205                  RTS     %5              ;RETURN TO FORTRAN ROUTINE
```

```
007776  004467  177276          $OVER0: JSR     R4,     $POLSH  ;ENTER POLISH MODE
007002  006312                          $P.2A                   ;PUSH 2 WORDS ON STACK (LONUM)
007004  006334                          $P.2B                   ;PUSH 2 WORDS ON STACK (HINUM)
007006  007114                          $AD200                  ;ADD 200 TO THE EXPONENT OF THE DEVISOR
007010  000000G                         $DVR                    ;ADDRESS OF FORTRAN DIVIDE
007012  007106                          $200AD                  ;ADD 200 TO THE EXPONENT OF ANS
007014  006402                          $TST                    ;DETERMINE CONDITION CODES
007016  006346                          $POP2X                  ;POP 2 WORDS AND EXIT POLISH MODE
007020  000411                          BR      $OVERA

007022  004467  177252          $OVER1: JSR     R4,     $POLSH  ;ENTER POLISH MODE
007026  006302                          $P.4A                   ;PUSH 2 WORDS ON STACK (LONUM)
007030  006324                          $P.4B                   ;PUSH 2 WORDS ON STACK (HINUM)
007032  007114                          $AD200                  ;ADD 200 TO THE EXPONENT OF THE DEVISOR
007034  000000G                         $DVD                    ;ADDRESS OF FORTRAN DIVIDE
007036  007106                          $200AD                  ;ADD 200 TO THE EXPONENT OF ANS
007040  006402                          $TST                    ;DETERMINE CONDITION CODES
007042  006360                          $POP4X                  ;POP 4 WORDS AND EXIT POLISH MODE
007044  032767  003000  171776  $OVERA: BIT     #003000,$FPS    ;CHECK FOR INTERUPTS ON OR OFF
007052  001406                          BEQ     $OVR1           ;BRANCH IF OFF
007054  052767  100000  171766          BIS     #100000,$FPS    ;SET FPS ERROR FLAG
007062  012767  000010  171762          MOV     #10.    $FEC    ;SET OVERFLOW EXCEPTION CODE
007070  052767  000002  171752  $OVR1:  BIS     #02.    $FPS    ;SET OVERFLOW BIT IN FPS
007076  000205                  $ERTS:  RTS     %5

007100  162716  040000          $SB200: SUB     #040000,(SP)
007104  000134                          JMP     @(R4)+

007106  062716  140000          $200AD: ADD     #140000,(SP)
007112  000134                          JMP     @(R4)+

007114  062716  040000          $AD200: ADD     #040000,(SP)
007120  000134                          JMP     @(R4)+

007122  162716  040000          $200SB: SUB     #040000,(SP)
007126  032767  000003  170642          BIT     #3,     PS      ;TEST FOR  C OR V BITS
007134  001402                          BEQ     $201SB
007136  062716  100000                  ADD     #100000,(SP)
007142  000134                  $201SB: JMP     @(R4)+

007144  004467  177130          $DVBZ0: JSR     R4,     $POLSH  ;ENTER POLISH MODE
007150  006312                          $P.2A                   ;PUSH DIVIDEND
007152  006402                          $TST                    ;CALCULATE CONDITION CODES
007154  006346                          $POP2X                  ;POP DIVIDEND INTO ANSWER
007156  000405                          BR      $DVBZA

007160  004467  177114          $DVBZ1: JSR     R4,     $POLSH  ;ENTER POLISH MODE
007164  006302                          $P.4A                   ;PUSH DIVIDEND
007166  006402                          $TST                    ;CALCULATE CONDITION CODES
007170  006360                          $POP4X                  ;POP DIVIDEND INTO ANSWER
007172  052767  100000  171650  $DVBZA: BIS     #100000,$FPS    ;SET FPS ERROR FLAG
007200  012767  000004  171644          MOV     #04.    $FEC    ;DIVIDE BY ZERO EXCEPTION CODE
007206  000205                          RTS     %5              ;RETURN TO FORTRAN

                        ;*****************************************************************
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                                ;FPP INTERUPT SERVICE ROUTINE
                                ;*************************************************************************

007210  170267  171626          FLTERR: STFPS   FPS              ;STORE FLOATING POINT STATUS
007214  170367  171624                  STST    FEC              ;STORE FLOATING EXCEPTION CODES
007220  032767  040000  171622          BIT     #40000, $FPS     ;CHECK INTERUPT DISABLE
007226  001402                          BEQ     .+6              ;BRANCH IF OFF
007230  104377                          HLT+377                  ;INTERUPT NOT SUPPOSED TO BE ENABLED
007232  000404                          BR      ERRTI

007234  005767  171610                  TST     $FPS             ;CHECK FORTRAN FPS FOR ERROR FLAG
007240  100401                          BMI     ERRTI            ;BRANCH IF FLAG SET
007242  104377                          HLT+377                  ;FLOATING POINT STATUS ERROR

007244  000002                  ERRTI:  RTI
```

```
007246  010046                  RANDM2: MOV     %0,-(6)         ;SAVE R0
007250  010146                          MOV     %1,-(6)         ;SAVE R1
007252  010246                          MOV     %2,-(6)         ;SAVE R2
007254  010346                          MOV     %3,-(6)         ;SAVE R3
007256  010446                          MOV     %4,-(6)         ;SAVE R4
007260  010546                          MOV     %5,-(6)         ;SAVE R5
007262  012704  001002                  MOV     #LONUM,%4       ;SET UP LONUM POINTER
007266  012705  001012                  MOV     #HINUM,%5       ;SET UP HINUM POINTER
007272  011400                          MOV     (4),%0          ;SET R0 WITH LOW
007274  011501                          MOV     (5),%1          ;SET R1 WITH HIGH
007276  012703  177771          REPET2: MOV     #-7,%3          ;SET SHIFT COUNT
007302  005002                          CLR     %2
007304  006300                  SHIFT2: ASL     %0              ;SHIFT R0 LEFT AND
007306  006101                          ROL     %1              ;ROTATE CARRY INTO R1 AND
007310  006102                          ROL     %2              ;ROTATE CARRY INTO R2
007312  005203                          INC     %3              ;CHECK FOR DONE
007314  001373                          BNE     SHIFT2          ;CONTINUE SHIFT LOOP
007316  061402                          ADD     (4),%2          ;ADD NUMBER TO MAKE X 129
007320  005501                          ADC     %1              ;PROPOGATE CARRY
007322  061501                          ADD     (5),%1          ;ADD NUMBER TO MAKE X 129
007324  005502                          ADC     %2              ;PROPOGATE CARRY
007326  062700  001057                  ADD     #1057,%0        ;ADD LOW CONSTANT
007332  005501                          ADC     %1              ;PROPOGATE CARRY
007334  005502                          ADC     %2              ;PROPOGATE CARRY
007336  062701  047401                  ADD     #47401,%1       ;ADD HIGH CONSTANT
007342  005502                          ADC     %2              ;PROPOGATE CARRY
007344  062702  000006                  ADD     #6,%2           ;ADD HIGHEST CONSTART
007350  060200                          ADD     %2,%0           ;REPRIME R0 WITH HIGHEST DIGIT
007352  005501                          ADC     %1              ;PROPOGATE CARRY
007354  010024                          MOV     %0,(4)+         ;SAVE R0
007356  010125                          MOV     %1,(5)+         ;SAVE R1
007360  020427  001006                  CMP     %4,#LONUM+4     ;CHECK FOR DONE ENOUGH
007364  001344                          BNE     REPET2          ;BRANCH IF NOT DONE
007366  012605                          MOV     (6)+,%5         ;RESTORE R5
007370  012604                          MOV     (6)+,%4         ;RESTORE R4
007372  012603                          MOV     (6)+,%3         ;RESTORE R3
007374  012602                          MOV     (6)+,%2         ;RESTORE R2
007376  012601                          MOV     (6)+,%1         ;RESTORE R1
007400  012600                          MOV     (6)+,%0         ;RESTORE R0
007402  000207                          RTS     %7              ;RETURN
```

```
007404  010046                  RANDM4: MOV     %0,-(6)         ;SAVE R0
007406  010146                          MOV     %1,-(6)         ;SAVE R1
007410  010246                          MOV     %2,-(6)         ;SAVE R2
007412  010346                          MOV     %3,-(6)         ;SAVE R3
007414  010446                          MOV     %4,-(6)         ;SAVE R4
007416  010546                          MOV     %5,-(6)         ;SAVE R5
007420  012704  001002                  MOV     #LONUM,%4       ;SET UP LONUM POINTER
007424  012705  001012                  MOV     #HINUM,%5       ;SET UP HINUM POINTER
007430  011400                          MOV     (4),%0          ;SET R0 WITH LOW
007432  011501                          MOV     (5),%1          ;SET R1 WITH HIGH
007434  012703  177771          REPET4: MOV     #-7,%3          ;SET SHIFT COUNT
007440  005002                          CLR     %2
007442  006300                  SHIFT4: ASL     %0              ;SHIFT R0 LEFT AND
007444  006101                          ROL     %1              ;ROTATE CARRY INTO R1 AND
007446  006102                          ROL     %2              ;ROTATE CARRY INTO R2
007450  005203                          INC     %3              ;CHECK FOR DONE
007452  001373                          BNE     SHIFT4          ;CONTINUE SHIFT LOOP
007454  061402                          ADD     (4),%2          ;ADD NUMBER TO MAKE X 129
007456  005501                          ADC     %1              ;PROPOGATE CARRY
007460  061501                          ADD     (5),%1          ;ADD NUMBER TO MAKE X 129
007462  005502                          ADC     %2              ;PROPOGATE CARRY
007464  062700  001057                  ADD     #1057,%0        ;ADD LOW CONSTANT
007470  005501                          ADC     %1              ;PROPOGATE CARRY
007472  005502                          ADC     %2              ;PROPOGATE CARRY
007474  062701  047401                  ADD     #47401,%1       ;ADD HIGH CONSTANT
007500  005502                          ADC     %2              ;PROPOGATE CARRY
007502  062702  000006                  ADD     #6,%2           ;ADD HIGHEST CONSTART
007506  060200                          ADD     %2,%0           ;REPRIME R0 WITH HIGHEST DIGIT
007510  005501                          ADC     %1              ;PROPOGATE CARRY
007512  010024                          MOV     %0,(4)+         ;SAVE R0
007514  010125                          MOV     %1,(5)+         ;SAVE R1
007516  020427  001012                  CMP     %4,#LONUM+10    ;CHECK FOR DONE ENOUGH
007522  001344                          BNE     REPET4          ;BRANCH IF NOT DONE
007524  012605                          MOV     (6)+,%5         ;RESTORE R5
007526  012604                          MOV     (6)+,%4         ;RESTORE R4
007530  012603                          MOV     (6)+,%3         ;RESTORE R3
007532  012602                          MOV     (6)+,%2         ;RESTORE R2
007534  012601                          MOV     (6)+,%1         ;RESTORE R1
007536  012600                          MOV     (6)+,%0         ;RESTORE R0
007540  000207                          RTS     %7              ;RETURN
```

```
007542  032767  002000  170020  .TRP:   BIT     #2000,SWR
007550  001405                          BEQ     .ET
007552  012767  000207  001416          MOV     #BELL,..TYPE    ;TYPE A BELL
007560  000004  011176                  TYPE,   .TYPE
007564  005267  001414          .ET:    INC     ERRORS          ;COUNT THE NUMBER OF ERRORS
007570  032767  020000  167772          BIT     #20000,SWR      ;SKIP TYPEOUT IF SET
007576  001116                          BNE     NHEAD
007600  174267  171216                  STF     AC2,    ANS1    ;SAVE THE ANSWER TO BE SURE
007604  000004  011102                  TYPE,   RET
007610  000004  011102                  TYPE,   RET
007614  011646                          MOV     (6),-(6)        ;PUT ADDRESS OF INSTRUCTION ON STACK
007616  162716  000002                  SUB     #2,(6)
007622  117667  000000  001356          MOVB    @(6),   WORDS
007630  012605                          MOV     (6)+,TTY        ;TYPE (6)+ IN OCTAL
007632  004767  000546                  JSR     %7,PRINTR       ;TYPE LEADING ZERO'S
007636  000004  011077                  TYPE,   SPACE+3
007642  012703  001002                  MOV     #LONUM, %3      ;SET UP POINTER
007646  004767  000174                  JSR     7,      $TYPE   ;TYPE A FLOATING POINT NUMBER
007652  000004  011105                  TYPE,   $SIGN
007656  004767  000164                  JSR     7,      $TYPE   ;TYPE A FLOATING POINT NUMBER
007662  000004  011130                  TYPE,   FPUAN
007666  004767  000154                  JSR     7,      $TYPE   ;TYPE A FLOATING POINT NUMBER
007672  000004  011076                  TYPE,   SPACE+2
007676  016705  171140                  MOV     FPS,TTY         ;TYPE FPS IN OCTAL
007702  004767  000476                  JSR     %7,PRINTR       ;TYPE LEADING ZERO'S
007706  105767  001274                  TSTB    WORDS           ;CHECK FOR STATUS ERROR
007712  100014                          BPL     .STAT           ;BRANCH IF NOT
007714  000004  011076                  TYPE,   SPACE+2
007720  016705  171120                  MOV     FEC,TTY         ;TYPE FEC IN OCTAL
007724  004767  000454                  JSR     %7,PRINTR       ;TYPE LEADING ZERO'S
007730  000004  011076                  TYPE,   SPACE+2
007734  016705  171106                  MOV     FPC,TTY         ;TYPE FPC IN OCTAL
007740  004767  000440                  JSR     %7,PRINTR       ;TYPE LEADING ZERO'S
007744  000004  011111  .STAT:   TYPE,   FORTAN
007750  004767  000072          JSR     7,      $TYPE   ;TYPE A FLOATING POINT NUMBER
007754  105767  001226  NOHEAD: TSTB    WORDS
007760  001425                          BEQ     NHEAD
007762  000004  011076                  TYPE,   SPACE+2
007766  016705  171056                  MOV     $FPS,TTY        ;TYPE $FPS IN OCTAL
007772  004767  000406                  JSR     %7,PRINTR       ;TYPE LEADING ZERO'S
007776  105767  001204                  TSTB    WORDS
010002  100014                          BPL     NHEAD
010004  000004  011076                  TYPE,   SPACE+2
010010  016705  171036                  MOV     $FEC,TTY        ;TYPE $FEC IN OCTAL
010014  004767  000364                  JSR     %7,PRINTR       ;TYPE LEADING ZERO'S
010020  000004  011076                  TYPE,   SPACE+2
010024  016705  171024                  MOV     $FPC,TTY        ;TYPE $FPC IN OCTAL
010030  004767  000350                  JSR     %7,PRINTR       ;TYPE LEADING ZERO'S
010034  005737  177570  NHEAD:  TST     @#$WR
010040  100001                          BPL     .+4
010042  000000                          HALT
010044  000002                          RTI
```

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010046  032767  001000  167514  $TYPE:  BIT     #1000,  SWR     ;CHECK TTY FORMAT
010054  001007                  BNE     TYPEI
010056  105767  170766          TSTB    $FPS
010062  100432                  BMI     TYPED
010064  004767  000076          JSR     7,      TYPEF
010070  022323          TYPEA:  CMP     (3)+,   (3)+    ;UP DATE THE TYPEOUT POINTER
010072  000207                  RTS     7

010074                  TYPEI:
010074  012305                  MOV     (3)+,TTY        ;TYPE (3)+ IN OCTAL
010076  004767  000302          JSR     %7,PRINTR       ;TYPE LEADING ZERO'S
010102  000004  011100          TYPE,   SPACE+4
010106  012305                  MOV     (3)+,TTY        ;TYPE (3)+ IN OCTAL
010110  004767  000270          JSR     %7,PRINTR       ;TYPE LEADING ZERO'S
010114  105767  170730          TSTB    $FPS
010120  100363                  BPL     TYPEA
010122  000004  011100          TYPE,   SPACE+4
010126  012305                  MOV     (3)+,TTY        ;TYPE (3)+ IN OCTAL
010130  004767  000250          JSR     %7,PRINTR       ;TYPE LEADING ZERO'S
010134  000004  011100          TYPE,   SPACE+4
010140  012305                  MOV     (3)+,TTY        ;TYPE (3)+ IN OCTAL
010142  004767  000236          JSR     %7,PRINTR       ;TYPE LEADING ZERO'S
010146  000207                  RTS     7

010150  012346          TYPED:  MOV     (3)+,-(6)       ;GET WORD 1
010152  012346                  MOV     (3)+,-(6)       ;GET WORD 2
010154  012346                  MOV     (3)+,-(6)       ;GET WORD 3
010156  012346                  MOV     (3)+,-(6)       ;GET WORD 4
010160  012746  000022          MOV     #18.,-(6)       ;CHAR COUNT
010164  000406                  BR      TYPEI
010166  012346          TYPEF:  MOV     (3)+,-(6)       ;GET WORD 1
010170  012346                  MOV     (3)+,-(6)       ;GET WORD 2
010172  005046                  CLR     -(6)            ;CLEAR WORD 3
010174  005046                  CLR     -(6)
010176  012746  000010          MOV     #8.,-(6)        ;CHAR COUNT
010202  004767  000104  TYPE1:  JSR     7,TY1           ;TYPE 1 BIT
010206  105766  000011          TSTB    9.(6)           ;CHECK EXPONENT
010212  001001                  BNE     .+4             ;BRANCH ON NON-ZERO EXPONENT
010214  005116                  COM     (6)             ;FLAG ZERO EXPONENT
010216  000004  011100          TYPE,   SPACE+4
010222  004767  000072          JSR     7,TY2           ;TYPE 2 BITS
010226  004767  000074          JSR     7,TY3           ;TYPE 3 BITS
010232  004767  000070          JSR     7,TY3           ;TYPE 3 BITS
010236  000004  011100          TYPE,   SPACE+4
010242  004767  000020          JSR     7,TYH           ;TYPE 2 BITS
010246  004767  000054  TYPE2:  JSR     7,TY3           ;TYPE 3 BITS
010252  005316                  DEC     (6)             ;DONE?
010254  001374                  BNE     TYPE2
010256  022626                  CMP     (6)+,(6)+       ;RESTORE
010260  022626                  CMP     (6)+,(6)+       ;  THE
010262  005726                  TST     (6)+            ; STACK
010264  000207                  RTS     7
```

```
010266  005766  000002          TYH:    TST     2(6)            ;CHECK FOR ZERO EXPONENT FLAG
010272  100405                          BMI     TYZ             ;BRANCH ON ZERO EXPONENT
010274  012746  000001                  MOV     #1,-(6)         ;TYPE HIDDEN BIT AND ONE
010300  011667  000672                  MOV     (6),.TYPE       ;FUDGE HIDDEN BIT
010304  000414                          BR      TY+4
010306  005166  000002          TYZ:    COM     2(6)            ;GET RID OF ZERO EXPONENT FLAG
010312  012746  000001          TY1:    MOV     #1,-(6)         ;TYPE 1 BIT
010316  000405                          BR      TY
010320  012746  000002          TY2:    MOV     #2,-(6)         ;TYPE 2 BITS
010324  000402                          BR      TY
010326  012746  000003          TY3:    MOV     #3,-(6)         ;TYPE 3 BITS
010332  005067  000640          TY:     CLR     .TYPE
010336  006166  000006                  ROL     6(6)            ;SHIFT WORD 4
010342  006166  000010                  ROL     8.(6)           ;SHIFT WORD 3
010346  006166  000012                  ROL     10.(6)          ;SHIFT WORD 2
010352  006166  000014                  ROL     12.(6)          ;SHIFT WORD 1
010356  006167  000614                  ROL     .TYPE           ;GET IT
010362  005316                          DEC     (6)             ;DONE?
010364  001364                          BNE     TY+4
010366  052767  000060  000602          BIS     #'0,.TYPE       ;MAKE IT ASCII
010374  000004  011176                  TYPE,   .TYPE           ;TYPE IT
010400  005726                          TST     (6)+            ;RESTORE THE STACK
010402  000207                          RTS     7
```

```
010404  112767  000001  000130  PRINTR: MOVB    #1,.PR          ;SET ZERO FILL SWITCH
010412  000402                  BR      .+6
010414  005067  000122          PRINTS: CLR     .PR             ;SUPRESS LEADING ZERO'S
010420  112767  177772  000115          MOVB    #-6,.PR+1       ;SET COUNT
010426  010446                  MOV     R4,-(6)         ;SAVE R4
010430  012704  010532                  MOV     #3$,R4          ;SET POINTER TO FIRST ASCII CHAR.
010434  105014                  CLRB    (4)             ;CLEAR FIRST BYTE
010436  000405                  BR      2$              ;ROTATE FIRST BIT
010440  105014          1$:     CLRB    (4)             ;CLEAR BYTE OF CHARACTER
010442  006105                  ROL     TTY             ;ROTATE BIT INTO C
010444  106114                  ROLB    (4)             ;PACK IT
010446  006105                  ROL     TTY             ;ROTATE BIT INTO C
010450  106114                  ROLB    (4)             ;PACK IT
010452  006105          2$:     ROL     TTY             ;ROTATE BIT INTO C
010454  106114                  ROLB    (4)             ;PACK IT
010456  105714                  TSTB    (4)
010460  001402                  BEQ     .+6
010462  105267  000054          INCB    .PR
010466  105767  000050          TSTB    .PR             ;CHECK FILL SWITCH
010472  001402                  BEQ     .+6
010474  152724  000060          BISB    #'0,(4)+        ;MAKE INTO ASCII CHAR
010500  105267  000037          INCB    .PR+1
010504  001355                  BNE     1$              ;REPEAT
010506  022704  010532          CMP     #3$,R4
010512  001002                  BNE     .+6
010514  112724  000060          MOVB    #'0,(4)+
010520  105014                  CLRB    (4)
010522  000004  010532          TYPE    ,3$             ;TYPE IT
010526  012604                  MOV     (6)+,R4         ;RESTORE R4
010530  000207                  RTS     PC

010532  000004          3$:     .BLKW   4
010542  000000          .PR:    0

010544  005267  000434  ERROR:  INC     ERRORS          ;COUNT ERRORS
010550  132737  000001  000041  BITB    #1,@#41         ;AUTO MODE?
010556  001412                  BEQ     1$              ;NO!
010560  022767  000010  000416  CMP     #10.,ERRORS     ;TOO MANY?
010566  001006                  BNE     1$              ;NOT YET
010570  013700  000042          MOV     @#42,R0         ;GET ADDRESS
010574  001403                  BEQ     1$              ;FORGET IT IF ZERO
010576  005037  000042          CLR     @#42            ;ZAP 42
010602  004710                  JSR     PC,(0)          ;CALL THE MONITOR
010604  000207          1$:     RTS     PC              ;RETURN
```

```
010606  012777  011002  000356  POWDWN: MOV     #ILLUP,@UPVEC   ;SET FOR FAST UP
010614  012777  000340  000352          MOV     #340,@UPVEC+2   ;PRIO:7
010622  170246                          STFPS   -(6)            ;GET THE FPS
010624  170011                          SETD
010626  174046                          STD     AC0,-(6)        ;SAVE AC'S
010630  174146                          STD     AC1,-(6)
010632  174246                          STD     AC2,-(6)
010634  174346                          STD     AC3,-(6)
010636  172404                          LDD     AC4,AC0
010640  174046                          STD     AC0,-(6)
010642  172405                          LDD     AC5,AC0
010644  174046                          STD     AC0,-(6)
010646  010046                          MOV     R0,-(6)         ;SAVE REGISTERS
010650  010146                          MOV     R1,-(6)
010652  010246                          MOV     R2,-(6)
010654  010346                          MOV     R3,-(6)
010656  010446                          MOV     R4,-(6)
010660  010546                          MOV     R5,-(6)
010662  010667  000264                  MOV     SP,SAVE6        ;SAVE SP
010666  012777  010676  000276          MOV     #POWUP,@UPVEC   ;SET UP VECTOR
010674  000000                          HALT

010676  016706  000250          POWUP:  MOV     SAVE6,SP        ;GET SP
010702  005001                  1$:     CLR     R1              ;WAIT LOOP FOR THE TT:
010704  005201                          INC     R1
010706  001376                          BNE     1$
010710  012605                          MOV     (6)+,R5         ;GET THE REGISTERS
010712  012604                          MOV     (6)+,R4
010714  012603                          MOV     (6)+,R3
010716  012602                          MOV     (6)+,R2
010720  012601                          MOV     (6)+,R1
010722  012600                          MOV     (6)+,R0
010724  170011                          SETD
010726  172426                          LDD     (6)+,AC0        ;RESTORE THE AC'S
010730  174005                          STD     AC0,AC5
010732  172426                          LDD     (6)+,AC0
010734  174004                          STD     AC0,AC4
010736  172726                          LDD     (6)+,AC3
010740  172626                          LDD     (6)+,AC2
010742  172526                          LDD     (6)+,AC1
010744  172426                          LDD     (6)+,AC0
010746  170126                          LDFPS   (6)+            ;RESTORE FPS
010750  012777  010606  000210          MOV     #POWDWN,@DWNVEC ;SET UP THE POWER DOWN VECTOR
010756  012777  000340  000204          MOV     #340,@DWNVEC+2
010764  000004  010770                  TYPE,   .+2             ;.ASCIZ <15><12>"POWER"
011000  000002                          RTI

011002  000000          ILLUP:  HALT                    ;THE POWER UP SEQUENCE WAS STARTED
011004  000777                  BR      .-2             ; BEFORE THE POWER DOWN WAS COMPLETE
```

```
011006  010546                  .IOT:   MOV     TTY,-(6)        ;SAVE TTY
011010  017605  000002                  MOV     @2(6),TTY       ;GET ADDRESS TO BE TYPED
011014  105715                  1$:     TSTB    (TTY)           ;TERMINATOR?
011016  001406                          BEQ     2$
011020  112537  177566                  MOVB    (TTY)+,@#177566 ;LOAD AND TYPE THE CHARACTER
011024  105737  177564                  TSTB    @#177564        ;IS THE PRINTER READY
011030  100375                          BPL     .-4
011032  000770                          BR      1$              ;GET THE NEXT CHARACTER
011034  017646  000002          2$:     MOV     @2(6),-(6)      ;GET ADDRESS TO BE TYPED
011040  062766  000002  000004          ADD     #2,4(6)         ;ADD 2 TO THE ADDRESS
011046  022666  000002                  CMP     (6)+,2(6)       ;IS IT .+2?
011052  001006                          BNE     3$              ;NO
011054  062705  000002                  ADD     #2,TTY          ;ADD 2 TO THE ADDRESS
011060  042705  000001                  BIC     #1,TTY          ;BACK UP TO AN EVEN BYTE
011064  010566  000002                  MOV     TTY,2(6)        ;RESTORE ADDRESS
011070  012605                  3$:     MOV     (6)+,TTY        ;RESTORE TTY
011072  000002                          RTI                     ;RETURN

011074  005015  020040  000040  SPACE:  .ASCIZ  <15><12>"   "
011102  005015     000  RET:    .ASCIZ  <15><12>
011105     040  020057     000  $SIGN:  .ASCIZ  " / "
011111     015  020012  043040  FORTAN: .ASCIZ  <15><12>"  FORTRAN:  "
011116  051117  051124  047101
011124  020072  000040
011130  036440  005015  020040  FPUAN:  .ASCIZ  " ="<15><12>"  FPU:      "
011136  050106  035125  020040
011144  020040  020040     000
                011152          .EVEN
011152  000000          SAVE6:  0
011154  177564          TPS:    177564          ;TELEPRINTER STATUS REGISTER
011156  177566          TPB:    177566          ;TELEPRINTER DATA BUFFER
011160  172160          FPTADR: 172160          ;FLOATING POINT ADDRESS ON THE 11 20
011162  000244  000246  FPVECT: 244,246         ;FLOATING POINT VECTOR ADDRESS
011166  000024  000026  DWNVEC: 24,26           ;POWER DOWN VECTOR ADDRESS
011172  000024  000026  UPVEC:  24,26           ;POWER UP VECTOR ADDRESS
011176  000000          .TYPE:  0
011200  000000          TRPB:   0
011202  000000          LAD:    0               ;LOOP ADDRESS
011204  000000          ERRORS: 0               ;ERROR COUNT
011206  000000          WORDS:  0               ;CONTAINS TYPEOUT INFO
011210  000377          TIMES:  377             ;ITERATION COUNT
                000001          .END
```

```
ACO     =%000000   371#  478*  486   551*  559   626*  634   701*  709   778*  786   855*  863
                   938*  946   1018* 1026  1102* 1110  1177* 1185  1254* 1262  1334* 1342  1410
                   1894* 1895  1896* 1897  1919* 1920  1921* 1922  1926*
AC1     =%000001   372#  479*  487   552*  560   627*  635   702*  710   779*  787   857*  865
                   939*  947   1019* 1027  1103* 1111  1178* 1186  1255* 1263  1335* 1343  1411
                   1905*
AC2     =%000002   373#  486*  487*  493   513   517   523   559*  560*  566   586   593   597
                   634*  635*  641   663   667   673   709*  710*  716   738   742   750   754*
                   787*  793   813   817   828   864*  865*  871   891   895   910   946*  947*
                   953   975   979   990   1026* 1027* 1033  1055  1059  1074  1110* 1111* 1117
                   1139  1143  1149  1185* 1186* 1192  1214  1218  1226  1262* 1263* 1269  1281
                   1295  1306  1342* 1343* 1349  1371  1375  1390  1718  1892  1924*
AC3     =%000003   374#  480*  513   520   553*  586   595   628*  663   670   703*  738   747
                   780*  813   820   825   858*  891   900   907   940*  975   982   987   1020*
                   1055  1064  1071  1104* 1139  1146  1179* 1214  1223  1256* 1291  1298  1303
                   1336* 1371  1380  1387  1893  1923*
AC4     =%000004   375#  1894  1922*
AC5     =%000005   376#  1896  1920*
ANS1      001022   413#  493*  517*  518*  519*  520   523*  566*  590*  591*  592*  593*  594*
                   595   598*  641*  667*  668*  669*  670   673*  716*  742*  743*  744*  745*
                   746*  747   750*  793*  817*  818*  819*  820   823*  824*  825   828*  871*
                   895*  896*  897*  898*  899*  900   903*  904*  905*  906*  907   910*  953*
                   979*  980*  981*  982   985*  986*  987   990*  1033* 1059* 1060* 1061* 1062*
                   1063* 1064  1067* 1068* 1069* 1070* 1071  1074* 1117* 1143* 1144* 1145* 1146
                   1149* 1192* 1218* 1219* 1220* 1221* 1222* 1223  1226* 1269* 1295* 1296* 1297*
                   1298  1301* 1302* 1303  1306* 1349* 1375* 1376* 1377* 1378* 1379* 1380  1383*
                   1384* 1385* 1386* 1387  1390* 1718*
ANS2      001032   418#  480   553   628   703   780   859   940   1020  1104  1179  1255  1335
                   1460* 1461* 1464* 1465* 1466* 1467*
BEG       001056   399   430#
BEGIN     001112   434   439#
BELL    = 000207   393#  1388  1713
DISPLA  = 177570   387#  1436* 1440*
DONE      006032   1396#
DUMMY   = 000000   388#  403   404   405   406   408   409   410   411   413   414   415   416
                   418   419   420   421
DWNVEC    011166   442*  443*  1928* 1929* 1969#
ERNO1     001506   495   501   506   511   515   522   526#
ERNO10    004330   1035  1041  1046  1049  1051  1054  1057  1066  1073  1077#
ERNO11    004630   1115  1125  1130  1135  1138  1141  1148  1152#
ERNO12    005140   1194  1200  1206  1210  1213  1216  1222  1232#
ERNO13    005462   1271  1277  1282  1287  1290  1293  1300  1305  1309#
ERNO14    006024   1351  1357  1362  1367  1370  1373  1382  1389  1393#
ERNO2     002004   566   574   577   588   597   601#
ERNO3     002304   644   649   654   663   670   672   676#
ERNO4     002610   718   724   729   734   737   740   749   753#
ERNO5     003120   790   801   806   811   815   820   827   831#
ERNO6     003450   873   879   885   889   893   900   907   913#
ERNO7     003770   955   961   966   971   974   977   984   989   993#
ERROR     010544   1875#
ERRORS    011204   1715* 1875* 1878  1974#
ERR1      007244   1621  1625  1627#
ERR1.1    001376   480   497#
ERR10     004146   1020  1037#
ERR11     004506   1114  1121#
ERR12     005066   1189  1196#
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ERR13   005316          1266    1273#
ERR14   005640          1346    1353#
ERR2    001664           562     570#
ERR3    002162           637     645#
ERR4    002460           712     720#
ERR5    002766           789     797#
ERR6    003276           867     875#
ERR7    003626           949     957#
FEC     001044           424#    466*    503     539*    576     614*    651     689*    726     766*    803     844*    881
                         926*    963     1006*   1043    1090*   1121*   1127    1165*   1196*   1202    1242*   1273*   1279
                        1322*   1353*   1359    1617*   1739
F.TERR  007210           450    1616#
FORTAN  011111          1744    1957#
FPC     001046           425#    467*    508     540*    581     615*    656     690*    731     767*    808     845*    886
                         927*    968     1007*   1048    1091*   1132    1166*   1207    1243*   1284    1323*   1364    1745
FPS     001042           423#    455*    490*    491     498     526*    538*    563*    564     571     601*    613*    630*
                         639     646     676*    688*    713*    714     721     753*    765*    790*    791     798     803*
                         843*    868*    869     876     913*    925*    950*    951     958     993*    1005*   1030*   1031*
                        1038    1077*   1089*   1112*   1115    1122    1152*   1164*   1187*   1190    1237    1229*   1241*
                        1264*   1267    1274    1309*   1321*   1344*   1347    1364    1393*   1618*   1734
FPTADR  011160           436    1967#
FPUAN   011130          1731    1960#
FPVECT  011162           450*    451*   1968#
MINUM   001012           408#    479     552     627     702     779     857     939     1019    1103    1178    1255    1335
                        1454    1455    1456    1457    1476    1636    1677
HLT   = 104000           391#    494     500     505     510     524     567     573     578     583     599     642     648
                         653     658     674     717     723     728     733     751     794     800     805     810     829
                         872     878     883     888     911     954     960     965     970     981     1034    1040    1045
                        1050    1075    1118    1124    1129    1134    1150    1193    1199    1204    1209    1227    1270
                        1276    1281    1286    1307    1350    1356    1361    1366    1391    1620    1625
ICNT    001000           402#    452*    1421    1429    1431    1433*   1434*   1436    1439*   1440    1480    1494
ILLUP   011002          1886    1933#
KTI     006252          1426    1432    1439#
LAD     011202           453*    482*    555*    630*    705*    782*    860*    942*    1022*   1106*   1181*   1258*   1338*
                        1435*   1441    1443    1973#
LONUM   001002           403#    478     551     626     701     778     856     939     1013    1103    1177    1254    1334
                        1448    1449    1450    1451    1483    1484    1487    1488    1635    1660    1676    1701    1727
M1120   001104           431     436#
NHEAD   010034          1717    1747    1752    1759#
NOHEAD  007754          1746#
NOP   = 000240           389#
OVER    006256          1422    1440#
PC    =%000007           370#    468*    541*    616*    691*    768*    846*    928*    1008*   1092*   1167*   1244*   1324*
                        1870*   1883*   1884*
POWDWN  010606           442    1886#   1928
POWUP   010676          1905    1908#
PRINTR  010404          1725    1735    1740    1743    1750    1755    1758    1774    1777    1782    1795    1841#
PRINTS  010414          1843#
PS    = 177776           386#   1593
RANDM2  007246           468     616     768     928    1092    1244    1629#
RANDM4  007404           541     691     846    1008    1167    1324    1670#
REPET2  007276          1639#   1661
REPET4  007434          1680#   1702
RET     011102          1719    1720    1955#
RETAD   006574          1482    1497    1905#
RET1    001342           487#   1605
```

```
RET10   004112          1027#   1512
RET11   004452          1111#   1513
RET12   004752          1186#   1514
RET13   005262          1263#   1515
RET14   005604          1343#   1516
RET2    001630           560#   1506
RET3    002126           635#   1507
RET4    002424           710#   1508
RET5    002732           787#   1509
RET6    003242           865#   1510
RET7    003572           947#   1511
R0      =%000000         362#    445*    476*    549*    624*    699*    776*    854*    936*   1016*   1100*   1175*   1252*
                        1332*   1410*   1518    1520    1522    1524    1526    1528    1880*   1898    1917*
R1      =%000001         363#   1480*   1481*   1482    1494*   1495*   1496*   1899    1909*   1910*   1916*
R2      =%000002         364#   1900    1915*
R3      =%000003         365#   1423*   1901    1914*
R4      =%000004         366#    469*    542*    617*    692*    769*    847*    929*   1009*   1093*   1168*   1245*   1325*
                        1446    1452    1458    1462*   1468*   1492    1502    1503*   1534*   1546*   1558*   1563*   1584
                        1587    1590    1596    1598*   1604*   1845    1846*   1864    1869*   1902    1913*
R5      =%000005         367#   1903    1912*
SAVE6   011152          1904*   1908    1964#
SAVLAD  006232          1428    1434#   1442
SCOPE = 104400           390#    461     527     602     677     754     832     914     994    1078    1153    1230    1310
                        1394
SHIFT2  007304          1641#   1645
SHIFT4  007442          1682#   1686
SP      =%000006         369#    430*    440*   1448*   1449*   1450*   1451*   1454*   1455*   1456*   1457*   1460    1461
                        1464    1465    1466    1467    1483*   1484*   1487*   1488*   1489    1498    1501    1583*   1586*
                        1589*   1592*   1595*   1904    1908*
SPACE   011074          1726    1733    1738    1741    1748    1753    1756    1775    1780    1783    1803    1807    1954#
SWR   = 177570           385#    387    1396    1401    1419    1421    1423    1425    1427    1711    1716    1759    1764
SW08  = 000400           377#   1419
SW09  = 001000           378#
SW10  = 002000           379#   1396
SW11  = 004000           380#   1427
SW12  = 010000           381#   1401
SW13  = 020000           382#
SW14  = 040000           383#   1425
SW15  = 100000           384#
TIMES   011210          1431    1976#
TPB     011156          1966#
TPS     011154          1965#
TRPB    011200          1403*   1972#
TST1    001444           492     509     513#
TST10   004214          1032    1053#
TST11   004556          1116    1133    1137#
TST12   005056          1191    1208    1212#
TST13   005366          1268    1285    1289#
TST14   005710          1348    1365    1369#
TST2    001732           565     582     586#
TST3    002230           640     657     661#
TST4    002526           715     732     736#
TST5    003034           792     809     813#
TST6    003344           870     887     891#
TST7    003674           952     969     973#
TTY     =%000005         368#   1724*   1734*   1739*   1742*   1749*   1754*   1757*   1773*   1776*   1781*   1794*   1850*
```

```
                    1852*  1854*  1936   1937*  1938   1940   1948*  1949*  1950   1951*
TY          010332  1821   1824   1826   1828*  1835
TYH         010266  1808   1817*
TYPE    =   000004   392*  1399   1714   1719   1720   1726   1729   1731   1733   1738   1741   1744   1748
                    1753   1756   1775   1780   1783   1803   1807   1837   1868   1930
TYPEA       010070  1769*  1779
TYPED       010150  1767   1788*
TYPEF       010166  1768   1794*
TYPEI       010074  1765   1772*
TYPEI       010202  1793   1799*
TYPER2      010246  1809*  1811
TYS         010306  1818   1822*
TYT         010312  1799   1823*
TYZ         010320  1804   1825*
TYZ         010326  1805   1806   1809   1827*
UPVEC       011172  1886*  1897*  1905*  1970*
WORDS       011206  1723*  1736   1746   1751   1975*
YESRT       006136   433*   441   1417*
$AD200      007114  1561   1571   1589*
$DVBZA      007172  1602   1608*
$DVBZO      007144  1527   1598*
$DVBZI      007160  1529   1604*
$DVD    =   ******  G       314*   545    695    850   1012   1171   1328   1550   1572
$DVR    =   ******  G       314*   472    620    772    932   1096   1248   1538   1562
$ERRA       006624  G       314*  1518*
$ERTS       007076          1533   1545   1581*
$FEC        001052           427*   463*   503    536*   576    611*   651    686*   726    763*   803    841*   881
                             923*   963   1003*  1043   1087*  1127   1162*  1202   1239*  1279   1319*  1359   1479*
                            1555*  1579*  1609*  1754
$FPC        001054           428*   464*   508    537*   581    612*   656    687*   731    764*   808    842*   886
                             924*   968   1004*  1048   1088*  1132   1163*  1207   1240*  1284   1320*  1364   1482*
                            1497*  1757
$FPS        001050           426*   462*   476    488    491    498    535*   549    561    564    571    610*   624
                             636    639    646    661    685*   699    711    714    721    736    762*   775    788
                             791    798    840*   854    866    869    876    922*   936    948    951    958    973
                            1002*  1016   1028   1031   1038   1053   1086*  1100   1113   1115   1122   1137   1161*
                            1175   1188   1190   1197   1212   1238*  1252   1265   1267   1274   1289   1318*  1332
                            1345   1347   1354   1369   1470   1475*  1478*  1485   1491*  1499   1532   1544   1554*
                            1576   1578*  1580*  1608*  1618   1623   1749   1766   1779
$OVERA      007044          1566   1576*
$OVERO      006776          1523   1553*
$OVERI      007022          1525   1568*
$OVRI       007070          1577   1580*
$POLSH      006300           469    542    617    692    769    847    929   1009   1093   1168   1245   1325   1446*
                            1534   1546   1558   1568   1598   1604
$POP2X      006346           474    622    774    934   1098   1250   1460*  1541   1565   1601
$POP4X      006360           547    697    852   1014   1173   1330   1464*  1563   1575   1607
$PP.2A      006312           470    618    770    930   1094   1246   1450*  1535   1559   1599
$PP.2B      006334           471    619    771    931   1095   1247   1456*  1536   1560
$PP.4A      006302           543    693    848   1010   1169   1326   1448*  1547   1569   1605
$PP.4B      006324           544    694    849   1011   1170   1327   1454*  1548   1570
$SB200      007100          1537   1549   1583*
$SIGN       011105          1729   1956*
$TEMP       006540          1471   1494*
$TOV        006556          1472   1498*
$TOV1       006570          1500   1502*
```

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$TST    006402          473     546     621     696     773     851     933    1013    1097    1172    1249    1329    1470#
                       1540    1552    1564    1574    1600    1606
$TST1   006524          1474    1477    1486    1489#
$TST2   006536          1490    1492#
$TYPE   010046          1728    1730    1732    1745    1764#
$UNDRA  006760          1542    1554#
$UNDRO  006672          1519    1532#
$UNDR1  006726          1521    1544#
$UNKER  006670          1530#
$ZDOAD  007106          1563    1573    1586#
$ZDOSB  007122          1539    1551    1592#
$ZDISB  007142          1594    1596#
.       = 011212         395#    396     397#    401#    482     499     504     555     572     577     630     647     655
                         705     722     727     782     799     804     860     877     882     942     959     964    1020
                        1039    1044    1106    1123    1128    1181    1198    1203    1260    1275    1280    1338    1355
                        1360    1619    1760    1801    1842    1857    1860    1865    1872#   1930    1934    1942    1953#
.EMT    006140          1418    1419#
.ET     007564          1712    1715#
.IOT    011006          1434    1936#
.PR     010542          1841*   1843*   1844*   1858*   1859    1862*   1873#
.STAT   007744          1737    1744#
.TRP    007542          1436    1711#
.TYPE   011176          1398*   1399    1713*   1714    1820*   1828*   1833*   1836*   1837    1971#
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PRINT	361#	1930										
SDUMP	361#											
STATUS	361#											
TYPEM	361#	1398	1713									

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ADC      819   897   898   899   981  1061  1062  1063  1297  1377  1378  1379  1647  1649  1651
        1652  1654  1657  1688  1690  1692  1693  1695  1698
ADD      818   896   980  1060  1296  1376  1586  1589  1595  1646  1648  1650  1653  1655  1656
        1687  1689  1691  1694  1696  1697  1945  1948
ASL     1481  1496  1641  1682
BEQ      492   499   504   509   515   522   565   572   577   582   588   597   640   647   652
         657   665   672   715   722   727   732   740   749   792   799   804   809   815   822
         827   870   877   882   887   893   902   909   952   959   964   969   977   984   989
        1032  1039  1044  1049  1057  1066  1073  1116  1123  1128  1133  1141  1148  1191  1198
        1203  1208  1216  1225  1268  1275  1280  1285  1293  1300  1305  1348  1355  1360  1365
        1373  1382  1389  1411  1420  1422  1430  1442  1519  1521  1523  1525  1527  1529  1533
        1545  1577  1594  1619  1712  1747  1857  1860  1877  1881  1939
BIC     1949
BICB    1405  1475  1478  1491  1554  1578  1580  1608  1836
BISB    1861
BIT      661   736   973  1053  1137  1212  1289  1369  1396  1401  1419  1425  1427  1470  1473
        1476  1532  1544  1576  1593  1618  1711  1716  1764
BITB    1876
BMI      489   562   637   712   789   867   949  1029  1114  1189  1266  1346  1471  1624  1767
        1818
BNE      662   737   974  1054  1138  1213  1290  1370  1397  1402  1426  1428  1432  1472  1474
        1477  1645  1661  1686  1702  1717  1765  1801  1811  1835  1863  1865  1879  1911  1947
BPL     1404  1486  1490  1500  1737  1752  1760  1779  1942
BR       434   495   501   506   511   568   574   579   584   643   649   654   659   718   724
         729   734   795   801   806   811   873   879   884   889   955   961   966   971  1035
        1041  1046  1051  1119  1125  1130  1135  1194  1200  1205  1210  1271  1277  1282  1287
        1351  1357  1362  1367  1542  1566  1602  1621  1793  1821  1824  1926  1842  1848  1934
        1943
CFCC     497   514   521   570   587   596   645   664   671   720   739   748   797   814   821
         826   875   892   901   908   957   976   983   988  1037  1056  1065  1072  1140  1147
        1215  1224  1292  1299  1304  1372  1381  1388
CLR      452   453   463   464   465   466   467   526   536   537   538   539   540   601   611
         612   613   614   615   676   686   687   688   689   690   753   763   764   765   766
         767   831   841   842   843   844   845   913   923   924   925   926   927   993  1003
        1004  1005  1006  1007  1077  1087  1088  1089  1090  1091  1152  1162  1163  1164  1165
        1166  1229  1239  1240  1241  1242  1243  1309  1319  1320  1321  1322  1323  1393  1400
        1640  1681  1796  1797  1828  1843  1882  1909
CLRB    1847  1849  1867
CMP      491   498   503   508   564   571   576   581   639   646   651   656   714   721   726
         731   791   798   803   808   869   876   881   886   951   958   963   968  1031  1038
        1043  1048  1115  1122  1127  1132  1190  1197  1202  1207  1267  1274  1279  1284  1347
        1354  1359  1364  1498  1501  1518  1520  1522  1524  1526  1528  1660  1701  1769  1812
        1813  1864  1878  1946
CMPB    1421  1431
CMPD     586   595   738   747   891   900   907  1055  1064  1071  1214  1223  1371  1380  1387
CMPF     513   520   663   670   813   820   825   975   982   987  1139  1146  1291  1298  1303
COM     1403  1802  1822
DEC     1495  1810  1834
DIVD     560   710   865  1027  1186  1343
DIVF     487   635   787   947  1111  1263
EMT      391
HALT     388   396  1530  1761  1906  1933
INC     1644  1685  1715  1875  1910
INCB    1434  1439  1858  1862
IOT      392
JMP      395  1416  1446  1452  1458  1492  1584  1587  1590  1596
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JSR      468  469  541  542  616  617  691  692  768  769  846  847  928  929 1008
        1009 1092 1093 1167 1168 1244 1245 1324 1325 1412 1534 1546 1558 1568 1598
        1604 1725 1728 1730 1732 1735 1740 1743 1745 1750 1755 1758 1768 1774 1777
        1782 1785 1799 1804 1805 1806 1808 1809 1883
LDD      551  552  553  559  701  702  703  709  856  857  858  864 1018 1019 1020
        1026 1177 1178 1179 1185 1334 1335 1336 1342 1894 1896 1919 1921 1923 1924
        1925 1926
LDF      478  479  480  486  626  627  628  634  778  779  780  786  938  939  940
         946 1102 1103 1104 1110 1254 1255 1256 1262
LDFPS    477  481  550  554  625  629  700  704  777  781  855  859  937  941 1017
        1021 1101 1105 1176 1180 1253 1257 1333 1337 1927
LDUB    1424
MOV      430  431  433  436  439  440  441  442  443  444  445  446  447  448  449
         450  451  462  476  482  535  549  555  610  624  630  685  699  705  762
         776  782  840  854  860  922  936  942 1002 1016 1022 1086 1100 1106 1161
        1175 1181 1238 1252 1258 1318 1332 1338 1398 1406 1408 1410 1435 1436 1440
        1443 1448 1449 1450 1451 1454 1455 1456 1457 1460 1461 1464 1465 1466 1467
        1479 1482 1483 1484 1487 1488 1497 1555 1579 1609 1629 1630 1631 1632 1633
        1634 1635 1636 1637 1638 1639 1658 1659 1662 1663 1664 1665 1666 1667 1670
        1671 1672 1673 1674 1675 1676 1677 1678 1679 1680 1699 1700 1703 1704 1705
        1706 1707 1708 1713 1721 1724 1727 1734 1739 1742 1749 1754 1757 1773 1776
        1781 1784 1788 1789 1790 1791 1792 1794 1795 1798 1819 1820 1823 1825 1827
        1845 1846 1869 1880 1886 1887 1898 1899 1900 1901 1902 1903 1904 1905 1908
        1912 1913 1914 1915 1916 1917 1928 1929 1936 1937 1944 1950 1951
MOVB    1423 1433 1480 1494 1723 1841 1844 1866 1940
NOP     1413 1414 1415
ROL     1642 1643 1683 1684 1829 1830 1831 1832 1833 1850 1852 1854
ROLB    1851 1853 1855
RTI     1407 1409 1417 1437 1444 1627 1762 1931 1952
RTS     1462 1468 1503 1556 1581 1610 1668 1709 1770 1786 1815 1839 1870 1884
SBC      519  592  593  594  669  744  745  746  824  904  905  906  986 1068 1069
        1070 1145 1220 1221 1222 1302 1384 1385 1386
SETD    1889 1918
STD      566  590  598  716  742  750  871  895  910 1033 1059 1074 1192 1218 1226
        1349 1375 1390 1890 1891 1892 1893 1895 1897 1920 1922
STF      493  517  523  641  667  673  793  817  828  953  979  990 1117 1143 1149
        1269 1295 1306 1718
STFPS    490  563  638  713  790  868  950 1030 1112 1187 1264 1344 1616 1888
STST    1121 1196 1273 1353 1617
SUB      518  591  668  743  823  903  985 1067 1144 1219 1301 1383 1593 1592 1722
TRAP     390
TST      432  488  561  636  711  788  866  948 1028 1113 1188 1265 1345 1441 1489
        1502 1623 1759 1814 1817 1838
TSTB    1429 1485 1499 1736 1746 1751 1766 1778 1800 1856 1859 1938 1941
.ASCIZ  1931 1954 1955 1956 1957 1960
.ASECT   313
.BLKW   1872
.END    1977
.EVEN   1931 1963
.GLOBL   314
.LIST    311  361  396  400  454 1395 1445 1628 1710 1763 1840 1885 1931 1935
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.NLIST   311  361  396  400  454 1395 1445 1628 1710 1763 1840 1885 1931 1935
.PAGE   1154 1259 1311 1395
.REPT      2  396
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DCFPUD.P11 CROSS REFERENCE TABLE -- PERMANENT SYMBOLS

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.TITLE    312

. ABS.  011212     000
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 ERRORS DETECTED:  0
 DEFAULT GLOBALS GENERATED:  0

 *,DCFPUD.SEQ/SOL/CRF/PAGNUM←DCFPUD
 RUN-TIME: 6 12 2 SECONDS
 RUN-TIME RATIO: 130/22=5.9
 CORE USED:  9K  (17 PAGES)
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N04

Spooler runtime 7 Seconds, 33 KCS, 189 disk reads, 3 disk writes, 51 pages