PDP11

POWER FAIL

MD-11-DZKAQ-F

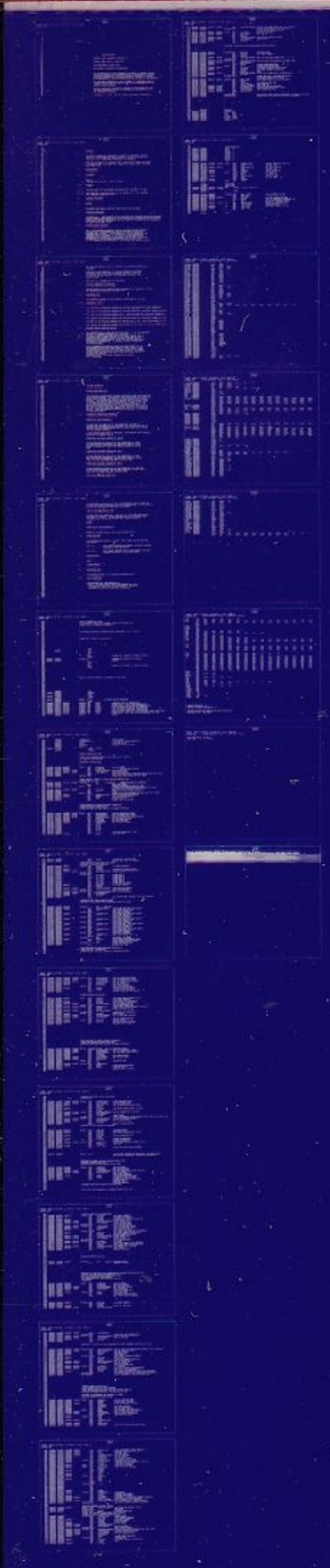
EP-DZKAQ-F-DL-A

FICHE 1 OF 1

NOV 1976

digital

MADE IN US



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                .REM %
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IDENTIFICATION

PRODUCT CODE: MAINDEC-11-DZKAQ-F-D

PRODUCT NAME: PDP-11 POWER FAIL

DATE RELEASED: AUGUST,1976

MAINTAINER: DIAGNOSTIC ENGINEERING

1. ABSTRACT

THE PDP-11 POWER FAIL DIAGNOSTIC CONSIST OF TWO PARTS, ONE OF WHICH IS A EXERCISER TEST WHICH CHECK ALL FACETS OF POWER FAIL. (REF SEC. 5.2) OPERATOR INTERVENTION IS REQUIRED.

PART TWO IS MADE UP OF SEVERAL SMALL TESTS WHICH ENABLE THE USER TO TROUBLE-SHOOT THE POWER FAIL MODULE WITH SMALL BASIC ROUTINES. (REF. SEC. 5.2)

2. REQUIREMENTS

2.1 EQUIPMENT

PDP-11
(MACHINE MAY HAVE UP TO 28K OF MEMORY)

2.2 STORAGE

2.2.1 THE MAIN BODY OF THE PROGRAM OCCUPIES FROM LOCATION 0 TO 3066

2.2.2 THE POWER FAIL EXERCISER USES ALL OF MEMORY UP TO THE LOADERS, FOR A MEMORY VOLATILITY TEST

3. LOADING PROCEDURE

3.1 METHOD

PROCEDURE FOR NORMAL ABSOLUTE TAPES SHOULD BE FOLLOWED.

4. STARTING PROCEDURE

****NOTE**** WHEN RUNNING THIS DIAGNOSTIC THE TERMINAL SHOULD BE POWERED FROM AN UNSWITCHED POWER OUTLET (NOT CONTROLLED BY PROCESSOR ON/OFF SWITCH). POWER FAIL TYPE OUT MESSAGE MAY NOT BE TYPED IF TERMINAL IS NOT POWERED BY AN UNSWITCHED POWER OUTLET.

4.1 CONTROL SWITCH SETTING

**** THIS PROGRAM CONTAINS A SWITCH REGISTER SIZING ROUTINE. AT LOAD TIME, THE PROGRAM WILL BE SET TO OPERATE FROM THE HARDWARE SWR (177570). THE PROGRAM WILL TRY TO REFERENCE THE HARDWARE SWITCH REGISTER. IF A TIMEOUT OCCURS BECAUSE NO HARDWARE SWITCH REGISTER IS AVAILABLE, THE PROGRAM CHANGES ALL REFERENCES TO THE SOFTWARE SWITCH REGISTER AT LOC. 176. IF THE SOFWARE SWITCH REGISTER IS TO BE USED THE OPERATOR SHOULD

SET THE APPROPRIATE VALUE IN LOCATION 176 BEFORE STARTING THE PROGRAM.

SR15 SET ALLOWS OPERATOR TO LOOP ON DIAGNOSTIC ROUTINES. DIAGNOSTIC WILL STILL HALT ON ERROR, BUT WILL NOT HALT AT THE END OF EACH PASS OF THE DIAGNOSTIC ROUTINE, WHEN SWITCH IS SET.

SR14 SET WILL DISABLE ANY TTY PRINTING.

4.2 STARTING ADDRESS OR ADDRESSES

BEFORE STARTING THE OPERATOR SHOULD REFERENCE THE PROGRAM LISTING FOR OPERATOR INSTRUCTIONS FOR EACH TEST.

4.2.1 EXERCISER TEST

THE STARTING ADDRESS OF THE POWERFAIL EXERCISER IS LOC.200.

4.2.2 DIAGNOSTIC TESTS

LOC. 204 IS THE STARTING ADDRESS FOR TESTING THE POWER FAIL TRAP CAPABILITY

LOC. 204 IS THE STARTING ADDRESS FOR TESTING POWER FAIL RE-START CAPABILITY (USI

LOC. 214 IS THE STARTING ADDRESS FOR TESTING POWER FAIL RE-START CAPABILITY (

LOC. 220 IS THE STARTING ADDRESS FOR TESTING POWER FAIL RE-START CAPABILITY (USI

LOC 224 IS THE STARTING ADDRESS FOR TESTING 2MILLI SEC. SHUT DOWN CAPABILITY OF

LOC. 230 IS THE STARTING ADDRESS FOR TESTING 2 MILLI SEC. UP TIME OF POWER FAIL.

4.3 PROGRAM AND/OR OPERATOR ACTION

THE OPERATOR HAS A LARGE PART IN THIS TEST. IT IS HIS RESPONSI-
ABILITY TO GENERATE A POWER FAIL CONDITION.
TO CAUSE A VALID POWER FAILURE ON A SYSTEM, REMOVE THE AC
FROM THE POWER CONTROL PANEL BY EITHER TRIPPING THE AC
BREAKER ON THE POWER BUS BOX, OR BY PULLING THE WALL PLUG,
WHICHEVER IS APPROPRIATE. IN HOUSE, A POWER INTERRUPTER
MAY ALSO BE USED.

NOTE: INTERRUPTING POWER BY USING THE FRONT PANEL KEY OR
THE BREAKER SWITCH ON A POWER SUPPLY IS NOT VALID. THIS
METHOD DEFEATS THE ACTION OF THE LINE FILTER OF THE POWER
CONTROL AND THUS CAN ALLOW NOISE FROM SWITCHING TRANSIENTS
TO ENTER THE SYSTEM.
REFER TO M.A.S.T. FOR MORE INFORMATION ON POWER
FAIL PROCEDURES.

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                        5.      ROUTINE ABSTRACTS
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                        5.1     MASTER EXERCISER TEST
                                ---------------------

                                THIS ROUTINE INCORPORATES A MEMORY VOLATILITY TEST WHILE WAITING
                                FOR A POWER FAILURE.  THE ROUTINE FIRST DETERMINES THE AMOUNT OF
                                MEMORY ON THE SYSTEM AND THEN FILLS THAT MEMORY WITH A 152525
                                PATTERN.  THE ROUTINE THEN CHECKS MEMORY FOR THE CORRECT DATA,
                                IF A POWER FAILURE OCCURS THE ROUTINE WILL STORE ALL OF THE
                                ACTIVE REGISTERS AND WAIT FOR 2 MILLISECONDS AND HALT.  THE
                                ROUTINE ON RESTART RESTORES THE ACTIVE REGISTERS AND WAITS TO
                                SEE THAT NO OTHER POWER FAILURE OCCURS WITHIN A 2 MILLISECOND
                                PERIOD.  WHEN THE ROUTINE EXITS FROM THE RESTORE IT GOES BACK
                                TO CHECKING MEMORY.

                        5.2     DIAGNOSTIC SUBROUTINE ABSTRACTS
                                ------------------------------

                                POWER FAIL TRAP CAPABILITY
                                --------------------------

                                IN THIS TEST THE ABILITY OF THE POWER FAIL TO TRAP TO
                                LOCATION 24 ON POWER DOWN AND POWER UP IS TESTED THE STACK IS
                                CHECKED FOR THE CORRECT VALUE AND THE STACK POINTER IS TESTED
                                FOR THE CORRECT CONTENTS.

                                A HALT OCCURS WHEN POWER IS RESTORED, THE OPERATOR MUST DEPRESS
                                CONTINUE TO COMPLETE TEST.

                                POWER FAIL RE-START CAPABILITY (WAIT)
                                -------------------------------------

                                IN THIS ROUTINE THE ABILITY OF THE POWER FAIL TO TRAP
                                AND STORE ACTIVE REGISTERS AND RESTART CORRECTLY USING
                                A WAIT INSTRUCTION TO WAIT FOR POWER FAILURE IS TESTED
                                HERE

                                POWER FAIL RE-START CAPABILITY (BR.)
                                ------------------------------------

                                IN THIS ROUTINE THE ABILITY OF THE POWER FAIL TO TRAP
                                AND STORE ACTIVE REGISTERS, AND RESTART CORRECTLY USING
                                A BR, TO WAIT FOR POWER FAILURE IS TESTED HERE.

                                POWER FAIL RE-START CAPABILITY (EMT)
                                ------------------------------------

                                IN THIS ROUTINE THE ABILITY OF THE POWER FAIL TO TRAP AND
                                STORE ACTIVE REGISTERS, AND RESTART CORRECTLY USING A EMT TO
                                WAIT FOR THE POWER FAILURE IS TESTED HERE

                                TEST 2 MILLISECONDS DOWN TIME
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IN THIS TEST THE AMOUNT OF TIME THE PROCESSOR HAS TO STORE THE
ACTIVE REGISTERS IS CHECKED THIS TIME SHOULD EQUAL 2 MILLISECONDS
BEFORE ALL PROCESSOR ACTION MUST BE STOPPED.

TEST 2 MILLISECONDS UP TIME

IN THIS TEST THE POWER FAIL LOCK OUT OF 2 MILLISECONDS DURING
RE-START IS CHECKED. DURING RESTORE FOR 2 MILLISECONDS THE
PROCESSOR WILL NOT ALLOW A POWER FAIL TRAP TO OCCUR

6. ERROR

6.1 ERROR HALTS AND DESCRIPTION

REFER TO LISTING FOR ALL HALTS AND DESCRIPTIONS

6.2 ERROR RECOVERY

IN THE EXERCISER MEMORY VOLATILITY TEST THERE ARE TWO RECOVER-
ABLE HALTS.

HALT NO.1. DATA LIGHTS CONTAIN BAD MEMORY LOCATION (DEPRESS
CONTINUE TO TEST SEE DATA)

HALT NO.2. DATA LIGHTS CONTAIN DATA OF BAD MEMORY LOCATION
(DEPRESS CONTINUE TO TEST NEXT WORD)

7. RESTRICTIONS

NONE

8. MISCELLANEOUS

8.1 EXECUTION TIME

THE EXERCISER TEST IS A CONTINUOUS RUNNING TEST.

8.2 ACT11 OPERATION

THIS PROGRAM WILL RUN UNDER ACT11.
**NOTE: IN QUICK VERIFY MODE THE PROGRAM WILL RUN
  BUT DOES NOT CHECK ANY OF THE POWERFAIL CIRCUITRY
  BECAUSE ACT WILL NOT POWER FAIL DURING QV.

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                                ;PDP-11 POWER FAIL TEST
                                ;THIS PROGRAM CONSIST OF SEVERAL TEST THAT INSURE THAT
                                ;POWER FAIL IS OPERATING CORRECTLY.
                                ;
                                ;
                                ;***PROGRAM SUPPORTS SOFTWARE SWITCH REGISTER  [LOC. 176]***
                                ;
                                ;POWER FAIL TRAPS TO LOCATION 24
                                ;
                                ;
                                ;
                                ;
                                        .ABS
        000000                          .=0
                                        .REPT   5
                                        .+2
                                        HALT                    ;POWER FAIL TRAPPED TO WRONG LOCATION
                                        .ENDR
000024  000000                  PFHAND: 0                       ;ADDRESS OF POWER FAIL HANDLER
000026  000000                          0                       ;STATUS
                                        .REPT   72
                                        .+2
                                        HALT                    ;POWER FAIL TRAPPED TO WRONG LOCATION
                                        .ENDR
                                ;
                                ;
                                ;
                                ;400 TO 1000 IN MEMORY IS ASSIGNED TO THE STACK
                                ;
                                ;
                                ;
                                ;
        000046                          .=46
000046  002572                          LOGICAL
        000052                          .=52
000052  140000                          140000
        000176                          .=176
000176  000000                  SWREG:  0                       ;SOFTWARE SWITCH REGISTER
        000200                          .=200
000200  000167  002142          MASTER: JMP     TEST5           ;COMPLETE TEST OF POWER FAIL
000204  000167  000570          START1: JMP     TEST1           ;ENTER TEST 1 (TEST TRAP CAPABILITY)
000210  000167  000654          START2: JMP     TEST2           ;ENTER TEST2 (TEST RE-START CAPABILITY)
000214  000167  001126          STR2A:  JMP     ALTEST          ;TEST RE-START USING BR. INSTRUCTION
000220  000167  001264          STR2B:  JMP     ALTST1          ;TEST RE-START USING EMT INSTRUCTION
000224  000167  001512          START3: JMP     TEST3           ;ENTER TEST3 (TEST FOR 2 MILLISECONDS TIME) DOWN TIME
000230  000167  001702          START4: JMP     TEST4           ;ENTER TEST4 (TEST FOR TWO MILLISECONDS) UP TIME
        000006                  SP=%6                           ;STACK
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                000000                  LIGHTS=%0                       ;DATA LIGHTS
                177776                  STATUS=177776                   ;LOCATION OF STATUS REGISTER
                000007                  PC=%7                           ;LOCATION OF PC
                000030                  EMTRP=30                        ;EMULATOR TRAP LOCATION
                000234                  SWRG=.
000234  177570                                  .WORD   177570
                001000                          .=1000
                                        ;
                                        ;BASIC POWER FAIL TEST
                                        ;
                                        ;TEST1 IS A ROUTINE USED TO THE POWER FAIL'S ABILITY
                                        ;TO TRAP TO LOCATION 24.
                                        ;
                                        ;OPERATOR INSTRUCTIONS
                                        ;
                                        ;
001000  012706  001000          TEST1:  MOV     #1000,SP        ;SET UP STACK
001004  004767  002304                  JSR     PC,SETSWR               ;SET UP SWR POINTER
001010  012767  001026  177006          MOV     #TEST1H,PFHAND  ;SET UP POINTER
001016  052767  000357  176752          BIS     #357,STATUS     ;SET STATUS BITS
001024  000001                          WAIT                    ;WAIT FOR POWER FAIL OPERATOR SHOULD TURN OFF HERE
001026  000000                  TEST1H: HALT                    ;POWER FAIL HALTS HERE ON WAY DOWN
                                        ;
                                        ;TEST1 CHECK - CHECK IF STACK WAS DECREMENTED AND
                                        ;STATUS WAS SET UP.
001030  026727  177740  001026  TEST1CH:        CMP     774,#TEST1H     ;CHECK PC AND SP (LOCATION)
001036  001401                          BEQ     .+4                     ;ARE THEY EQUAL
001040  000000                  HALT1:  HALT                            ;ERROR! PROCESSOR FAILED TO TRAP
                                                                        ;LOCATION 774 SHOULD CONTAIN #TEST1H IN STACK
001042  026727  177730  000357          CMP     776,#357                ;WAS THE STATUS STORED CORRECTLY
001050  001401                          BEQ     .+4                     ;TEST
001052  000000                  HALT2:  HALT                            ;ERROR THE STATUS BEFORE THE TRAP WAS NOT STORED
001054  012700  000210                  MOV     #START2,LIGHTS  ;SET UP LIGHTS WITH ADDRESS
001060  005777  177150                  TST     @SWRG                   ;TEST SWITCH REGISTER
001064  100745                          BMI     TEST1                   ;IS BIT 15 SET
001066  000000                          HALT                            ;NORMAL HALT NO ERRORS
                                        ;
                                        ;TEST ROUTINE TO CHECK RE-START CAPABILITY
                                        ;USING THE WAIT INSTRUCTION
                                        ;OPERATOR MUST SET HALT SWITCH TO ENABLE POSITION
                                        ;
                                        ;
001070  012767  000357  176700  TEST2:  MOV     #357,STATUS     ;SET UP CONDITION CODES
001076  012767  000005  176722          MOV     #5,PFHAND+2     ;SET UP POWER FAIL CODES
001104  012767  001152  176712          MOV     #TEST2A,PFHAND  ;SET UP POINTER TO STORE ROUTINE
001112  012706  001000                  MOV     #1000,SP        ;SP UP STACK POINTER
001116  004767  002172                  JSR     PC,SETSWR               ;SET SWR POINTER
001122  012700  152525                  MOV     #152525,%0      ;SET UP FAST MEMORY
001126  010001                          MOV     %0,%1
001130  010102                          MOV     %1,%2
001132  010203                          MOV     %2,%3
001134  010304                          MOV     %3,%4
001136  010405                          MOV     %4,%5
001140  000001                          WAIT                    ;WAIT FOR POWER FAIL TRAP
001142  005777  177066                  TST     @SWRG                   ;LOOP ON TEST
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001146  100750                          BMI     TEST2           ;IF SR-15=1 LOOP ON TEST
001150  000000                          HALT                    ;NORMAL TEST HALT NO ERRORS
                                ;OPERATOR MUST TURN POWER OFF HERE
                                ;ROUTINE TO STORE ACTIVE REG.
001152  022706  000774          TEST2A: CMP     #774,SP         ;IS STACK CORRECT
001156  001406                          BEQ     TEST2B
001160  010667  002024                  MOV     SP,SAVE         ;CONTENTS OF STACK SAVED.
001164  012767  001172  176632          MOV     #HALT3E,PFHAND  ;STACK CONTAINS WRONG ADDR
001172  000000          HALT3E: HALT
001174  010046          TEST2B: MOV     %0,-(SP)        ;STORE REG 0
001176  010146                  MOV     %1,-(SP)        ;STORE REG 1
001200  010246                  MOV     %2,-(SP)        ;STORE REG 2
001202  010346                  MOV     %3,-(SP)        ;STORE REG 3
001204  010446                  MOV     %4,-(SP)        ;STORE REG 4
001206  010546                  MOV     %5,-(SP)        ;STORE REG RE STACK
001210  022706  000760          CMP     #760,SP         ;IS STACK CORRECT
001214  001404                  BEQ     TEST2D
001216  012767  001224  176600  HALT4E: MOV     #HALT4E,PFHAND  ;THE STACK IS WRONG
001224  000000                  HALT                    ;WAIT FOR RESTART
001226  012767  001250  176570  TEST2D: MOV     #TEST2CH,PFHAND ;SET UP NEW POINTER
001234  012767  000005  176564          MOV     #5,PFHAND+2
001242  010667  001742                  MOV     SP,SAVE
001246  000000                          HALT                    ;ALL ACTIVE REG. STORED. WAIT FOR RESTART.
                                ;
                                ;OPERATOR MUST TURN POWER ON HERE
                                ;ROUTINE TO RE-STORE ACTIVE REGISTER AFTER RE-START.
                                ;
001250  016706  001734          TEST2CH:        MOV     SAVE,SP
001254  022726  152525                  CMP     #152525,(SP)+   ;TEST SAVE REG FOR FAST MEMORY
001260  001401                          BEQ     .+4             ;TEST FAST MEMORY %5
001262  000000          HALT5E: HALT                    ;SAVE REG IN ERROR
001264  022726  152525                  CMP     #152525,(SP)+   ;TEST SAVE REG FOR FAST MEMORY
001270  001401                          BEQ     .+4             ;TEST FAST MEMORY %4
001272  000000          HALT6E: HALT                    ;SAVE REG IN ERROR
001274  022726  152525                  CMP     #152525,(SP)+   ;TEST SAVE REG FOR FAST MEMORY
001300  001401                          BEQ     .+4             ;TEST FAST MEMORY %3
001302  000000          HALT7E: HALT                    ;SAVE REG IN ERROR
001304  022726  152525                  CMP     #152525,(SP)+   ;TEST SAVE REG. FOR FAST MEMORY
001310  001401                          BEQ     .+4             ;TEST FAST MEMORY %2
001312  000000          HALT8E: HALT                    ;SAVE REG IN ERROR
001314  022726  152525                  CMP     #152525,(SP)+   ;TEST SAVE REG. FOR FAST MEMORY
001320  001401                          BEQ     .+4             ;TEST FAST MEMORY %1
001322  000000          HALT9E: HALT                    ;SAVE REG IN ERROR
001324  022726  152525                  CMP     #152525,(SP)+   ;TEST FAST MEMORY %0
001330  001401                          BEQ     .+4
001332  000000          HALT10E:        HALT            ;SAVE REG. IN ERROR
001334  022706  000774                  CMP     #774,SP         ;TEST STACK FOR CORRECT ADDR.
001340  001401                          BEQ     .+4             ;STACK SHOULD HAVE 2 WORDS.
001342  000000          HALT11E:        HALT            ;STACK HAS WRONG ADDR.
001344  000002                          RTI             ;RETURN FROM TRAP
                                ;
                                ;TEST ROUTINE TO CHECK RE-START CAPABILITY
                                ;USING THE BR. INSTRUCTION
                                ;OPERATOR MUST SET HALT SWITCH TO ENABLE POSITION
                                ;
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  433  001346  012767  000357  176422  ALTEST: MOV     #357,STATUS     ;SET UP CONDITION CODES
  434  001354  012767  000005  176444          MOV     #5,PFHAND+2     ;SET UP POWER FAIL CODES
  435  001362  012767  001412  176434          MOV     #ALT2,PFHAND    ;SET UP POWER DOWN POINTER
  436  001370  012706  001000                  MOV     #1000,SP        ;SET UP STACK
  437  001374  004767  001714                  JSR     PC,SETSWR       ;SET SWR POINTER
  438  001400  000777                  REALST: BR      .               ;WAIT FOR POWER FAIL
  439  001402  005777  176626                  TST     @SWRG           ;FETCH SWITCH REGISTER
  440  001406  100757                          BMI     ALTEST          ;BIT15=1 LOOP ON TEST
  441  001410  000000                          HALT                    ;NORMAL TEST HALT NO ERRORS
  442                                   ;
  443                                   ;STORE ROUTINE FOR ALTEST
  444                                   ;
  445  001412  022706  000774          ALT2:   CMP     #774,SP         ;HAS STACK BEEN PUSHED TWICE
  446  001416  001406                          BEQ     ALT2A           ;YES STACK CORRECT
  447  001420  010667  001564                  MOV     SP,SAVE         ;SAVE STACK TO INTERAGATE
  448  001424  012767  001432  176372          MOV     #ALT2X,PFHAND   ;SET UP ERROR POINTER
  449  001432  000000                  ALT2X:  HALT                    ;STACK WAS PUSHED >2<
  450  001434  022767  001400  177332  ALT2A:  CMP     #REALST,774     ;DOES STACK CONTAIN CORRECT ADDRESS
  451  001442  001404                          BEQ     ALT2B           ;STACK CONTAIN LOC BR.
  452  001444  012767  001452  176352          MOV     #ALT2AX,PFHAND
  453  001452  000000                  ALT2AX: HALT                    ;LOCATION 774 INCORRECT
  454  001454  010667  001530          ALT2B:  MOV     SP,SAVE         ;SAVE STACK
  455  001460  012767  001476  176336          MOV     #ALT2C,PFHAND   ;SET UP RESTART POINTER
  456  001466  012767  000005  176332          MOV     #5,PFHAND+2
  457  001474  000000                          HALT                    ;END OF STORE ROUTINE
  458  001476  016706  001506          ALT2C:  MOV     SAVE,SP         ;RE-SET STACK
  459  001502  062716  000002                  ADD     #2,(SP)         ;SET NEW RETURN ADDRESS
  460  001506  000002                          RTI                     ;RETURN TO LOC (BR.)+1
  461                                   ;
  462                                   ;
  463                                   ;
  464                                   ;
  465                                   ;
  466                                   ;
  467                                   ;
  468                                   ;
  469                                   ;
  470                                   ;TEST ROUTINE TO CHECK RESTART CAPABILITY
  471                                   ;USING THE EMULATOR TRAP FOR A WAIT
  472                                   ;OPERATOR MUST SET HALT SWITCH TO ENABLE POSITION
  473                                   ;
  474                                   ;
  475  001510  012767  000357  176260  ALTST1: MOV#357,STATUS  ;SET UP CONDITION CODES
  476  001516  012767  000005  176302          MOV     #5,PFHAND+2     ;SET UP POWER FAIL CODES
  477  001524  012767  001600  176272          MOV     #ALT3A,PFHAND   ;SET UP POWER DOWN POINTER
  478  001532  012706  001000                  MOV     #1000,SP
  479  001536  004767  001552                  JSR     PC,SETSWR       ;SET SWR POINTER
  480  001542  012767  003200  176260          MOV     #LRTI,EMTRP     ;SET UP EMT TRAP
  481  001550  012767  000005  176254          MOV     #5,EMTRP+2
  482  001556  104002                  EMTWT:  EMT     +2              ;EMULATOR TRAP
  483  001560  000776                          BR      .-2
  484  001562  016767  001440  176240  ALTST2: MOV     SAVE7,EMTRP
  485  001570  005777  176440                  TST     @SWRG           ;TEST SWITCH REGISTER
  486  001574  100745                          BMI     ALTST1          ;LOOP ON TEST
  487  001576  000000                          HALT                    ;NORMAL HALT NO ERRORS
  488                                   ;
```

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                                        ;ROUTINE TO STORE ACTIVE REGISTERS
                                        ;POWER DOWN
                                        ;
001600  016767  176224  001420   ALT3A:  MOV     EMTRP,SAVE7     ;SAVE EMULATOR TRAP
001606  012767  001740  176214           MOV     #ALT3X,EMTRP    ;SET UP ERROR HALT
001614  022706  000774                   CMP     #774,SP         ;HAS STACK BEEN PUSHED TWICE
001620  001414                           BEQ     ALT3C
001622  022706  000770                   CMP     #770,SP         ;HAS STACK BEEN PUSHED 4 TIMES
001626  001411                           BEQ     ALT3C
001630  012767  001650  176166   ALT3B:  MOV     #ALT3BX,PFHAND  ;SET UP POWER FAIL POINTER
001636  012767  000005  176162           MOV     #5,PFHAND+2
001644  010667  001340                   MOV     SP,SAVE         ;SAVE STACK
001650  000000                   ALT3BX: HALT                    ;STACK INCORRECT (STACK PUSHED LESS THAN 2 OR MORE THAN
001652  012767  001674  176144   ALT3C:  MOV     #ALT3D,PFHAND   ;SET UP RE-START POINTER
001660  012767  000005  176140           MOV     #5,PFHAND+2     ;SET UP NEW STATUS
001666  010667  001316                   MOV     SP,SAVE
001672  000000                           HALT                    ;END OF STORE ROUTINE
                                        ;ROUTINE TO TEST POWER UP SEQUENCE
                                        ;
                                        ;
001674  016706  001310           ALT3D:  MOV     SAVE,SP         ;RESTORE STACK
001700  022706  000774                   CMP     #774,SP         ;WAS STACK PUSHED ONLY TWICE
001704  001726                           BEQ     ALTST2          ;
001706  022706  000770                   CMP     #770,SP         ;ARE WE DOING AN EMT
001712  001403                           BEQ     ALT3E
001714  010667  001270                   MOV     SP,SAVE         ;STACK IN SAVE REG.
001720  000000                           HALT                    ;STACK INCORRECT
001722  022767  003200  177040   ALT3E:  CMP     #LRTI,770       ;DOES STACK CONTAIN CORRECT INFO
001730  001714                           BEQ     ALTST2          ;YES EXIT
001732  011667  001252                   MOV     (SP),SAVE
001736  000000                           HALT                    ;STACK CONTAINS WRONG ADDRESS
                                        ;
                                        ;
                                        ;
001740  000000           ALT3X:  HALT                    ;EMT ACTIVE INSTEAD OF POWER FAIL ON POWER DOWN
                                                        ;EMT ACTIVE ON RESTART INSTEAD OF POWER FAIL
                                        ;
                                        ;ROUTINE TO CHECK TWO MILLISECOND STORE TIME
                                        ;AVERAGE INSTRUCTION TIME
                                        ;ROUTINE WAITS FOR SHUT DOWN IN EMT LOOP
                                        ;
001742  012706  001000           TEST3:  MOV     #1000,SP        ;SET UP STACK
001746  004767  001342                   JSR     PC,SETSWR       ;SET SWR POINTER
001752  012767  002000  176044           MOV     #TEST3A,PFHAND  ;SET UP POWER FAIL STORE POINTER
001760  012767  000005  176040           MOV     #5,PFHAND+2     ;SET UP STATUS
001766  000001                           WAIT                    ;WAIT FOR INTERRUPT
001770  005777  176240                   TST     @SWRG           ;FETCH SWITCHES AND TEST
001774  100762                           BMI     TEST3           ;IF SR15=1 LOOP ON TEST
001776  000000                           HALT                    ;NORMAL TEST HALT NO ERRORS
                                                                 ;LOOP ON TEST
                                                                 ;RESTART PROGRAM
                                        ;OPERATOR MUST TURN POWER OFF AND ON HERE
                                        ;
                                        ;TEST FOR 2 MILLISECONDS OF AVERAGE INSTRUCTION TIME
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                                                ;TIME OF LOOP 57.4 MICROSECONDS
002000  022706  000774            TEST3A: CMP     #774,SP         ;IS STACK CORRECT
002004  001411                            BEQ     TEST3B          ;STACKER IS CORRECT
002006  010667  001176                    MOV     SP,SAVE         ;CONTENTS OF STACK IN SAVE REG.
002012  012767  002026  176004            MOV     #HALT12E,PFHAND ;SETUP ERROR HALT
002020  012767  000000  176000            MOV     #0,PFHAND+2     ;SETUP STATUS WORD
002026  000000                    HALT12E:HALT                    ;WAIT FOR RE-START
002030  012767  003200  175772    TEST3B: MOV     #LRTI,EMTRP     ;SET UP EMULATOR TRAP
002036  012767  000005  175766            MOV     #5,EMTRP+2      ;SET UP EMULATOR STATUS
002044  005067  001156                    CLR     SAVE7           ;SET COUNT TO ZERO
002050  104000                    TIMLOP: EMT+0                   ;EMT TRAP (EMT LOOP=57.4 MICROSEC)
002052  022706  000774                    CMP     #774,SP         ;IS STACK CORRECT AFTER EMT
002056  001407                            BEQ     TEST3D          ;STACK CORRECT CONTINUE
002060  012767  002074  175736            MOV     #HALT13E,PFHAND ;SETUP ERROR HALT
002066  012767  000000  175732            MOV     #0,PFHAND+2     ;SETUP STATUS
002074  000000                    HALT13E:HALT                    ;WAIT FOR RE-START
002076  062767  000001  001122    TEST3D: ADD     #1,SAVE7        ;+1 COUNT
002104  022767  000043  001114            CMP     #35.,SAVE7      ;HAS LOOP TAKEN 2 MILLISECONDS
002112  001356                            BNE     TIMLOP          ;TIME LESS THAN 2 MILLISECONDS
002114  012767  002130  175702            MOV     #TEST3CH,PFHAND ;SET POWER FAIL POINTER
002122  010667  001062                    MOV     SP,SAVE         ;SAVE STACK
002126  000000                            HALT                    ;ROUTINE COMPLETE

                                        ;
                                        ;PROGRAM RESTART ROUTINE
                                        ;
                                        ;
002130  016706  001054          TEST3CH:        MOV     SAVE,SP ;RESTORE STACK
002134  000002                                  RTI             ;RETURN TO TEST3
                                        ;
                                        ;
                                        ;

                                        ;
                                        ;ROUTINE TO TEST FOR 2 MILLISECONDS OF AVERAGE INSTRUCTION TIME
                                        ;ACTIVE TIME BEFORE NEXT POWER LOW FLAG.
                                        ;EMT LOOP TAKES 56 MICROSECONDS
                                        ;THE OPERATOR MUST TURN POWER OFF AND ON
                                        ;VIGOROUSLY

002136  012706  001000          TEST4:  MOV     #1000,SP        ;SET UP STACK
002142  004767  001146                  JSR     PC,SETSWR       ;SET SWR POINTER
002146  012767  002174  175650          MOV     #TEST4A,PFHAND  ;SET POINTER TO HALT
002154  012767  000005  175644          MOV     #5,PFHAND+2     ;SET UP STATUS
002162  000001                          WAIT                    ;WAIT FOR POWER FAIL
002164  005777  176044          TEST4E: TST     @SWRG           ;TEST SWITCHES
002170  100762                          BMI     TEST4           ;IF SR15=1 LOOP ON TEST
002172  000000                          HALT                    ;HALT TEST OVER NO ERRORS
                                        ;
                                        ;
                                        ;
002174  022706  000774          TEST4A: CMP     #774,SP         ;IS STACK CORRECT
002200  001411                          BEQ     TEST4B
002202  010667  001002                  MOV     SP,SAVE         ;STACK IN SAVE REG
002206  012767  002222  175610          MOV     #HALT14E,PFHAND
```

```
                                        MOV     #5,PFHAND+2
                                HALT14E:HALT                    ;STACK DID NOT CONTAIN 774
                                TEST4B: MOV     #TEST4CH,PFHAND ;SET UP RE-START POINTER
                                        MOV     #5,PFHAND+2     ;SET UP STATUS
                                        MOV     SP,SAVE
                                        HALT
                                ;
                                ;ROUTINE TO TEST FOR 2 MILLISECONDS UP TIME (AVERAGE INSTRUCTION TIME)
                                ;
                                ;
                                TEST4CH:MOV     #HALT15E,PFHAND ;SET UP HALT IF TRAP OCCURS BEFORE 2 MILLISECONDS
                                        MOV     #LRTI,EMTRP     ;SET UP EMULATOR TRAP
                                        MOV     SAVE,SP         ;RESTORE STACK
                                        CLR     SAVE7           ;ZERO SAVE 7
                                UPTIME: EMT+1                   ;EMT TRAP (LOOP=56 MICROSEC)
                                        CMP     #774,SP         ;TEST STACK
                                        BEQ     TEST4D          ;STACK IS CORRECT CONTINUE
                                        MOV     #HALT16E,PFHAND ;SET UP ERROR HALT
                                        MOV     #0,PFHAND+2     ;SET UP STATUS
                                        WAIT                    ;WAIT FOR POWER FAIL
                                TEST4D: ADD     #1,SAVE7        ;+1 COUNTER
                                        CMP     #36.,SAVE7      ;HAS LOOP TAKEN 2 MILLISECONDS
                                        BNE     UPTIME          ;NOT YET 2 MILLISECONDS
                                        JMP     TEST4E          ;THE POWER HAS BEEN UP FOR 2 MILLISECONDS
                                HALT15E:HALT                    ;WE DID NOT HAVE 2 MILLISECONDS OF POWER OK
                                HALT16E:HALT                    ;STACK INCORRECT AFTER EMULATOR TRAP

                                ;
                                ;
                                ;
                                ;
                                ;
                                ;MEMORY POWER ON/OFF TEST
                                ;LOAD MEMORY WITH SET DATA PATTERN
                                ;THEN COMPARE DATA FOR BIT DROP OUT OR BIT PICK UP
                                ;RE-ENTER COMPARE ROUTINE IF POWER FAIL OCCURS
                                ;
                                ;ROUTINE TO DETERMINE THE AMOUNT OF MEMORY
                                ;ROUTINE TESTS FOR A MAX OF 28K
                                ;
                                TEST5:  MOV     #TREMST,4       ;SET UP FOR BUS TRAP
                                        CLR     TEMPST          ;CLEAR TEMP. STORAGE
                                        MOV     #340,6          ;LOCK UP PRIORITY LEVELS
                                        MOV     #1000,SP
                                        JSR     PC,SETSWR       ;SET SWR POINTER
                                        CLR     SAVE            ;SET UP TEST FOR 8K
                                EXMST:  TST     @SAVE           ;TEST MEMORY FOR AVAILABILITY
                                        ADD     #4000,SAVE      ;SET UP TEST FOR NEXT 1K
                                        CMP     #160000,SAVE    ;TEST FOR BUS TRAP ERROR
                                        BNE     EXMST           ;TEST NEXT 4K BLOCK
                                TREMST: TST     @#42
                                        BEQ     .+20
                                        CMP     #LOGICAL,@#42
                                        BEQ     .+10
                                        SUB     #3000,SAVE
                                        SUB     #500,SAVE       ;SET UP FOR LAST AVAILABLE BANK
```

```
                                                MOV     SAVE,HLIMIT     ;LAST AVAILABLE MEMORY ADDRESS
                                                MOV     #6,4            ;RESTORE TRAP HALT POINTER
                                                MOV     HLT,6           ;RESTORE HALT.
                                                MOV     #TEST5A,PFHAND  ;SET UP POINTER
                                                MOV     #1000,SP        ;SET UP STACK
                                                MOV     LLIMIT,%2       ;LOW MEMORY LIMIT
                                        FILDAT: MOV     #152525,(2)+    ;LOAD DATA INTO MEMORY
                                                CMP     HLIMIT,%2       ;COMPARE FOR LAST MEMEORY LOCATION
                                                BNE     FILDAT          ;LOAD NEXT LOCATION
                                        CMDX:   MOV     LLIMIT,%2       ;SETUP FOR COMPARE
                                        CMDAT:  CMP     HLIMIT,%2       ;TEST FOR LAST ADDRESS
                                                BNE     ACTMOD
                                                TSTB    TEMPST
                                                BPL     CKACT
                                                JMP     TYPE
                                        CKACT:  MOV     @#42,%0
                                                BEQ     CMDX
                                                TST     FLAG
                                                BEQ     CMDX
                                                RESET
                                        LOGICAL:JSR     %7,(0)
                                                NOP
                                                NOP
                                                NOP
                                                JMP     @#200
                                        ACTMOD: CMP     #152525,(2)+    ;TEST DATA
                                                BEQ     CMDAT           ;COMPARE NEXT WORD
                                                MOV     %2,SAVE1        ;ADDRESS OF ERROR+2
                                                SUB     #2,SAVE1        ;SUBTRACT TO CALCULATE CORRECT ADDRESS
                                                MOV     SAVE1,LIGHTS    ;DATA ERROR IN THIS ADDRESS
                                                MOV     #HALT18E,PFHAND ;SET UP POWER FAIL TRAP FOR ERROR
                                        HALT18E:HALT                    ;LOC DATA LIGHTS CONTAINS BAD DATA

                                        ;FAILING ADDRESS IN DATA LIGHTS
                                        CONAD:  MOV     @SAVE1,LIGHTS   ;PUT DATA IN DISPLAY LIGHTS
                                        HALT19E:HALT                    ;BAD DATA
                                        CONAC:  BR      CMDAT           ;COMPARE NEXT WORD
                                        ;ENTER THIS ROUTINE WHEN POWER FAIL OCCURRS
                                        ;STORE ALL ACTIVE REGISTERS THEN HALT;
                                        TEST5A: MOV     LIGHTS,-(SP)    ;SAVE LIGHTS
                                                MOV     %2,-(SP)        ;SAVE MEMORY ADDRESS
                                                CMP     #770,SP         ;IS STACK CORRECT
                                                BEQ     TEST5E          ;STACK CORRECT
                                                MOV     SP,SAVE         ;STACK SAVED
                                                MOV     #HALT20E,PFHAND
                                                MOV     #5,PFHAND+2     ;SET UP STATUS
                                        HALT20E:HALT                    ;WAIT FOR RE-START
                                        TEST5E: MOV     #HALT21E,PFHAND ;SET UP FOR 2 MILLISECOND DOWN TIME ERROR
                                                MOV     #5,PFHAND+2     ;AVERAGE INSRUCTION TIME
                                                MOV     #LRTI,EMTRP     ;SET UP EMULATOR TRAP
                                                MOV     #5,EMTRP+2
                                                CLR     SAVE7           ;CLEAR COUNT REGISTER
                                        MASTIM: EMT     +2              ;EXECUTE EMT
                                                CMP     #770,SP         ;IS STACK CORRECT AFTER TRAP
                                                BEQ     XTIME           ;YES
                                                MOV     SP,SAVE
```

```
                                                MOV     #HALT22E,PFHAND ;NO SET UP ERROR TRAP STACK NOT CORRECT
                                        HALT22E:HALT                    ;STACK SHOULD EQUAL 770 (SAVE REG.
                                                                        ;CONTAINS CONTENTS OF STACK)
                                        XTIME:  ADD     #1,SAVE7        ;ADD TO TIME COUNT
                                                CMP     #23.,SAVE7      ;IS TIME OK
                                                BNE     MASTIM
                                                MOV     #TEST5CH,PFHAND ;YES SETUP RESTART ADDRESS
                                                MOV     #5,PFHAND+2     ;SAVE STACK
                                                MOV     SP,SAVE         ;
                                                HALT
                                        ;
                                        ;RESTORE ACTIVE REGISTERS AND RETURN FROM INTERRUPT
                                        ;
                                        ;
                                        TEST5CH:MOV     SAVE,SP         ;RESTORE STACK
                                                CMP     #770,SP         ;IS STACK CORRECT
                                                BEQ     UPXTIM
                                                MOV     #HALT23E,PFHAND ;SET UP FOR STACK ERROR TRAP
                                        HALT23E:HALT
                                        UPXTIM: MOV     #HALT24E,PFHAND ;SET UP FOR 2 MILLISECOND UP TIME ERROR
                                                MOV     #5,PFHAND+2
                                                CLR     SAVE7           ;CLEAR COUNT REGISTER
                                        EMTUP:  EMT     +3              ;EXECUTE EMULATOR TRAP
                                                ADD     #1,SAVE7        ;INCREMENT EMULATOR TRAP COUNT
                                                CMP     #770,SP         ;IS STACK CORRECT AFTER EMT
                                                BEQ     CNTEMT          ;YES
                                                MOV     #HALT25E,PFHAND ;STACK NOT CORRECT(SET UP EPROR HALT)
                                                MOV     SP,SAVE
                                        HALT25E:HALT                    ;STACK DID NOT = 770(SAVE REGISTER
                                                                        ;CONTAINS CONTENTS OF STACK
                                        CNTEMT: CMP     #35.,SAVE7      ;HAS POWER BEEN UP 2 MILLISECONDS
                                                BNE     EMTUP
                                                MOV     (SP)+,%2        ;NO EXECUTE NEXT EMT
                                                MOV     (SP)+,LIGHTS    ;YES TIME OK
                                                MOV     #TEST5A,PFHAND  ;REST ARE ACTIVE REGISTER
                                                MOV     #5,PFHAND+2     ;RETURN FROM POWER FAIL TRAP
                                                MOV     #177777,FLAG    ;SET POWER FAIL FLAG
                                                BISB    #200,TEMPST
                                                RTI
                                        HALT21E:HALT                    ;WE DID NOT HAVE TWO MILLISECONDS TO STORE ACTIVE REG.
                                        HALT24E:HALT                    ;POWER WAS NOT ACTIVE FOR TWO MILLISECONDS
                                        ;
                                        ;
                                        ;
                                        ;
                                        ;
                                        ;
                                        ;
                                        NOP=240
                                        FLAG:177777
                                        HLT:    HALT
                                        LRTI:   RTI
                                        LLIMIT: 4000
                                        HLIMIT: 17500
                                        TEMPST: 0
```

```
                                        ;WORK REGISTERS
003210  000000                  SAVE:   0
003212  000004                  SAVE1:  4
003214  000000                  SAVE2:  0
003216  000000                  SAVE3:  0
003220  000000                  SAVE4:  0
003222  000000                  SAVE5:  0
003224  000000                  SAVE6:  0
003226  000000                  SAVE7:  0

003230  032777  040000  174776  TYPE:   BIT     #40000,@SWRG            ;SHOULD INHIBIT PRINTING?
003236  001016                  BNE     CONT                    ;IF SO:  BR
003240  023727  000042  002572          CMP     @#42,#LOGICAL           ;ACT AUTO ACCEPT?
003246  001412                  BEQ     CONT                    ;IF SO:  BR
003250  012700  003300          MOV     #MSG,R0                 ;POINT TO MESSG.
003254  105737  177564  WAIT:   TSTB    @#TPS                   ;TTY READY?
003260  100375                  BPL     WAIT                    ;IF NOT:  BR
003262  112037  177566          MOVB    (R0)+,@#TPB             ;OUTPUT CHAR.
003266  001372                  BNE     WAIT                    ;IF NOT DONE:  BR
003270  005067  177712          CLR     TEMPST
003274  000167  177254  CONT:   JMP     CKACT

        177564                  TPS=177564
        177566                  TPB=177566
003300  005015  053520  020122  MSG:    .ASCIZ  <15><12>.PWR FAIL.
003306  040506  046111     000
        003314                  .EVEN

003314  013746  000006  SETSWR: MOV     @#6,-(SP)               ;SAVE CURRENT VECTOR
003320  013746  000004          MOV     @#4,-(SP)
003324  012737  003340  000004  MOV     #1$,@#4                 ;SET UP TIMEOUT VECTOR
003332  005777  174676          TST     @SWRG                   ;TRY TO REFERENCE HARDWARE SWR
003336  000404                  BR      2$                      ;BR IF NO TIMEOUT OCCURS
003340  012767  000176  174666  1$:     MOV     #SWREG,SWRG             ;POINT TO SOFTWARE SWR
003346  022626                  CMP     (SP)+,(SP)+             ;RESTORE STACK
003350  012637  000004  2$:     MOV     (SP)+,@#4               ;RESTORE TIMEOUT VECTOR
003354  012637  000006          MOV     (SP)+,@#6
003360  000207                  RTS     PC

        000001                  .END
```

DZKAQF.SRC CROSS REFERENCE TABLE -- USER SYMBOLS

```
ACTMOD  002606            668     682#
ALTEST  001346            316     433#    440
ALTST1  001510            317     475#    486
ALTST2  001562            484#    511     517
ALT2    001412            435     445#
ALT2A   001434            446     450#
ALT2AX  001452            452     453#
ALT2B   001454            451     454#
ALT2C   001476            455     458#
ALT2X   001432            448     449#
ALT3A   001600            477     492#
ALT3B   001630            498#
ALT3BX  001650            498     501#
ALT3C   001652            495     497     502#
ALT3D   001674            502     509#
ALT3E   001722            513     516#
ALT3X   001740            493     523#
CKACT   002554            670     672#    790
CMDAT   002534            667#    683     693
CMDX    002530            666#    673     675
CNTEMT  003122            739     744#
CONAC   002650            693#
CONAD   002642            691#
CONT    003274            781     783     790#
EMTRP = 000030            324#    480*    481*    484*    492     493*    552*    553*    612*    706*    707*
EMTUP   003070            736#    745
EMTWT   001556            482#
EXMST   002402            647#    650
FILDAT  002516            663#    665
FLAG    003174            674     750*    763#
HALT1   001040            348#
HALT10  001332            423#
HALT11  001342            426#
HALT12  002026            549     551#
HALT13  002074            558     560#
HALT14  002222            600     602#
HALT15  002342            611     625#
HALT16  002344            618     626#
HALT18  002640            687     688#
HALT19  002646            692#
HALT2   001052            352#
HALT20  002704            701     703#
HALT21  003170            704     753#
HALT22  002764            713     714#
HALT23  003046            731     732#
HALT24  003172            733     754#
HALT25  003120            740     742#
HALT3E  001172            384     385#
HALT4E  001224            394     395#
HALT5E  001262            408#
HALT6E  001272            411#
HALT7E  001302            414#
HALT8E  001312            417#
HALT9E  001322            420#
HLIMIT  003204            657*    664     667     767#
HLT     003176            659     764#
```

```
LIGHTS=%000000   321# 353* 686* 691* 696  747*
LLIMIT  003202   662  666  766#
LOGICA  002572   307  653  677# 782
LRTI    003200   480  516  552  612  706  765#
MASTER  000200   313#
MASTIM  002742   709# 718
MSG     003300   784  794#
NOP    = 000240   762#
PC     =%000007   323# 338* 368* 437* 479* 532* 587* 645* 807*
PFHAND  000024   287# 339* 365* 366* 384* 394* 396* 397* 434* 435* 448* 452* 455*
                 456* 476* 477* 498* 499* 502* 503* 533* 534* 549* 550* 558* 559*
                 564* 588* 589* 600* 601* 603* 604* 611* 618* 619* 660* 687* 701*
                 702* 704* 705* 713* 719* 720* 731* 733* 734* 740* 748* 749*
REALST  001400   438# 450
R0     =%000000   784* 787
SAVE    003210   383* 398* 405  447* 454* 458  500* 504* 509  514* 518* 548* 565*
                 573  599* 605* 613  646* 647  648* 649  655* 656* 657  700* 712*
                 721* 728  741* 771#
SAVE1   003212   684* 685* 686  691  772#
SAVE2   003214   773#
SAVE3   003216   774#
SAVE4   003220   775#
SAVE5   003222   776#
SAVE6   003224   777#
SAVE7   003226   484  492* 554* 561* 562  614* 621* 622  708* 716* 717  735* 737*
                 744  778#
SETSWR  003314   338  368  437  479  532  587  645  798#
SP     =%000006   320# 337* 367* 381  383  386* 387* 388* 389* 390* 391* 392  398
                 405* 406  409  412  415  418  421  424  436* 445  447  454  458*
                 459* 478* 494  496  500  504  509* 510  512  514  518  531* 546
                 548  556  565  573* 586* 597  599  605  613* 616  644* 661* 696*
                 697* 698  700  710  712  721  728* 729  738  741  746  747  798*
                 799* 804  805  806
START1  000204   314#
START2  000210   315# 353
START3  000224   318#
START4  000230   319#
STATUS= 177776   322# 340* 364* 433* 475*
STR2A   000214   316#
STR2B   000220   317#
SWREG   000176   311# 803
SWRG   = 000234   325# 354  376  439  485  536  591  780  801  803*
TEMPST  003206   642* 669  751* 768# 789*
TEST1   001000   314  337# 355
TEST1C  001030   346#
TEST1H  001026   339  342# 346
TEST2   001070   315  364# 377
TEST2A  001152   366  381#
TEST2B  001174   382  386#
TEST2C  001250   396  405#
TEST2D  001226   393  396#
TEST3   001742   318  531# 537
TEST3A  002000   533  546#
TEST3B  002030   547  552#
TEST3C  002130   564  573#
TEST3D  002076   557  561#
```

F02

DZKAQF.SRC CROSS REFERENCE TABLE -- USER SYMBOLS

```
TEST4   002136            319     586#    592
TEST4A  002174            588     597#
TEST4B  002224            598     603#
TEST4C  002246            603     611#
TEST4D  002320            617     621#
TEST4E  002164            591#    624
TEST5   002346            313     641#
TEST5A  002652            660     696#    748
TEST5C  003026            719     728#
TEST5E  002706            699     704#
TIMLOP  002050            555#    563
TPB     = 177566          787*    793#
TPS     = 177564          785     792#
TREMST  002424            641     651#
TYPE    003230            671     780#
UPTIME  002272            615#    623
UPXTIM  003050            730     733#
WAIT    003254            785#    786     788
XTIME   002766            711     716#
.       = 003362          282#    287     293     306#    308#    310#    312#    325     327#    347     351     407     410
                          413     416     419     422     425     438     483     652     654     796#
```

G02

DZKAQF.SRC CROSS REFERENCE TABLE -- PERMANENT SYMBOLS

```
ADD      459  561  621  648  716  737
BEQ      347  351  382  393  407  410  413  416  419  422  425  446  451  495  497
         511  513  517  547  557  598  617  652  654  673  675  683  699  711  730
         739  783
BIS      340
BISB     751
BIT      780
BMI      355  377  440  486  537  592
BNE      563  623  650  665  668  718  745  781  788
BPL      670  786
BR       438  483  693  802
CLR      554  614  642  646  708  735  789
CMP      346  350  381  392  406  409  412  415  418  421  424  445  450  494  496
         510  512  516  546  556  562  597  616  622  649  653  664  667  682  698
         710  717  729  738  744  782  804
EMT      482  555  615  709  736
HALT     287  293  342  348  352  356  378  385  395  399  408  411  414  417  420
         423  426  441  449  453  457  487  501  505  515  519  523  538  551  560
         566  593  602  606  625  626  688  692  703  714  722  732  742  753  754
         764
JMP      313  314  315  316  317  318  319  624  671  681  790
JSR      338  368  437  479  532  587  645  677
MOV      337  339  353  364  365  366  367  369  370  371  372  373  374  383  384
         386  387  388  389  390  391  394  396  397  398  405  433  434  435  436
         447  448  452  454  455  456  458  475  476  477  478  480  481  484  492
         493  498  499  500  502  503  504  509  514  518  531  533  534  548  549
         550  552  553  558  559  564  565  573  586  588  589  599  600  601  603
         604  605  611  612  613  618  619  641  643  644  657  658  659  660  661
         662  663  666  672  684  686  687  691  696  697  700  701  702  704  705
         706  707  712  713  719  720  721  728  731  733  734  740  741  746  747
         748  749  750  784  798  799  800  803  805  806
MOVB     787
NOP      678  679  680
RESET    676
RTI      427  460  574  752  765
RTS      807
SUB      655  656  685
TST      354  376  439  485  536  591  647  651  674  801
TSTB     669  785
WAIT     341  375  535  590  620
.ABS     281
.ASCIZ   794
.END     809
.EVEN    796
.REM       8
.REPT    283  289
.WORD    326
```

ERRORS DETECTED: 0
DEFAULT GLOBALS GENERATED: 0

*DZKAQF,DZKAQF/SOL/PAGNUM/CRF=DSKZ:DZKAQF.SRC
RUN-TIME: 2 5 1 SECONDS

```
.MAIN.  MACY11 27(732)  14-JUN-76  14:56  PAGE 22
DZKAQF.SRC      CROSS REFERENCE TABLE -- PERMANENT SYMBOLS

 RUN-TIME RATIO: 29/9=3.1
 CORE USED:  6K  (11 PAGES)
```